

# ELIMINATING LEGAL AND POLICY BARRIERS TO INTEROPERABLE GOVERNMENT SYSTEMS

Phase II: Recommendations

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Electronic Commerce, Law, and Information Policy Strategies



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***ELIMINATING LEGAL AND POLICY BARRIERS TO INTEROPERABLE  
GOVERNMENT SYSTEMS***

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## Preface

This report defines interoperability as essentially a problem in sharing information. By understanding the full range of problems and opportunities associated with sharing information, our report goes far beyond the simple technical problems of hardware and software compatibility to strike at the deep bureaucratic, societal and economic barriers to building interoperable government systems.

While this report considerably expands the definition of interoperability, there are certain aspects of the interoperability problem that this report does not address. Ever present in our interviews with federal, state and local policymakers and practitioners was the uncertainty and ambiguity surrounding privacy rights and how to protect them. Our study found that organizations were very concerned about privacy, but that few developed concrete solutions. To skirt tough issues, often organizations focused on interoperability projects that had low political and privacy saliency.

As information systems continue to become more interconnected and interoperable, and the opportunities for “networked solutions” grow, concerns about how privacy rights are to be protected, both by the public and the private sectors, will need to be addressed. The ECLIPS companion project *The Protection of Personal Information in Intergovernmental Data-Sharing Programs: A Four-Part Report on Informational Privacy Issues in Intergovernmental Programs* (June 30, 1998)<sup>1</sup> begins to address both these issues and their attendant solutions.

Our report also does not focus on two other areas important to fully understanding interoperability: (1) international law and practice, and (2) procurement policy and procedures. These areas lie outside of the expertise of the project team.

Finally, many of the problems identified in our interviews as being “interoperability problems” really stem from fundamental problems endemic to the management of information technology in the public sector:

1. inadequate resources to replace technologically obsolescent hardware and software;
2. difficulty in attracting and retaining the best technical support skills;
3. the particular mix of environmental constraints in the public sector which make it uniquely difficult to plan and implement projects, such as:
  - a. the various political, issue, and budgetary cycles that repeatedly disrupt the long-run planning and implementation of projects;
  - b. the high visibility of the public sector that make the management of risk problematic;

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<sup>1</sup> <http://iep.fedworld.gov/library/eclipse/cover.htm>

- c. the unique scale and scope of many public sector information system problems that make it difficult to find and adapt best practices from elsewhere; and
- d. turf battles between agencies to secure resources and avoid costs and risks.

Our report does not address these problems since they are well understood and discussed elsewhere. Nevertheless, part of the promise of interoperability lies in its unique position as being an answer to many of the generic problems mentioned above. Interoperability may alleviate the resource constraint by doing more with less.

## **Acknowledgements**

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# ELIMINATING LEGAL AND POLICY BARRIERS TO INTEROPERABLE GOVERNMENT SYSTEMS

## Executive Summary

Interoperability is more than “digital plumbing” — making sure that bits and bytes flow properly. Fundamentally, our interest in interoperability is really an interest in sharing information.

Sharing information reduces the “paperwork burden” on the citizen, streamlines work processes, makes more effective use of individual and shared information technologies, and enriches the formulation, implementation, and evaluation of policy. At the same time, there are many real and perceived barriers to interoperability. The barriers fall into four categories including:

- **political** (privacy concerns, ambiguity about statutory and political authority to share information and the threat of opening up the agency to scrutiny);
- **organizational** (lack of trust among agencies, very little experience in how to identify opportunities to interoperate, or to carry on interoperable);
- **economic** (the difficulty in defining and then providing appropriate resource incentives for those situations where interoperability is a ‘public good’); and
- **technical** (hardware and software incompatibility and inconsistent data structures).

Our report makes specific, practical recommendations to improving interoperability and to achieving these goals. Taken together, these recommendations cluster around the five central findings discussed below.

*Each member of the stakeholder community has different information needs...*

*...taken together, these needs define a broad range of policy requirements...*

*...so that interoperable systems are critical to improved policy and management.*

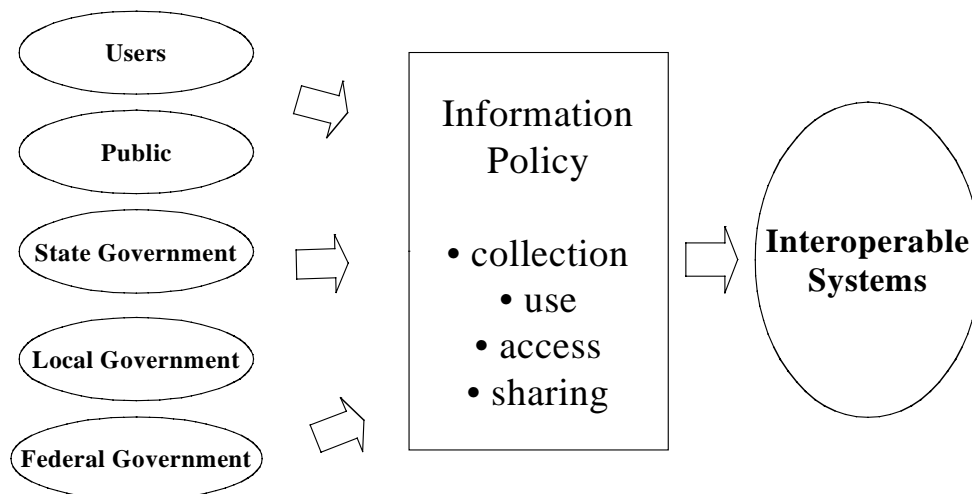


Figure 1.

## **1. INTEROPERABILITY MEANS THE SHARING OF INFORMATION**

Our interviews repeatedly identified hardware and software problems of sharing data as much less important when compared to such problems as identifying opportunities for sharing, aligning data definitions, and providing political and economic incentives for the sharing of information. Far too often, interoperability is still thought of as strictly a technical problem or as a managerial or policy problem that can be solved through more powerful hardware and software. This old, “technical” paradigm also underlies the policy architecture in how we now deal with interoperability.

Before any kind of significant breakthrough can be achieved in improving interoperability, we need a significant paradigm shift to occur. By understanding interoperability as the sharing of information, policy and management tools can be aligned to support the more effective sharing of information. Using this idea, the project team identified several direct and indirect barriers in the current information policy architecture.

## **2. THERE IS A NATURAL EVOLUTION, OR LEARNING CURVE, IN THE DEVELOPMENT OF INTEROPERABLE SYSTEMS**

Working in the future networked, interoperable world will clearly mean new ways of doing things. All of us understand, however, that the complex machinery of government takes time to incrementally reinvent itself.

Our study identified various degrees of interoperation among governmental units. Taking these degrees of interoperation as the natural steps in the evolution of interoperable system revealed a set of barriers and catalysts for action. These catalysts are not deterministic; rather, taken together, they provide a representative selection of possible solutions on how to improve interoperability. In some local situations, strong executive leadership or different constituency environments will make a barrier that would be insurmountable in one community, an easy problem to solve in another situation.

