# Interoperable, Practical and Remarkable e-government:

## When, why and how to put reusable XML components to work with web services.

**EXPOSURE DRAFT**

**From the Research and Development Workgroup's project team for XML Technologies**

Submitted to members of the
National Electronic Commerce Coordinating Council

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**Abstract:**

This paper describes a way to create a dynamic framework for connecting isolated government legacy systems. To illustrate, it proposes XML standards for some frequently used subsets of environmental compliance data, and suggests the value of managing a compliance data workflow through an XML-driven online exchange.

Most examples derive from permit requirements for oil and gas wells. The paper also offers some national security implications of an online compliance workflow service.

## National Electronic Commerce Coordinating Council

The National Electronic Commerce Coordinating Council (**NECCC**) is an alliance of national state government associations dedicated to the advancement of electronic government within the states. The Council is comprised of the National Association of State Auditors, Comptrollers and Treasurers (**NASACT**), the National Association of State Chief Information Officers (**NASCIO**), the National Association of State Purchasing Officials (**NASPO**), and the National Association of Secretaries of State (**NASS**). In addition to these voting members, other governmental and private organizations participate in an advisory capacity. These associations include the Information Technology Association of America (**ITAA**), the National Automated Clearing House Association (**NACHA**), the National Association of Government Archives and Records Administrators (**NAGARA**), the National Association of State Chief Administrators (**NASCA**), the National Association of State Treasurers (**NAST**), and the National Governors Association (**NGA**). ITAA and NACHA represent private information technology companies and the financial services and technology industries.

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## Acknowledgements

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# Natural evolution of compliance fragmentation

Past innovations about how people work in groups and how people manage information have not necessarily made collaboration a lot easier. In 1906, one record-keeping breakthrough occurred when Charles Smead replaced rubber bands by inventing the Bandless Filing Envelope. Around the same time, organizations discovered new ways to compartmentalize people and tasks after Frederick Taylor published the conclusions drawn from his time-and-motion research.

**Decades after reliance on manila folders, microfiche, mainframes, and middle management, it's no wonder that information still tends to exist in silos.** Now that computing is cheaper and more powerful, and Internet connectivity is more prevalent, some of the deeply buried, fossilized barriers to collaboration are increasingly visible.

## Example: Environmental protection

The horizontal and vertical division of government responsibilities in the U.S. is most evident in environmental protection. While the Environmental Protection Agency drives regulatory legislation, other federal, state, and local government bodies refine the rules, enforce them, and manage all aspects of compliance administration.

### ☐ The burden on industry

Any facility that has the potential to pollute air, contaminate water, produce hazardous waste, or otherwise impact natural resources must comply with environmental laws. **Many facility operators manage and report redundant data to satisfy differences in federal, state, and local requirements that exist among overlapping government jurisdictions.**

Forty percent of small businesses do not fully comply with most regulations. When firms were asked how burdens might be reduced, 95% recommended simplifying reporting and record keeping.[1] Arguably, the burden is no lighter for large enterprises.

### ☐ The burden on government

State agencies receive over 18 million environmental compliance reports a year from over a million facility operators. **More than 90% of the reports arrive on paper.** It's estimated that at least 60% of an agency's administrative work is devoted to data input, correction, and validation.

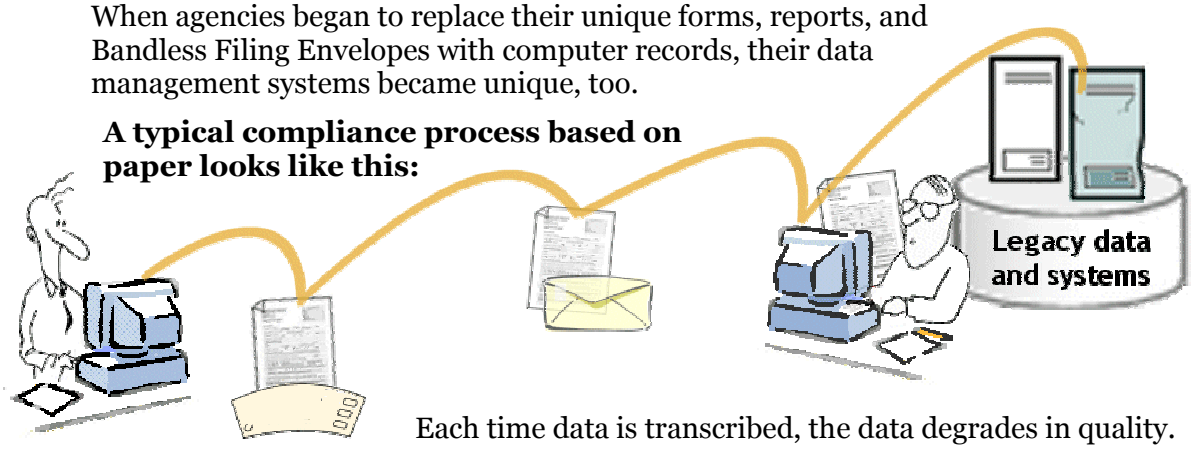
[1] "The Changing Burden of Regulation, Paperwork and Tax Compliance on Small Business" – US Small Business Administration, 1995.