## **3. SHARING INFORMATION MEANS PLANNING FOR BOTH ITS COLLECTION AND USE**

One of the principal contributions of the information resource management movement is the application of the “life cycle” model from the management of information technology to the management of information itself. The “life cycle” notion argues that if important decisions are not taken early in the collection of information, the consequences of these decisions will have an impact on how that information, for example, would be archived.

Extending this powerful idea to the problem of interoperability means that the effective sharing of information cannot be an afterthought once information is already collected. Once interoperability is understood to be the “sharing of information,” the planning and management of information must include sharing concerns early in the management of those information resources.

#### **4. THERE IS NO STRONG FEDERAL/STATE ARCHITECTURE IN PLACE**

Our review of the legal and policy documents together with our federal and state interviews revealed significant progress in the development of federal information technology and information policy. But more work is needed. What are needed are not so much additional policy prescriptions as much as support mechanisms to make it possible for agencies to implement the policy. The goals and methods that are articulated in current federal policy must be more thoroughly implemented throughout the federal system. In practice, strong federal / state architecture must also include opportunities for the states to participate much earlier in the planning process. Inconsistent federal data collection and reporting requirements must be harmonized. Finally, ways must be found to counter the perception, and often times the reality, that federal data requirements are another form of unfunded mandates.

#### **5. IN A TECHNOLOGY-DRIVEN SOCIETY, TECHNICAL STANDARDS ARE ANOTHER KIND OF PUBLIC LAW**

Technical standards are like law, because they determine, for the indefinite future, the kinds of activities society can undertake. However, unlike public law, many of the processes designed to create standards do not have the protections and safeguards that are present in other law-making institutions and processes.

The implication for government is that while there have been many notable breakthroughs in clarifying and supporting government activity in the standards-setting process, most government agencies are still the passive recipients of standards, without access to a process to influence that standard. This includes standards-setting activities within government and outside of government.

### **Basic Themes Throughout Recommendations**

While the recommendations are more specifically discussed below, several basic themes emerge:

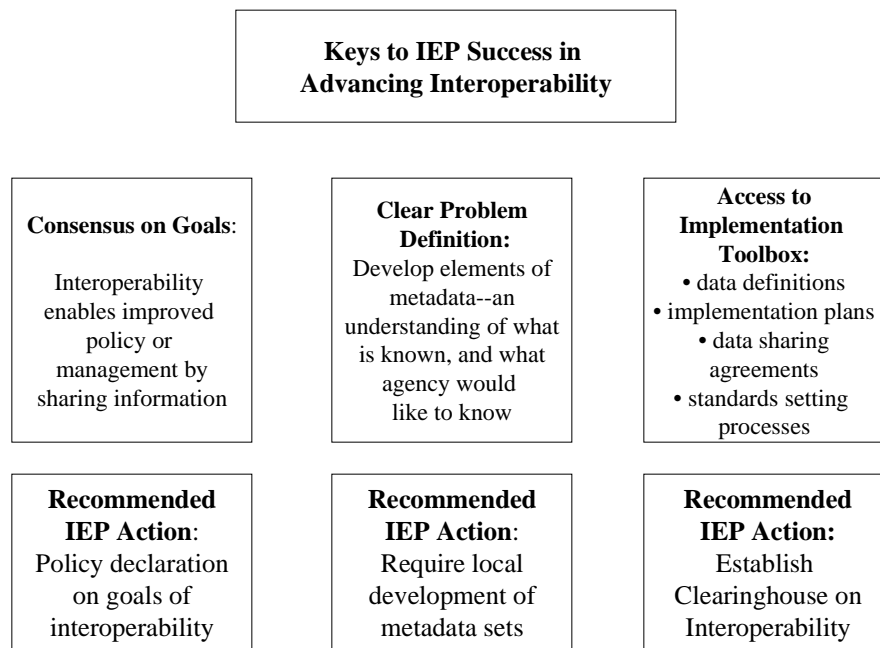
The recommendations are very much influenced by an ecological model of information use.<sup>2</sup> Fundamentally, it is the policy networks, or the community of

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<sup>2</sup> McConnell, Bruce W. (1996). “New Wine in Old Wineskins” Journal of Government Information 23(3): 217-225.

stakeholders and government agencies that make policy that define the universe of information needs. These needs define what information should be collected, how it is used and eventually, how that information is shared.

Central mandates, if at all appropriate, must be very sensitive to those communities' needs. Central directives should only be undertaken when it is clear that there is a clear broader public good that can be achieved beyond what the local communities of interest would not normally do, if left unattended. A useful analogy is the conservationists' efforts to grow and sustain coral reefs. By sinking a car or bus in tropical waters, conservationists provide a firm structure upon to which all kinds of diverse and colorful flora and fauna can secure themselves. Similarly, central mandates should provide a backbone structure to allow many different ecologies to develop and thrive.



Two central mandates emerge as critical for the IEP to advance the development of interoperable systems:

1. Require the development of locally defined and maintained meta-data. Requiring meta-data allows other communities of interest to find and learn about the kinds of information being collected by other communities and users. The local communities, however, should define the meta-data that is important to them.

2. Develop a clearinghouse function that would allow for the identification and documentation of best practices. Many different groups within stakeholder communities need to know what tactics work to implement interoperable systems successfully. It is far more efficient for this research to be done centrally than requiring each initiative to fund this individually. These set of best practices, or even a checklist of potentially important issues that should be considered, could then be examined for their relevance to each user community.

# I. Findings and Recommendations

## A. Interoperability means the sharing of information

*Finding 1:* Interoperability among federal, state and local level information systems is more than “plumbing” - making sure that the information pipes fit together through compatible hardware and software. Fundamentally, interoperability is “the sharing of information.” “Sharing information” is the *use* of information generated from another organization to improve policy or management.<sup>3</sup> ***Agency information policymakers and managers must make this first, conceptual leap before there can be any real progress in improving interoperability.***

*Recommendation 1a:* One way to begin to educate policymakers and managers to this conceptual leap is to make a policy declaration that the ultimate goal of interoperability is the sharing of information. By doing this, the organization of management and policy efforts moves from its historical focus on technical compatibility to information sharing. Once policy makers and managers focus on information sharing, it becomes easier to generate the appropriate operational subgoals and success criteria.

The operational subgoals of interoperability should include the extent to which the tools that enable information sharing are in place. These tools include: (1) the identification of the existence of information; (2) the provision of meta-data about the data enabling the prospective user to make some kind of an assessment of the utility of the information; and (3) a clear policy for when, under what conditions, and how, organizations should make their information available (this policy statement could be a formal policy decision, supported by the interpretive or informal rulemaking process to involve relevant stakeholders). This policy would include an interpretation of legal authority to share information and an economic model to support the identification of costs associated with the sharing of information.

The criteria for successful interoperability is not the extent to which there are compatible technical systems; but rather, whether information is truly shared and used by policymakers and managers.

*Recommendation 1b:* Once interoperability is seen as a problem in sharing information, interoperability projects should not automatically be delegated to strictly technical teams. Stated positively, teams working on interoperability of the projects should include persons who understand the strategic information needs organization and those with the ability to translate those strategic needs

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<sup>3</sup> Use of information can include: 1) being directly used in the decision process; 2) validating or refuting an already completed decision process; 3) instigating an organization to act even if the information is never used in the decision process; and 4) creating new information by combining data from several sources.

into technical solutions. Blending teams of technicians, managers, and strategists improves the chances of solving the difficult problem of “talking solutions to problems.”

Recommendation 1c: Information sharing needs must be driven by a clear understanding of what the organization “knows” and what it would like to know. Continually revisiting this goal is the essence of continuous improvement in policy and management. Assembling the information the organization already possesses is a first logical step in developing a needs assessment, which will help organizations to understand how to respond to their own information needs as well as those of other organizations.

This understanding should begin with an inventory of the information in the possession of the organization. It then moves towards the organization’s knowledge as captured by policy documents but then quickly moves outward, using networking technology, to linkages with sister organizations in state and local government, to stakeholders in academia, industry and non-profit sectors.

The first step in building this inventory can be met for federal agencies by simply complying with the statutory law to implement the GILS service as required by the Paperwork Reduction Act [44 U.S.C. 3511]. States should also implement a GILS-like service. By having pointers to data and policy documents, organizations begin the task of identifying what the organization knows. Policy documents contain the implicit statements of the programmatic goal(s) of a program, how resources are translated into program outcomes and whether they, in fact, have achieved their intended goals. Identifying these documents and sources is a statement about what the organization “knows.”

Recommendation 1d: Phase I identified many barriers to interoperability but also many success stories. The “word” must be spread that interoperable solutions save time, money, and improves the organization’s effectiveness. Our interviews showed that organizations found that the benefits of developing interoperable systems justified their own expense, aside from the spin-off benefits enjoyed by other organizations or the public.

The IEP should identify successful interoperability projects and include, with the permission of the agency, pointers to individuals who were instrumental in the completion of the project. Of particular interest could be showcasing the successes of the National Spatial Data Infrastructure.<sup>4</sup>

Recommendation 1e: Special recognition and rewards should be provided for those individuals in the organization who can translate the strategic needs of the organization into technical terms and solutions. These employees are critical to

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<sup>4</sup> <http://www.fgdc.gov/NSDI/Nsdi.html>

successful technology insertion and adoption in any setting, private or public. To promote further personal development of employees within agencies with this rare talent, informal rewards could include a budget for conference travel or subscriptions to journals and information services to support their “translation” services. More tangible benefits could include monetary bonuses where these individuals were responsible for significant cost-savings.

*Finding 2:* Interoperability projects frequently fail because important meta-data about the information is either not known or is not shared. Meta-data is “data about the data.” Meta-data are the important data that must be known before information is shared. Examples of meta-data include such characteristics as the quality of the data (timeliness, precision, clarity, accuracy); whether it is quantifiable; whether it is verifiable; how accessible it is; whether it is comprehensive; who the information was collected from; the authority under which the data was collected; limitations on the use of that data; the author of the data; and the physical and logical storage characteristics of the data.

This meta-data can be made available in two ways: (1) formally, through an information system like GILS; or (2) informally through people who know about the information. The choice of formal and informal approaches depends on the complexity and richness of the meta-data. In many cases, formal approaches are a satisfactory solution to the initial problem of “pointing to” and identifying potential opportunities for sharing information. But as the complexity and richness of the meta-data increases, organizations and department will tend to rely more on informal approaches to support inter-agency use of information.

*Recommendation 2a:* GILS is an important formal solution to the sharing of meta-data. Beyond providing an inventory of the information possessed by the organization as discussed above, GILS also attaches meta-data about the information that is crucial to deciding whether information would be useful. It is essential that information policy makers and managers renew their commitment to the GILS project as a starting point in identifying meta-data important for interoperability.

*Recommendation 2b:* One of the most important steps in renewing the commitment to the GILS effort is to assemble a clearinghouse to accumulate GILS experiences and best practices. Presently, there is no formal institution to support this activity. Education and the sharing of best practices now occur in an ad hoc manner.

There have been some concerns expressed about the costs and time to provide the GILS service. The clearinghouse could identify some of the best practices which now use information technology to ‘skim off’ much of the meta-data as part of the routine information creation and transaction process. This could significantly increase compliance and the quality of meta-data available. Also,

the establishment of a clearinghouse would relieve the demands that are now made upon organizations that are the leaders in GILS. The demands now imposed upon the leaders in the GILS community to share their knowledge about what works has a real opportunity cost for the overall intergovernmental effort, since it takes away from their time to continually innovate.

Recommendation 2c: On the informal side, meta-data can be shared by improving the network of contacts among organizations. On the federal level, points of contact between organizations must be extended beyond the CIO Council. While the CIO council improves the chances of agency policy convergence on interoperability, there should be more points of contact among managers, technicians and stakeholders. Each of these communities has a role in taking the policy and actually implementing interoperable solutions. Implementation requires ongoing collaboration among these communities.

The institutions supporting these informal organizations need not be a statutory creation. In fact, most of the problems in interoperability are best handled by the “informal organization.” Policy makers and managers, however, must support these informal organizations and provide the resources when these informal organizations appear.

Recommendation 2d: Agencies should share personnel to foster a mutual understanding of their data and information needs. Fundamentally, knowledge resides in the people -- not in formal information systems. This ‘sharing’ of personnel can take many forms. Where organizations have had a relatively close working relationship and expect to have a close relationship in the future, it may be possible to share personnel by stationing individuals from one organization with its companion organization. By stationing individuals in another organization or ‘trading individuals’, the opportunities and constraints for sharing information can more quickly be identified. Alternatively, “red teams” or “tiger teams” could be assembled to address strategic cross-agency opportunities such as drugs, children’s or family issue clusters by pulling selected individuals out of the bureaucracy and charging them with designing and implementing new interoperable, cross-agency systems.

*Finding 3:* Frequently the cost and time constraints are too prohibitive to effectuate the sharing of information even if the meta-data is available.

Recommendation 3: Even if short-term benefits of sharing information cannot be realized, agencies should still develop an inventory, including meta-data, of their information assets. This will allow for the better identification of the long-term opportunities for sharing even if the short-term needs of the agency cannot be met. Interoperability is a long-term project and it may take time for long-term information strategies for agencies to converge. The possibility for this convergence must begin, however, with this identification of information assets.

For example, the match-merging of two databases may simply not be possible because the key identifiers for the records in each database are incompatible. While in the short-run, match-merging may not be possible, the clarification of meta-data may promote the long-term partnering of information processing strategies. This could include a method to collect two sets of key identifiers or to develop a standard to harmonize their key identifiers. The same strategy could also take place for non-key information but the first targets should be in the convergence of important key information.