## ☐ Why there's so much baggage to carry

The bureaucratic maze of environmental compliance has evolved from legislative acts independently focused on air quality, water protection, hazardous waste control, and resource conservation. It's been further complicated by unique geographic needs -- it makes sense for Alaska and Louisiana to have different requirements and procedures for water protection.[2]

These logical differences in regulations and procedures have driven federal, state, and local agencies to implement different methods and processes for managing compliance data. Paper forms and reports had to be unique within each jurisdiction. When agencies began to replace their unique forms, reports, and Bandless Filing Envelopes with computer records, their data management systems became unique, too.

**A typical compliance process based on paper looks like this:**




Each time data is transcribed, the data degrades in quality. According to one federal agency's internal study, its staff spends a high proportion of time handling data rather than on analysis and decision making.

**What if the process was digitized?** Moving compliance activities from paper to online transactions certainly can help reduce the low-value payback of many data administration tasks, and will allow agencies to deploy resources for higher-value work – like protecting the environment.

## Maximizing investments in legacy systems

Hundreds of environmental agencies have squeezed as much as possible from their technology budgets during the last two decades. In preparation for Y2K, many agencies obtained resources to replace obsolete systems. All agencies, however, now seem to be battling for sufficient budgets to plan and implement e-government capabilities.

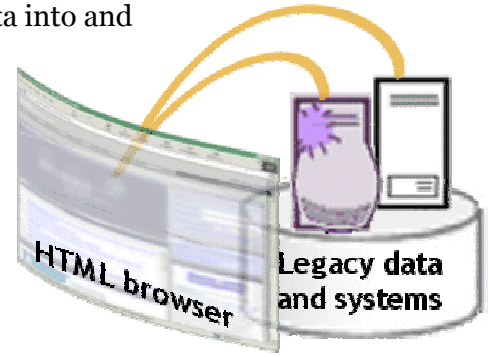
Despite constituent pressure to put compliance transactions online, legislators are cautious about uncoordinated technology spending, especially in this unpredictable economic and tech development climate. **One balanced approach is to apply new technologies that can extend the life of existing government systems.** The immediate e-government opportunity is to transform compliance processes by intelligently connecting, not uprooting, isolated systems and silos of data.

[2] See Appendix C (page 20) for references on environmental regulatory compliance.

## Minimizing additional costs of a digital veneer

Most government organizations have already set up websites to publish contact information, instructions, printable forms, and other useful resources. While these initiatives aren't easy to implement or cheap to manage, publishing content on the web is certainly easier and cheaper than enabling transactions on the web.

Some agencies are creating online forms that digitally mimic paper forms, then relying on human intervention to move the form data into and between legacy systems. Other agencies are web-enabling their legacy systems, but **it's expensive for an agency even to build a browser interface that pushes data into and between assorted legacy systems.** It's hard to find an example of a pure web application in government.




Does it make sense for agencies with parallel missions and with overlapping constituent populations to spend money "webifying" similar forms and processes? Not really, but it's happening anyway.

Government administrators are under considerable pressure to get their act online, and a handful of them are leading the way in environmental compliance. Even though they're getting good ROI marks, these leaders share frustration seeing the duplicate efforts (and millions of dollars spent) in counterpart agencies.

## Using new technologies to solve the problem

By applying software standards like XML and communications protocols like SOAP in Web Service architectures, agencies can help overcome some of these barriers, particularly for e-government initiatives.

What does that mean?

- XML (eXtensible Markup Language) is a specification developed by the W3C. XML is designed especially for Web documents, and it allows designers to create their own customized tags, enabling the definition, transmission, validation, and interpretation of data between applications and between organizations. XML is a data description standard.
- SOAP (Simple Object Access Protocol) provides a way for applications to communicate over the Internet, independent of platform. SOAP relies on XML to define the format of the information and then adds the necessary HTTP headers to send it. SOAP is a communications protocol.
- Web Services describes a system model with three functional layers. The most fundamental layer is made up of software standards (XML) and communication protocols (SOAP) that make it possible for diverse organizations to conduct transactions electronically. The middle layer is the service grid housing the utilities that support these transactions such as security, authentication and accounting. The top layer is made up of the various applications that support the specific end to end activities that make up e-government. An online data exchange is a web services application.