*Finding 4:* There are two ways agencies share data — using formal “sharing agreements” and through needs-driven, ad hoc arrangements.

Many agencies use “sharing agreements” or contracts to specify how data is to be shared. In many cases, these agencies go through the process of developing interoperable systems alone. This results in unnecessary duplication of time and resources as agencies work through many of the same common planning and implementation problems. Moreover, the complexity of the process can also be a severe disincentive for smaller agencies and bureaus that do not very often enter into such arrangements.

Often, within and among state agencies, particular, need-driven data-sharing arrangements have emerged. This ad hoc approach, while an important step in learning how to share data, can lead to a patchwork data-sharing policy. Ad hoc approaches invite the creation of inconsistent policies and practices across agencies and levels of government.

Environmental protection offers many instances of intra-agency cooperation agreements and informal, needs-based sharing of data as responsible agencies transition from media-based data collection and storage systems (e.g., air, water, etc.) to a facility, one-stop form of information management. Intra-agency pooling of information and information technology typically has a common supervisor (maybe as far up as the director of the agency), but this does not totally remove the use of written agreements for sharing data. Additionally, responsibilities for environmental protection are typically spread over several state agencies (typically agriculture, health, natural resources, fish and wildlife, occupational safety, and the like). Further complicating matters, states often have local or regional authorities with responsibility for a particular coastal area, or river region that also must interface with environmental information systems and needs. Coordinated environmental protection agencies in adjacent states also have common environmental needs (e.g., Ohio River matters are relevant to six bordering states).

*Recommendation 4:* From existing sharing agreements<sup>5</sup>, select best practices and develop a “uniform contract” or “formbook” from which others can draw

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<sup>5</sup> In the area of spatial data, the U.S.G.S. is collecting existing sharing agreements to provide guidance to future partnership agreements. See <http://www.mapping.usgs.gov/www/partners/>.

expectations about future behavior. One of the most important tools available to attorneys is the use of a “formbook.” If a lawyer has a problem to solve, chances are there will need to be some kind of document to solve that problem. If the lawyer has to go to court, he consults a formbook for the many kinds of documents that must be filed with the court. It may be as simple as selecting the form and filling in the name of the parties. If a contract has to be negotiated, the attorney can consult a contract formbook, which gives all kinds of contract to solve all kinds of contract problems. The responsibilities laid out in a contract have been time-tested as practical by the courts and are backed up as being the law.

The “formbook” approach provides practitioners with commonly understood set of practices that clarifies responsibilities of each party. Over time, interoperability agreements become routinized because the full list of concerns that must be considered are made explicit, the respective responsibilities are made clear and useful tools, accumulated over time, are located in one place. In the case of interoperability contracts, the “formbook” approach might be indexed by the many possible issues in sharing information identified earlier. It would then suggest clauses, or ways, in which those potential problems could be avoided or if they occur, how they could be mitigated. The “formbook” could be built up from many different experiences of agencies. Minimally, the collection of sharing agreements can serve as a checklist to guide agency planning. If the true promise of a networked government is to be realized, interoperability agreements and arrangements must be executed and tested in practice. In order for this to occur, interoperability must move from an ad hoc development to a systematic organizational strategy with clear performance expectations.

*Finding 5:* Developing strong interoperable systems at the federal, state and local level requires construction of, and access to, a reservoir of specialized knowledge and experience of practitioners in information resource management.

*Recommendation 5:* In addition to developing a clearinghouse to support the implementation of GILS, there should also be a formal, institutional capacity which brokers sharing agreements between agencies and collects and distributes knowledge about best practices for interoperability. This formal institutional capacity could also be responsible for compiling the formbook mentioned above. Presently, there is no agency that provides this information in a sustained way. The organization ultimately responsible for providing this information should be established as an independent entity—it is critical that it should not have agency oversight or be perceived as a competitor for scarce resources, lest it discourage potential client agencies in coming to it for assistance.

*Finding 6:* One barrier to interoperability, or the use of shared information, is the belief that providing undigested data too freely to the public will permit its distortion and misuse, perhaps by persons advancing a political agenda rather than advancing governance.

*Recommendation 6a:* Now is the time when visionary government leaders can set the agenda and determine the relationship between citizen and government in the provision and sharing of information. Agencies should seize the opportunity in defining what are reasonable expectations in how information is provided.

In the age of the “remote-channel changer” and the “clickable blue WWW link”, it will not be long before consumers demand the same level of response from their government. This is critical because the information system reforms proposed go directly to the heart of what agencies do – collect, process and then distribute information. A move towards more interoperability will transform how agencies achieve their mission—a transformation that will require a long time horizon to accomplish. Nevertheless, at the pace as which technology is changing public expectations, agencies cannot wait to begin the process. In many cases, the project team found the fear of distortion and misuse unfounded when organizations actually began sharing more information. For the politically salient problems, where distortion and misuse will occur regardless of the degree of information provided, agencies should provide more contextual information and meta-data. Public access to more information often corrects information distortion.

*Recommendation 6b:* Models of data stewardship should be reviewed to ascertain the proper level of contextual information accompanying the data as both are made available to the public and other stakeholders. The requirement that these models be developed should be required and monitored centrally but developed locally. Again, this process could take place through the rule-making process to include relevant stakeholders in the establishment of this policy.

## **B. There is a Natural Evolution, or Learning Curve, in the Development of Interoperable Systems**

*Finding 7:* There are factors that tend to support the identification, planning, and implementation of data-sharing arrangements. This is the knowledge about how to share information. If there is a natural learning curve, agencies can use this knowledge to learn from the mistakes of others by climbing the learning curve faster and more intelligently. Our interviews have identified several factors in managing this learning curve:

1. Sharing is more likely when agencies have a history of working together.

2. Sharing is more likely when there is free, centralized money than when agencies are asked to fund sharing out of their own budgets.
3. Federal/state sharing will only be accomplished when it is perceived in those agencies' own self-interest.
4. Multi-level or multi-agency information sharing arrangements benefit by making all the interested organizations, equal parties to the agreement.
5. Interoperability projects are more easily implemented when the focus is on sharing transaction information (as opposed to operational or strategic information) since these are the processes where tangible benefits in reduced costs and improved service can most easily be documented.
6. Interoperability projects are more easily implemented when the projects result in short, or even same year benefits as opposed to long run benefits. Interoperability projects are more likely when the sharing occurs within an agency and budget savings can more easily be shared than when the sharing occurs between agencies.
7. Crisis is an essential catalyst for intergovernmental collaboration point in raising awareness and providing the political capital necessary to sustain progress towards a solution.