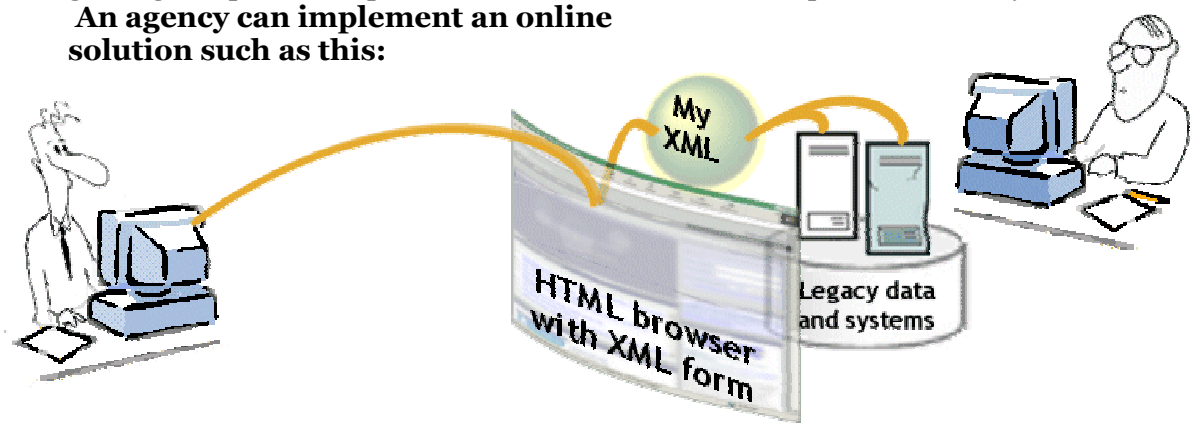
XML-driven web services can create the dynamic framework that lowers the dollar, time, and manpower investments to enable online transactions, especially for environmental agencies and their business constituents. **A small investment now in this kind of framework will continue to reap benefits even after funds become available for the relentless evaluation of current administrative processes, for designing better data management systems, and for implementing new technical e-government infrastructures.**

# How data interoperability helps government and industry

A point-to-point regulatory process occurs when a single organization transmits compliance information to another organization. Putting the transaction online will probably improve data quality and processing time. However, **if an agency builds a browser interface that is uniquely structured to move data into its unique legacy applications, the opportunity for interoperability is lost.**

If fossilized compliance applications remain isolated among environmental agencies, e-government initiatives can use standard XML components as a guiding compass to map online transaction data into unique back office systems.

**An agency can implement an online solution such as this:**

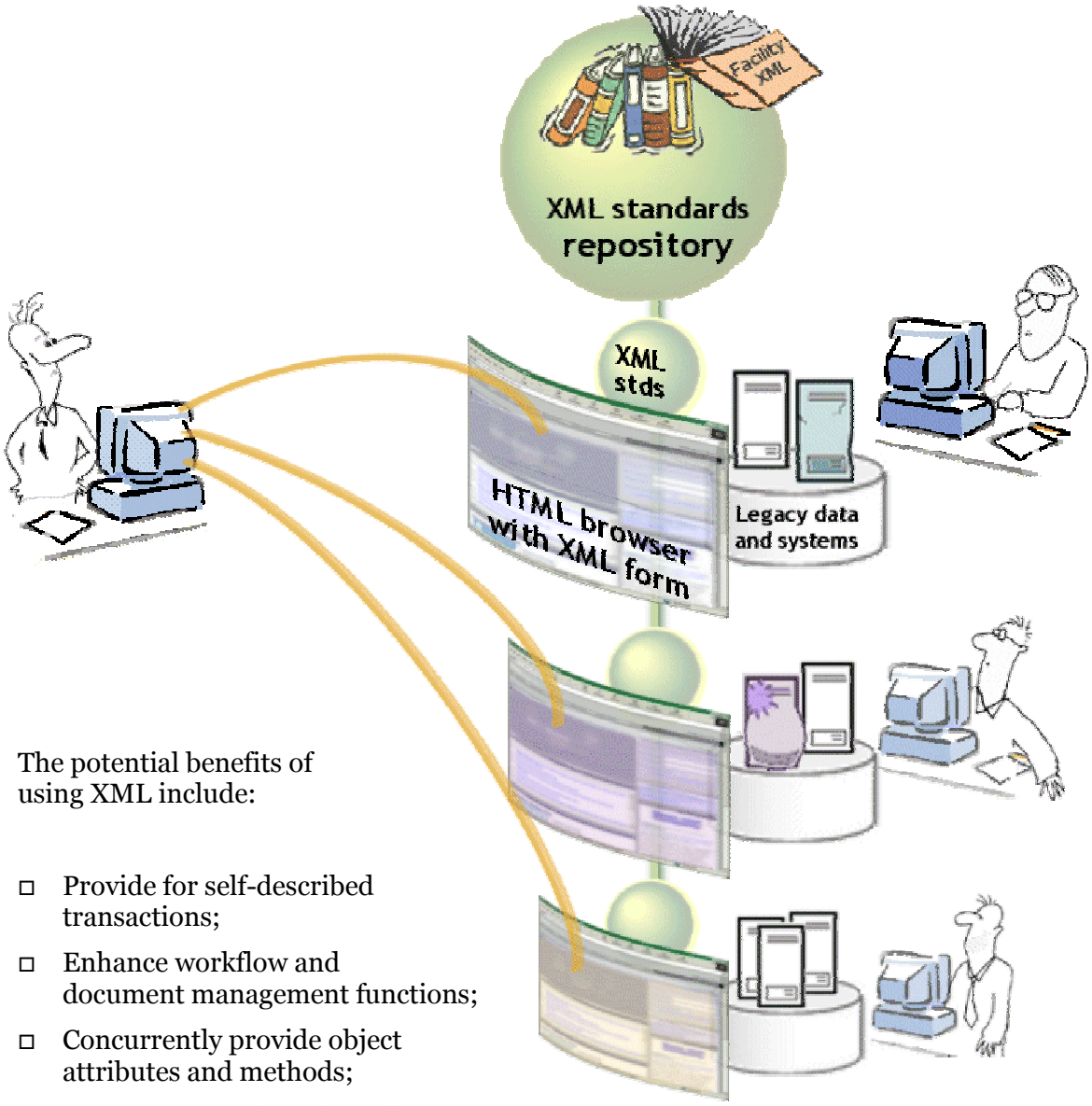



## Where XML can fit in a point-to-point compliance workflow

The benefits of data interoperability depend on the development, acceptance, widespread implementation, and ongoing support of standard XML components. Environmental agencies moving beyond e-government "brochure" websites and into e-government transactions should consider adopting XML technologies immediately.

Even with some acceptable standards published in a sanctioned repository, The adoption of XML standards still does little to disrupt existing administrative processes, as illustrated on the following page.

## Potential results of point-to-point online compliance




The potential benefits of using XML include:

- Provide for self-described transactions;
- Enhance workflow and document management functions;
- Concurrently provide object attributes and methods;
- Create a semantic web application rather than "batch" transactions;
- Ease of implementation;
- Acceptance by a number of vendors and partners.

The data transfer process is different, but the business process has not really changed. The filers are still filling out forms, only now the forms are better controlled in a browser. Information is transcribed via a standard XML schema, which can be mapped to match existing data models.

Applying XML standards within government can yield greater benefits if agencies take inventory of horizontal and vertical data-exchange "conversations" and look for commonalities. Public-private partnerships can promote the development of XML-enabled tools that support the predominant document components and formats, saving governments from endless custom scripting to map variant DTDs to local standards.

> When today's processes and forms are put online, [government] customers will initially be pleased ...but dissatisfaction will arise as they find that they have to visit a dizzying array of sites addressing similar needs. Congress and the public will then demand that sites be consolidated by function, so that all of a customer's needs are addressed in one place.
>
> "E-Transitions" article
> E-Gov Journal, Nov 2000

As the diagram on the preceding page illustrates, however, XML technologies alone will not resolve some of the problems that plague environmental compliance administration for both government and industry:

- Redundant administrative tasks for filers;
- Redundant data management for agencies;
- Disconnected legacy systems;
- Difficulty capturing environmental trends.