*Recommendation 7a:* Use the above critical success factors to select demonstration projects from a competitive grants program. The competitive grants program would draw upon the natural interest and creativity of interest groups. The grant program could be structure along specific subject areas, or based upon critical barriers identified to implementing interoperability. A subject area grant could ask for proposals from criminal justice and natural resources agencies. This approach would be taken if there is a desire to “seed” efforts and generate interest and activity in selected program areas. Another categorization scheme could specify what things are most urgently needed to be learned so that the lessons from the demonstration project could be disseminated broadly. This approach would be taken if there were a desire to pursue the “clearinghouse” function mentioned earlier. Some of the categories of things to learn, could include: a) how to deal with concerns over privacy; b) how to use interoperability to meet the problem of scarce resources for government information technology; c) how to use GILS or meta-data infrastructure to support interoperability; or d) using coordinating mechanisms to support joint, or cross, federal, state and local sharing initiatives.

In addition, one of the more salient crises in the public information system community is the Y2K problem; one of the most troublesome aspects of the Y2K problem is the interdependence of systems. An agency may have done all it can to identify problems with its own software, but it is still dependent on information supplied by other computers. Identifying the interfaces and the data exchanged is central to the Y2K; but it also happens to be important to the interoperability

question generally. Careful selection of Y2K projects well on their way towards completion may benefit from, and build upon, the efforts already underway to inventory and examine interfaces.

Recommendation 7b: Increase the chances for interoperability by reducing the uncertainty surrounding the costs and problems of interoperability. The clearinghouse mentioned above should also conduct a retrospective evaluation of a well-chosen sample of prior interoperability projects. This would identify cost factors and their magnitude. Presumably, over time, learning would reduce these costs considerably but identifying these costs up front would remove risk and uncertainty and increase the number of sharing arrangements.

### **C. Sharing Information Means Planning for Both Its Collection and Use**

*Finding 8:* Our review of policy documents revealed that there is a policy architecture in place to support information sharing. While the strong policy statements are in place, agencies also need support mechanisms to understand the range of economic, political, technical and organizational issues involved with information sharing and the range of best practices to deal with these issues.

Our cursory review of state policy documents suggests that their agencies are not required to specifically address attempts to share information in their information technology plans. Occasionally, state legislatures have suggested that agencies coordinate their efforts, and there are other provisions that allow agencies to cooperate and to share information technology. However, there are few specific provisions require cooperation or an examination of opportunities to share information. This should be extended to the planning of what information they hope to collect. This avoids data definition problems and many other meta-data problems.

Recommendation 8a: Establish and fund a federal / state clearinghouse to gather together best practices on information sharing.

Recommendation 8b: Like the federal government, states need to specifically require agencies to consider and evaluate information sharing opportunities through budget directives or as a requirement in planning information technology capital projects.

*Finding 9:* There is a scarcity of quantitative measures of interoperability such that an objective assessment of progress toward interoperability goals can be made. Whether or not such measures exist in the scholarly literature on the field, we found scant evidence of that such are seriously attended to in the daily life of information system managers.

Recommendation 9: Define measures from the identified generic benefits of interoperability. So that there is a “fair” objective measure of progress, measures of the barriers to interoperability should also be made. This will allow organizations to provide a fair picture of their efforts to obtain interoperability. The organization responsible for defining measures and evaluations should not be the same organization advising on best practices. The organization gathering the best practices should, however, provide input into the measures developed.

**D. There is No Strong Federal/State Architecture in Place to Support Interoperability**

*Finding 10:* At the federal level, agency legislation mandates a strong, agency-wide strategic-planning effort, which lays the foundation for smart strategic information planning. But the strong emphasis on planning that makes the connection between resources and outcomes clear, defines measures for success and installs a variety of accountability and reporting measures, actually has the perverse effect of excluding states from the planning effort. Unfortunately, if states are not involved early with the federal strategic planning for information needs, and this is tightly bound with information planning and procurement, there is little chance for the states to have a real voice in the process.

State officials also expressed the hope that federal requirements for providing data should be rationalized. Far too often, states view these requirements as another form of unfunded mandate because there are significant programmatic and fiscal responsibilities that come along with these information requests. In some cases, the states are not sure that this information is even being used. State and local governments will need to see a benefit in collecting and providing this information to the federal government. Finally, states are concerned about the sometimes inconsistent data requirements—agencies explicitly requiring different kinds of information from states.

Recommendation 10: Provide a formal method by which states can provide input early in the federal information strategic planning process. One way to do this is to establish a Joint Board, similar to such bodies in the regulated telecommunications industry. In the telecommunications industry, the enabling statute defining the role of the federal government in regulation is ambiguous about the respective responsibilities for the states and the federal government. In order to address the conflict between state and federal authorities, the law allows the FCC to call for the creation of a joint board to discuss potential solutions and advise the FCC. The Board does not abrogate the sovereignty of either the federal or state governments. The Board merely provides advice to the FCC on how best to achieve consensus.

IEP could spearhead development of a “Joint Board” which can include states in the planning much earlier, thus increasing the chances for harmonization in the planning and implementation of information systems.

The joint board would draw its members from policy or technical experts from the states. The joint board would receive technical and logistical support from either the states’ technical staff or from the organization providing the clearinghouse function.

*Finding 11:* Interoperability is hindered by statutory requirements that data be collected and reported to Congress according to specific statutory definitions. Definitions of many common terms (“solid waste,” “hazardous waste,” and the like) often differ from federal to state government and from program to program within one agency, leading to separate (but highly redundant and overlapping) data collection and storage methods that have no path to interoperability.

*Recommendation 11:* A review of statutory definitions should be undertaken to identify inconsistencies among statutory definitions and harmonize those definitions where the rationale for different definitions does not outweigh the advantages of interoperability. From this review, the possibility of harmonizing these definitions can be considered (and recommended, when appropriate).

*Finding 12:* There is an inherent tension between the need for national information system interoperability with a particular programmatic focus (for example, environmental information) and the no less compelling forces for interoperability across programs within a state. Our review of environmental information system interoperabilities has indicated that state agencies are typically under pressure to coordinate their information systems primarily within the agency, secondarily across related agencies within the state, and thirdly, in accordance with national interoperability policies. Insofar as interoperabilities can be achieved simultaneously at more than one of these levels, agencies will attempt to meet all three demands. However, when priorities must be assigned to interoperabilities, the above priority sequence tends to be observed.

*Recommendation 12:* Another function that can be provided by the clearinghouse referred to above, might be to coordinate federal and state information sharing.

*Finding 13:* The federal information management architecture is not scalable—that is, smaller levels of government cannot effectively duplicate the federal architecture. The federal government will impose undue expectations on the states if it plans under the assumption that state and local governments can use the federal information policy architecture.

*Recommendation 13:* The federal government should consider supporting the development of regional compacts so that the costs and benefits of fully

developed information policy architecture can be realized. We found many instances of states helping other states. Often, these clusters of states occurred in the same region of the country.

**E. In a Technology-Driven Society, Technical Standards is Another Kind of Public Law**

*Finding 14:* While the federal government has made significant progress in redefining how government participates in the standards process, infrastructure and process must now support the policy. Most critical is insuring the continued adoption of open standards and insuring that the technological standards that are adopted support the government's goal of sharing information.