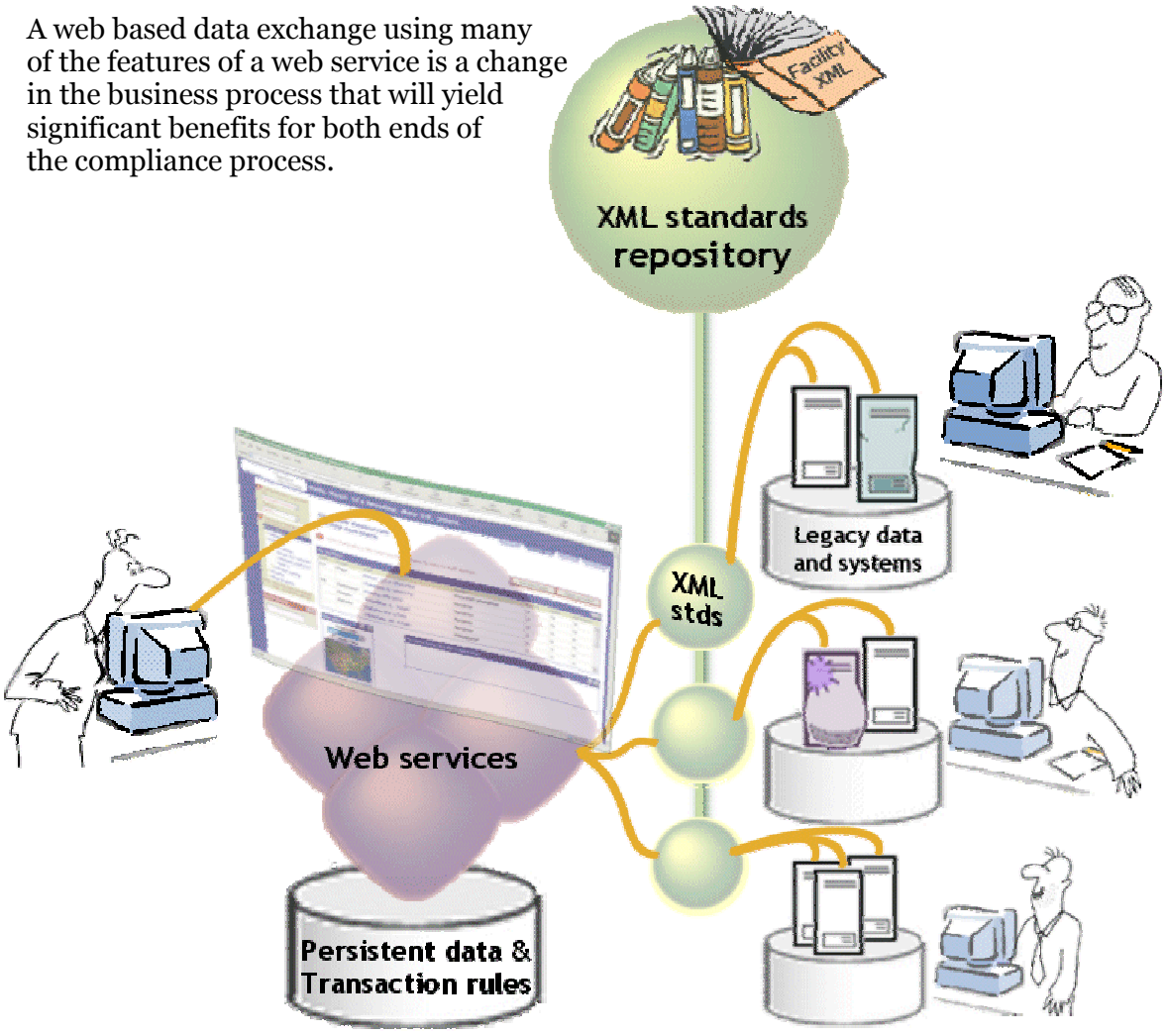
# How web services help government and industry

What has been called e-business has for the most part been a primitive patchwork of old technologies with a browser interface. Most companies that do business on the Internet have to yoke together existing systems with new ones to create the illusion of integration. The uninformed filer (or regulator) may think it's a single, streamlined system, but behind the scenes, people are often manually taking information from one application and entering it into another. This is inefficient, slow and mistake ridden.

Web Services takes the intervention out of the network. The architecture will enable connections between applications.[3]

## Where XML can fit in a multi-point compliance workflow

A web based data exchange using many of the features of a web service is a change in the business process that will yield significant benefits for both ends of the compliance process.




[3] Harvard Business Review, "Your Next IT Strategy," October 2001 (John Hagel III and John Seely Brown)

## Potential results of multi-point online compliance

- Build on existing systems
- Start small and build a platform for growth
- XML engine connects disparate data through common tags
- Meta-rules govern reporting and data requirements for varying environmental regulations
- Secured data warehousing provides control over sensitive, private information for corporations
- Browser interface offers simplified compliance data management, reporting, and tracking
- Batch transfers offer timely, expeditious reporting between corporations and agencies
- Data conversion enables agencies to inexpensively upgrade legacy data systems

Regulatory compliance is an ongoing, significant cost of doing business. It is clear that reducing its complexity will reduce its cost – for industry as well as government. Technology is key to unlocking values, which include:

- Returning savings in cost of compliance to business,
- Enabling G4B transactions associated with compliance to be processed faster
- Reducing errors in compliance processes
- Exposing information earlier and more appropriately.
- The information technology framework we envisage, coupled with an increasing agreement on standards, will:
- Smooth the ride and grease the wheels of communication and collaboration.
- Enable the movement of large amounts of data, of a variety of types, between the different points that need to examine and respond to it.
- Enable consistent access through a variety of channels, in a variety of languages.
- Enable consistent access from a variety of device types, fixed and mobile, from PCs to single chip sensors, and applications, interoperating in real or near-real time.

## Overcoming infrastructure phobias?

No one argues the value of e-government infrastructures, but successful cross-agency cooperation is not widely evident yet. Agency administrators may fear cooperation means integration of data structures and processes, which could force consolidation and threaten their existence. Ironically, there is less need for these kinds of concerns today than ever before. Technology actually makes life better in this regard, not worse.

## Anticipated impact for a nation on alert

There are new and critical agenda items in development to support homeland security. Government organizations must adopt near-term data solutions that arm them with relevant information and make it possible to act and react swiftly. For example, while new EPA procedures are in place to protect drinking water sources from contamination[4], the systems for monitoring water quality remain fragmented across states, municipalities, and other local governing bodies. A real-time aggregate view of data is not available to quickly recognize patterns of change in air, water, or hazardous waste conditions.

**Any collaborative solution that takes too long to implement is not going to be effective or accepted.** A dynamic framework built from XML technologies and web services can be implemented rapidly, right now, because the components of the dynamic framework do not require the redesign of organizational systems and structures. Working within the existing structures of environmental agencies is the only way to enable quick success.

Implementation of XML-based web services, particularly for high-priority practices of monitoring air and water, can accelerate:

- Compliance workflow efficiencies for facility operators and enforcement agencies
- Collection of granular data at multiple points
- Transmission of data between different systems
- Consolidation of information across jurisdictions to identify environmental trends.

## Benefits of a web services architecture

A web services architecture provides several benefits, including:

- Promoting interoperability by minimizing the requirements for shared understanding
- Enabling just-in-time integration
- Reducing complexity by encapsulation
- Enabling interoperability of legacy applications.

## Functions that web services could provide

- Security: Information provided by citizen/business to government and vice versa (personal information provided about citizen/business from government)
- Registry: Citizen/business registers for services this will provide information used to build a user profile provide personalization
- Information on demand: Search engine that provides personalized, reliable, accurate, timely, any time any place information displayed in categories relevant to government

[4] See EPA press release of October 22, 2001: http://www.epa.gov/epahome/headline_102201.htm

- Forms builder: Ability for government to generate forms; update as needed; provide access to citizen/businesses for submission via web.
- Transactions: Provide ability to submit fees, fines for government compliance
- Scheduling: Ability to schedule any face-to-face interactions on-line that are required to meet government compliance requirements as part of the business process targeted for this service offering
- Hot Links: Ability to access information relevant to particular business customer segments, business needs, etc.
- Secure Messaging and Use of XML/EDI/WS,etc: Provide common protocols that enhance interoperability between data bases, including legacy systems

In other words -- interoperability agreement and infrastructure, and secure workflow

# Next steps for government and industry stakeholders

E-government initiatives should not reinvent, but **connect** with compliance data architectures and products that are based on open standards, including XML, using a "best of breed" approach. This is the best way to take advantage of XML and web service capabilities now and in the future.

Federal, state, and local government agencies should work with providers that will help them to:

- Participate fully in advancing government-wide thinking on XML usage, especially with active organizations such as XML.gov, XBRL.org, and the Environmental Council of States (www.sso.org/ecos).
- Understand and develop taxonomies for regulatory processes, and find and collaborate with other bodies making similar efforts.
- Ensure that as e-government applications emerge, they make sensible use of XML technologies, regardless of whether broad agreement has been reached yet on implementation controls, such as a central XML Namespace for government.
- Transfer knowledge, skills and ideas to relevant individuals and organizations through the provider's expertise, research and development capabilities.

## Testing an online exchange for compliance

Several members of this NECCC project team expect to follow up on the work they accomplished this year. They propose to:

- Pick one environmental focus and one industry segment. (The current team has included public and private sector members that support the energy industry.)
- Within that environmental and industry realm, select a particular compliance process. (This team has focused on the permit for drilling an oil or gas well.)
- Prioritize the compliance activities and processes. What headaches do facility operators and government administrators share? What has the biggest impact on economic growth, national security, or constituent confidence?
- Identify all interactions, stakeholders, and origination points for a selected process.
- Produce and pilot a prototype that solves the selected problem, and that demonstrates the value of the XML-based web service.

## Defining other reusable XML components

The scope of this NECCC project did not include ongoing development or maintenance of recommended XML components or standards. Another organization must become caretaker of the standards[5]. Government and industry stakeholders must contribute resources to support the important work of the candidate organizations.

[5] Examples of these organizations are included in Appendix A (see page ).