Currently, there is sporadic representation by public agencies in the standards-setting process. Where there is representation on the federal level, NIST does most of the representation to non-security related standards discussions but NIST is also limited by resources from doing more.

Most state agencies communicate their preferences for a technical standard directly to their vendors but they feel that other avenues to insure good standards should be cultivated. Alternatively, public servants also communicate their needs for a technical standard through their professional communities, but they agree that this results in a splintered representation of government and public interests. States do not necessarily want the federal government to become involved in the standard-setting process on their behalf. They also desire that standards should be established only when pilot projects have proven the workability of those standards. Standards should follow proven best practices.

*Recommendation 14a:* Working with professional organizations like NASIRE and The League of Cities, provide funding to provide support to government organizations that could not otherwise support the high expenses involved in participating in the standards process. The costs of participating in the standards process are very high and often government agencies have much more pressing needs. The funds to support the standards work could be targeted to individuals who would be readily identified by the important professional organizations.

*Recommendation 14b:* Require that the clearinghouse that investigates best practices also provide advice to the standards-setting process. The process supporting the timing in adopting a standard, the gathering of empirical data on best practices and the actual implementation of a standard which will uncover difficulties with that standard is a very delicate one and will require close and active participation with the user and the standards communities.

*Recommendation 14c:* Require that agencies specify what technical and performance requirements are necessary for the advancement of their policy goals. These technical or performance criteria make it easier for standards bodies to translate user needs into technical standards.

## II. CONCLUSION

Interoperability is now gaining the attention of information and information technology policy makers. While short-term, the Year 2000 problem illustrates the immediate need to interoperate well, we believe that interoperability should have a much longer planning and implementation horizon. Fundamentally, interoperability means the easy sharing of information among governmental and private sector organizations, and this represents a fundamentally different way of managing and making policy.

Interoperability is now gaining the attention of information and information technology policy makers. While short-term problems like Y2K emphasize the immediate need to interoperate well, interoperability should have a much longer planning and implementation horizon. Fundamentally, interoperability means the easy sharing of information among governmental and private sector organizations, and this represents a fundamentally different way of making and managing policy.

This report has focused on the need to develop a systematic and integrated policy architecture to address the multiple kinds of barriers to interoperability. In addition to addressing the technical barriers to interoperability, this report also examines the far more difficult political, organizational and economic barriers. Table One takes the barriers identified in Phase One, Table Two, and accumulates the recommendations for each of those barriers. Recommendations are systematically listed for policy makers, managers, technicians, and the policy community to support each of these actors in the planning, implementation, and evaluation policy functions.<sup>6</sup>

Our findings show that most important for progress towards interoperability is achieving the correct balance between central directives and local needs (specific initiatives within federal agencies and states and within local government initiatives). For example, centrally, there ought to be a collection of best practices so that local initiatives can have the full benefit of other agency experiences. Local initiatives would then pick and choose whether and how they would interoperate. Centrally, the federal government should coordinate its own information management before requiring states to develop interoperable systems. Centrally, the federal government should develop standards. Locally, states and other local governments should be included in the process. Centrally, there ought to be a requirement that meta-data be collected so that potential opportunities for interoperability have a greater chance of being identified and implemented. Local initiatives would decide which meta-data to collect over and above certain core elements.

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<sup>6</sup> Numbers in parentheses for each recommendation correspond to the numbered item in the main body of the report.

Clearly, interoperability is a two-way street—mandates handed down or initiatives undertaken exclusively at the federal or the state level will not succeed unless there is strong interaction between each unit of government at many points along the process, from initial conceptualization and planning to implementation and evaluation. If the recommendations set forth in this report are implemented, we believe that the IEP can provide an ongoing forum for this exchange as it continues to advance interoperability on the federal and states' agenda for action.

**Table 3**

**Interoperability Policy Architecture:  
Planning, Implementing and Evaluating Policy**

**Recommendations to Improve Planning of Interoperability**

Policy Makers	Management	Technical	Policy Community
<p><b>Goal: Set broad guidelines that allow for interoperability but do not micromanage</b></p> <p>Barrier</p> <ul style="list-style-type: none"> <li>Many still see interoperability as technical</li> </ul> <p><i>Recommendation</i></p> <ul style="list-style-type: none"> <li>Formally declare interoperability as information sharing and require sub-goals (1a)</li> </ul> <p>Barrier</p> <ul style="list-style-type: none"> <li>No formal institution champion to <u>support</u> interoperability</li> </ul> <p><i>Recommendation</i></p> <ul style="list-style-type: none"> <li>The IEP should identify successful interoperability projects and ultimately create a more permanent mechanism to champion interoperability (1d)(8a)</li> <li>States must include sharing opportunities in planning (8b)</li> </ul> <p>Barrier</p> <ul style="list-style-type: none"> <li>Inconsistent statutory data definitions</li> </ul> <p><i>Recommendation</i></p> <ul style="list-style-type: none"> <li>Agencies need to review statutes and rules for inconsistent data requirements (11)</li> </ul>	<p><b>Goal: Take broad policy guidelines and translate/ supplement those guidelines to establish policy for each local situation</b></p> <p>Barrier</p> <ul style="list-style-type: none"> <li>Managers still plan interoperability as a technical problem</li> </ul> <p><i>Recommendation</i></p> <ul style="list-style-type: none"> <li>Agency implement OMB A-130 by making policy declaration the importance of information sharing to interoperability (1a)</li> </ul> <p>Barrier</p> <ul style="list-style-type: none"> <li>Short run considerations displace long-term planning on interoperability systems</li> </ul> <p><i>Recommendation:</i></p> <ul style="list-style-type: none"> <li>Even if short-term benefits of sharing information cannot be realized, agencies should still develop an inventory of information assets, to allow for convergence to take place. (1c)(3)</li> </ul>	<p><b>Goal: Understand technical laws and standards necessary to implement technology</b></p> <p>Barrier</p> <ul style="list-style-type: none"> <li>Technical community unfamiliar with the policy choices important to information sharing</li> </ul> <p><i>Recommendation</i></p> <ul style="list-style-type: none"> <li>Information sharing needs must be driven by a clear understanding of what the organization “knows” (1c)</li> </ul> <p>Barrier</p> <ul style="list-style-type: none"> <li>Projects fail technically because important meta-data not available</li> </ul> <p><i>Recommendation</i></p> <ul style="list-style-type: none"> <li>Renew commitment to the GILS mandate (2a)</li> </ul> <p>Barrier:</p> <ul style="list-style-type: none"> <li>Linkages among information plan, functions meet that plan and standards to be not clearly defined</li> </ul> <p><i>Recommendation</i></p> <ul style="list-style-type: none"> <li>Specific performance requirements allow better coordination (14c)</li> </ul> <p>Barrier</p> <ul style="list-style-type: none"> <li>Government agencies still passive recipients of standards</li> </ul> <p><i>Recommendation</i></p> <ul style="list-style-type: none"> <li>Provide support to government organizations (14a)</li> </ul>	<p><b>Goal: Ensure that local needs will be met, or minimally, will not be hindered through appropriate policy</b></p> <p>Barrier</p> <ul style="list-style-type: none"> <li>State and local governments enter the discussion late over interoperability requirements imposed by the federal Government</li> </ul> <p><i>Recommendation</i></p> <ul style="list-style-type: none"> <li>Agencies need to provide a more formal method by which states can provide earlier input into the federal information strategic planning process (10)</li> </ul>