# Appendix A: XML standards and technologies

## What is XML?

EXtensible Markup Language (XML) is used to create files for exchanging and displaying data. XML uses markup symbols to describe and define data in a readable format. XML allows users to define metadata that, through the use of tags, identifies data elements contained within a document. This helps facilitate information exchange between systems by ensuring that all parties exchanging data share a common understanding of what is being exchanged.

### ☐ XML documents

Development of an XML document begins with the identification and definition of common data elements. The data elements are described with meaningful tags. For example, an XML-tagged document for a business card might look like this:

```
<business_card>
    <first_name>Bubba</first_name>
    <middle_initial>Q</middle_initial>
    <last_name>Smith</last_name>
    <company>Datamonger, Inc.</company>
    <e-mail>bqsmith@datamonger.com</e-mail>
</business_card>
```

If an XML document contains a large number of data elements, or tags, then its developers may create a **document type declaration (DTD)** to define the names and rules for that set of tags.

Using the business card example, the DTD might look like this:

```
<schema targetNS="http://someplace/businesscard.xsd" version "1.0"
  xmlns="http://www.w3.org/1999/XMLSchema">
    <element name="businesscard">
        <type>
            <element name="first_name" type="string"/>
            <element name="middle_initial" type="string"/>
            <element name="last_name" type="string"/>
            <element name="company" type="string"/>
            <element name="e-mail" type="string"/>
        </type>
    </element>
</schema>
```

Good DTDs and schemas are now being parked in publicly accessible registries (the DTD example above indicates that it's parked in a registry called "someplace").

### ☐ Some XML technologies

The **XML processor**, usually embedded in the application used to view the XML document, checks to make sure the XML file or document follows all the rules defined in the DTDs.

The **XML parser** is responsible for reading the XML document and creating its document tree. This, defined in the DTD, is a hierarchical structure of the content.

## If you really want to know more about XML…

The following list includes a few links to publications that describe the potential benefits of XML technologies, and organizations that support the development of XML standards. This is not an exhaustive nor an NECCC-endorsed list.

### "XML in 10 Points (7 really)"

http://www.w3.org/XML/1999/XML-in-10-points
Attempts to capture enough of the basic concepts to enable a beginner to see the forest through the trees…

### "XML for Not-Yet Techies"

http://www.topxml.com/xml/articles/xmlnontechies/Default.asp
This article offers a brief description of XML, how it evolved and what we can do with it in the future.

### XML.gov

Cooperative XML efforts between government agencies and the private sector.

### ebXML.org

Helping develop globally standard methods to communicate data in common terms and define and register business processes.

### XBRL.org

Extensible Business Reporting Language (XBRL) is an open specification which uses XML-based data tags to describe financial statements for both public and private companies.

### XML.com

News, articles, events, tools, and a myriad of all things XML.

### W3.org

The World Wide Web Consortium (W3C) develops interoperable technologies (specifications, guidelines, software, and tools) to lead the Web to its full potential as a forum for information, commerce, communication, and collective understanding.

## Proposed XML components for environmental compliance

The recommendations from this project team will be published in a final whitepaper.

## Additional resources about government XML standards

These papers and organizations explain other XML opportunities for government.

### ☐ Health Insurance Portability and Accountability Act

The enactment of the Health Insurance Portability and Accountability Act of 1996 (HIPAA) has led to vigorous activity within the health-care community to develop XML standards that will provide for improved portability and availability of group health coverage. Efforts to comply with HIPAA guidelines led to the formation of the Workgroup for Electronic Data Interchange (WEDI) <http://www.wedi.org>, a non-profit coalition including governmental, non-profit, and private sector participants. WEDI has organized an Emerging Technologies committee that has made XML one of its major initiatives. The committee issued a statement declaring, "The use of Web-based technologies to provide a universal access point for aggregating data from disparate systems seems a foregone conclusion. XML's ability to facilitate the exchange of information between systems, coupled with the emerging applications to process XML documents on the server, make it the obvious choice as the back-end framework for healthcare information systems",

### ☐ Toward National Sharing of Governmental Information

In this 1999 report, NASIRE (now NASCIO) pointed to XML as a promising open standard for sharing dynamic structured information (i.e., dynamic documents) as a part of inter-agency or intergovernmental transactions. NASIRE states: "The recent standardization of XML provides a robust extensible encapsulation method superior to any now in use; what is still lacking is widespread knowledge about and adoption of the new standard, both for 'new-start' sharing applications and re-work of existing applications. The development of document specifications for sharing requires substantial work at the national level…and then large amounts of painstaking work to complete the library of sharing documents."