## Interoperability Policy Architecture: Planning, Implementing and Evaluating Policy

### Recommendations to Improve Implementation of Interoperability

Policy Makers	Management	Technical	Policy Community
<p><b>Goal: Monitor implementation without micromanaging</b></p> <p>Barrier:</p> <ul style="list-style-type: none"> <li>Policy mandates collection of meta-data but does not create institution to support/ champion implementation of GILS</li> </ul> <p><i>Recommendation:</i></p> <ul style="list-style-type: none"> <li><i>Create and support clearinghouse to accumulate GILS experiences and best practices. (2b)</i></li> </ul> <p>Barrier</p> <ul style="list-style-type: none"> <li>Policy makers do not have knowledge base of the critical success factors to support interoperability</li> </ul> <p><i>Recommendation</i></p> <ul style="list-style-type: none"> <li><i>Building upon the lessons learned in previous studies, test and extend the accumulated understanding of what works through well-chosen demonstration projects (7a)</i></li> </ul>	<p><b>Goal: Coordinate human resources, political, technical, and fiscal resources within and across organizations</b></p> <p>Barrier</p> <ul style="list-style-type: none"> <li>Managers too often implement interoperability projects as a technical problem to be left to technicians to solve or for technology to solve</li> </ul> <p><i>Recommendation</i></p> <ul style="list-style-type: none"> <li><i>Agency managers need to identify and include individuals who can translate the agency's needs into technical solutions projects (1b)</i></li> </ul> <p>Barrier</p> <ul style="list-style-type: none"> <li>Projects do not often have technology / organization translators actively participating</li> </ul> <p><i>Recommendation</i></p> <ul style="list-style-type: none"> <li><i>Special recognition and rewards should be provided for these "translators" (1e)</i></li> </ul> <p>Barrier</p> <ul style="list-style-type: none"> <li>Informal organization often overlooked as being infrastructure to support sharing meta-data</li> </ul> <p><i>Recommendation</i></p> <ul style="list-style-type: none"> <li><i>Agency managers need to support informal network of contacts beyond the CIO council (2c)</i></li> </ul>	<p><b>Goal: Match technical opportunities within the organization's budget and program constraints</b></p> <p>Barrier</p> <ul style="list-style-type: none"> <li>Government organizations are often forced to "choose" standards or forced to delay implementation because of uncertainty as to which standards are appropriate</li> </ul> <p><i>Recommendation</i></p> <ul style="list-style-type: none"> <li><i>Clearinghouse function that investigates best practices could inform the decisions about which standards to pick? (14b)</i></li> </ul>	<p><b>Goal: Ensure that policy is implemented consistently across the entire policy community</b></p> <p>Barrier</p> <ul style="list-style-type: none"> <li>No central coordination of federal and state information sharing.</li> </ul> <p><i>Recommendation</i></p> <ul style="list-style-type: none"> <li><i>Clearinghouse could help, in selected areas, coordinate federal and state information sharing (12)</i></li> </ul> <p>Barrier</p> <ul style="list-style-type: none"> <li>Federal government information sharing with states may require information management infrastructure that is not scaleable to all states</li> </ul> <p><i>Recommendation</i></p> <ul style="list-style-type: none"> <li><i>States ought to work together to form regional alliances to support information management (13)</i></li> </ul> <p>Barrier</p> <ul style="list-style-type: none"> <li>Perception that providing undigested data freely will lead to misuse inhibits agency dissemination of information</li> </ul> <p><i>Recommendation</i></p> <ul style="list-style-type: none"> <li><i>Govt. should seize agenda by providing contextual information through meta-data to discourage misuse (6a)(6b)</i></li> </ul>

	<p style="text-align: center;"><b>Management</b></p> <p><b>Goal: Coordinate human resources, political, technical, and fiscal resources within and across organizations</b></p> <p>Barrier</p> <ul style="list-style-type: none"> <li>• Inability to share personnel is severe barrier to sharing meta-data about information in respective organizations</li> </ul> <p><i>Recommendation</i></p> <ul style="list-style-type: none"> <li>• <i>Agencies should share personnel informally or through strategic cross-agency projects in such domains as drugs or children's issues (2d)</i></li> </ul> <p>Barrier</p> <ul style="list-style-type: none"> <li>• Use of innovative solutions to interoperability in "sharing contracts" not widely disseminated wasting opportunities to share and leading to inconsistent practices</li> </ul> <p><i>Recommendation</i></p> <ul style="list-style-type: none"> <li>• <i>From existing sharing agreements create a uniform contract or formbook to disseminate knowledge (4)</i></li> </ul>		
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## Interoperability Policy Architecture: Planning, Implementing and Evaluating Policy

### Recommendation to Improve Evaluation of Interoperability

Policy Makers	Management	Technical	Policy Community
<p><b>Goal: Obtain information to understand necessary policy changes on a continuous basis</b></p> <p>Barrier</p> <ul style="list-style-type: none"> <li>There is little commonly-understood systematic knowledge on the relative success of interoperability projects and the explanations for their success</li> </ul> <p><i>Recommendation</i></p> <ul style="list-style-type: none"> <li><i>Create and support clearinghouse to evaluate interoperability experiences and best practices (2b)</i></li> </ul>	<p><b>Goal: Develop appropriate milestones and measures of success</b></p> <p>Barrier</p> <ul style="list-style-type: none"> <li>There is little commonly-understood systematic knowledge on the relative success of interoperability projects and the explanations for their success</li> </ul> <p><i>Recommendation</i></p> <ul style="list-style-type: none"> <li><i>Create and support clearinghouse to evaluate interoperability experiences and best practices (2b)</i></li> </ul> <p>Barrier</p> <ul style="list-style-type: none"> <li>There is a scarcity of quantitative measures if interoperability such that an objective measure of progress towards interoperability can be made</li> </ul> <p><i>Recommendation</i></p> <ul style="list-style-type: none"> <li><i>Define measures from the identified generic benefits of interoperability (9)</i></li> </ul>	<p><b>Goal: Monitor performance of systems and measure success against accepted measures of interoperability</b></p> <p>Barrier</p> <ul style="list-style-type: none"> <li>There is little commonly-understood systematic knowledge on the relative success of interoperability projects and the explanations for their success</li> </ul> <p><i>Recommendation</i></p> <ul style="list-style-type: none"> <li><i>Create and support clearinghouse to evaluate interoperability experiences and best practices (2b)</i></li> </ul> <p>Barrier</p> <ul style="list-style-type: none"> <li>There is a scarcity of quantitative measures if interoperability such that an objective measure of progress towards interoperability can be made</li> </ul> <p><i>Recommendation</i></p> <ul style="list-style-type: none"> <li><i>Define measures from the identified generic benefits of interoperability (9)</i></li> </ul>	<p><b>Goal: Participate in the evaluation and the development of recommendations for the next round of policy development and implementation</b></p> <p>Barrier</p> <ul style="list-style-type: none"> <li>There is little commonly-understood systematic knowledge on the relative success of interoperability projects and the explanations for their success</li> </ul> <p><i>Recommendation</i></p> <ul style="list-style-type: none"> <li><i>Create and support clearinghouse to evaluate interoperability experiences and best practices (2b)</i></li> </ul>

## PROJECT TEAM INFORMATION

### **DAVID LANDSBERGEN, LEAD AUTHOR**

David Landsbergen is an Associate Professor and the Associate Director for Doctoral Studies in the School of Public Policy and Management at the Ohio State University. Professor Landsbergen teaches, conducts research, and consults on the legal and policy issues surrounding the introduction of new information technology. He holds a J.D. and a Ph.D. from the Maxwell School at Syracuse University. He was an Ameritech Research Fellow. Professor Landsbergen has consulted with, among others, the National Regulatory Research Institute, the U.S. Department of Health and Human Services, the Georgia Public Service Commission, the Columbus Chamber of Commerce, the Utah Department of Public Utilities, the Ohio Department of Administrative Services, and the Niagara Mohawk Power Company. He also conducts executive education programs with the Fisher College of Business and the School of Public Policy and Management Executive Education programs. Professor Landsbergen has published numerous articles for both theoreticians and practitioners and has served as a guest editor for Telematics and Informatics and the Journal of Management Science and Policy Analysis.

### **GEORGE WOLKEN, JR, CO-AUTHOR**

Dr. Wolken brings to the program considerable personal background in computer and electronic technology including a Ph.D. degree from Harvard University making use of advance computer and software technologies applied to physics and over 40 journal publications related to software and computer technologies. Dr. Wolken is Of Counsel in the intellectual property group of Porter, Wright, Morris & Arthur (Columbus office) responsible for providing representation, counseling and legal services in patent and related areas of intellectual property law concentrating on the development, creation, management, commercialization and litigation involving advanced technology with special emphasis on modern developments in software technologies, advanced computing technologies, optical and wireless communication technologies and related licensing, commercial, security and policy issues.

### **CLAY BENTON, RESEARCH SPECIALIST**

Clay Benton, a third-year student at the Ohio State University College of Law, is a research assistant for ECLIPS working on the interoperability project. He received a dual degree in Chemistry and Psychology from Ohio Wesleyan University in Delaware, Ohio. While obtaining his undergraduate degree, Clay managed Comic Town, a comic book specialty store in Westerville, Ohio. Clay's primary interest area is in Intellectual Property Law.

### **JEFF WILHELM, RESEARCH SPECIALIST**

Jeff Wilhelm, a third-year law student at the Ohio State University College of Law and a Managing Editor of the *Ohio State Law Journal*, is a research assistant concentrating on privacy issues. Previously, Mr. Wilhelm was involved in developing another ECLIPS

project, the States Inventory Project, where he was the primary researcher. He received a B.A. in political science and history from Furman University in Greenville, South Carolina.

### **SHANNON SULLIVAN, RESEARCH SPECIALIST**

Shannon Sullivan, a third-year law student at the Ohio State University College of Law, is the graduate research assistant on the ECLIPS interoperability project. Shannon has demonstrated interest in a variety of academic areas, having obtained a major in Piano Performance and a minor in Management from Miami University, Oxford Ohio. Before attending law school she worked briefly at a US Brokerage House dealing primarily with garment imports, simultaneously teaching piano at a local conservatory. Her primary interests in the field of law include the new area of Cyberlaw, and International Law.

### **CHERYL D. STEVENS**

Cheryl D. Stevens is the Program Coordinator at ECLIPS. She currently manages a staff of ten people including professors, researchers, and graduate students. She is also responsible for the financial management of the program. In addition to her many managerial tasks, Ms. Stevens was instrumental in providing research for the IEP Privacy and Interoperability projects as well as for providing exposure for the States Inventory Project. She is a graduate of Bowling Green State University with a B.A. in Political Science. Ms. Stevens is a national member of Pi Sigma Alpha, the political science honorary fraternity.

### **J. KEITH HARMON, PROJECT DIRECTOR**

J. Keith Harmon is the Project Director at ECLIPS. He is currently involved in several Internet and electronic commerce-related projects, covering such areas as telecommunications policy, privacy law, smart card issues, and Internet use policies. He is also the Research Director of the States Inventory Project. Mr. Harmon's other duties include researching and reporting on other legal and policy issues relating to the Internet, including intellectual property, jurisdiction in cyberspace, First Amendment law, procurement reform, electronic authentication, and related issues.

Prior to joining ECLIPS, Mr. Harmon served as a Legal Fellow at the Office of Information and Regulatory Affairs (OIRA) at the Executive Office of the President. Mr. Harmon graduated with honors from the John Marshall Law School and was on the Editorial Board of the *John Marshall Journal of Computer and Information Law*. He has an undergraduate degree in business administration from the University of Florida and is a licensed attorney with the Florida Bar.

### **ABOUT ECLIPS**

ECLIPS (Electronic Commerce, Law, and Information Policy Strategies) was founded in 1994 as a center to aid governments, businesses, and academic institutions across the globe in the development of policies for the governance and use of cyberspace. Our extensive activities demonstrate our commitment to strategies that maximize the growth

and acceptance of electronic commerce, help governments minimize the need for regulation, and ensure the protection of individual rights.

ECLIPS is dedicated to developing and maintaining a high level of expertise in the many issues concerning electronic commerce and cyberspace. As a result, our research staff spends a considerable amount of time researching and keeping pace with the ever-changing laws, policies, business practices, and technologies of the Internet and electronic commerce. Our research areas are as diverse as cyberspace itself—including the issues of electronic commerce as well as related areas such as intellectual property, standards development, and privacy.

### **ABOUT OSC**

The Ohio Supercomputer Center (OSC) is a state-supported resource serving Ohio's higher education community. OSC offers computing resources on a peer-review basis to faculty and students conducting research in several disciplines, including medicine, business, economics, law, engineering, chemistry, mathematics, and physics.

Center staff assist faculty and student researchers by providing workshops, one-on-one classes, and web-based training materials. Ohio high school students step into the world of high performance computing and networking during OSC's annual Summer Institute. Students explore scientific investigation through collaborative team projects and intensive classes. Ohio high school teachers may also participate in this program.

Critical partnerships in computational science, like the Department of Defense's High Performance Computing Modernization Program and the National Computational Science Alliance, allow OSC to help position the state as a national technology leader. The Center's networking initiative, OARnet, provides Internet access to the majority of Ohio's colleges and universities and state government agencies. Through OARnet, more than a million Ohioans are connected to the vast information resources available on-line.