### ☐ Court filings and LegalXML.org

The justice community, with its history of nationwide - and even worldwide - information sharing, has already begun the painstaking task of developing shared XML documents. Legal XML (http://www.legalxml.org), a national non-profit organization founded in 1998, is comprised of volunteer members from private industry, non-profit organizations, government and academia. The mission of Legal XML is to develop open, non-proprietary technical standards for legal documents and related applications. The group has established numerous discipline-specific working groups (e.g., courts http://www.courtxml.org) and an Integrated Justice Working Group (IJWG) to facilitate information sharing across the justice system. The IJWG has as its stated mission:

"…to identify and define the DTDs (document type definitions) for documents exchanged between courts, justice agencies, and key stakeholder agencies and organizations throughout the justice enterprise. The Integrated Justice Work Group will develop open, non-proprietary XML markup and related electronic interchange standards for documents routinely exchanged between federal, state, and local organizations in the justice environment".

Much of LegalXML's document development process will likely complement work being done by SEARCH, the National Consortium for Justice Information and Statistics (http://www.search.org), which is compiling justice information "exchange points" as part of its ongoing integrated justice efforts. The exchange point study reports that:

"Agencies need to share critical information at key decision points throughout the justice process. Justice agencies conduct a series of what are essentially conversations at these key decision points in the justice process…At arrest, for example, the arresting agency typically sends certain information regarding the arrestee to the state criminal history records repository (for example, name, age, sex, race, driver's license number, electronic image of the arrestee's fingerprints, arrest charge information, etc.) to record the arrest transaction in the instant case…Every state, and to a lesser extent each jurisdiction within each state, is free, within certain constitutional and statutory boundaries, to construct and define their information exchange processes. Accordingly, there is considerable variation throughout the nation…Notwithstanding these and other variations, there appears to be significant consistency on key dimensions of information exchange - conversations - in justice processing throughout the nation".

All areas of government can identify multiple information exchange points - such conversations, both across agencies and between the local, state and federal levels.

### ☐ Federal CIO Council

The federal government has begun investigating the potential uses of XML for enterprise-wide interoperability through the Federal CIO Council's XML Working Group. The council announced the formation of the group, which works under its Enterprise Interoperability and Emerging Information Technology Committee (EIEITC), saying, "eXtensible Markup Language (XML) embodies the potential to alleviate many of the interoperability problems associated with the sharing of data within and across organizations." The working group will undertake four activities:

- ☐ Identify pertinent standards and best practices;
- ☐ Establish partnerships with industry and public interest groups;
- ☐ Establish partnerships with governmental communities of interest; and
- ☐ Education and outreach.

### ☐ XML and Human Resources data

The time has come for governmental entities and their related IT associations to aggressively pursue enterprise-wide XML DTDs for information exchange. They should consider opportunities to plug into existing private-sector efforts such as the HR-XML Consortium (http://www.hr-xml.org/), a national, non-profit organization seeking "an e-commerce framework for human resources." This consortium offers a free membership to non-profits, which includes participation in technical working groups and voting rights.

# Appendix B: References on web services

Web services are self-contained, modular applications that can be described, published, located, and invoked over a network -- generally over the Internet, but also within Intranets and Extranets. Web services fulfill three roles: service provider, service requester and service broker; and three basic operations: publish, find and bind. A network component can play any or all of these roles.

Previous attempts at distributed computing (CORBA, Distributed Smalltalk, Java RMI) have yielded systems where the coupling between various components in a system is too tight to be effective for low-overhead, ubiquitous e-business or e-government over the Internet. These approaches require too much agreement and shared context among systems from different organizations to be reliable for open, low-overhead e-business.

Meanwhile, the current trend in the application space is moving away from tightly coupled monolithic systems and towards systems of loosely coupled, dynamically bound components. Systems built with these principles are more likely to dominate the next generation of e-business systems, with flexibility being the overriding characteristic of their success.

In the near future, applications will be based on compositions of services discovered and marshaled dynamically at runtime (just-in-time integration of services). Service (application) integration becomes the innovation of the next generation of e-business, as businesses move more of their existing IT applications to the Web, taking advantage of portals and e-marketplaces and leveraging new technologies such as XML.

The concept of Web Services is our view of what the next generation of e-business architectures for the Web will look like. The Web Services architecture describes principles for creating dynamic, loosely coupled systems based on services, but no single implementation. There are many ways to instantiate a Web Service by choosing various implementation techniques for the roles, operations, and so on described by the Web Services architecture.

Use of the Web Services architecture provides the following benefits:

- Promotes interoperability by minimizing the requirements for shared understanding

  An XML-based interface definition language and a protocol of collaboration and negotiation are the only requirements for shared understanding between a service provider and a service requester. By limiting what is absolutely required for interoperability, collaborating Web services can be truly platform and language independent. By limiting what is absolutely required, Web Services can be implemented using a large number of different underlying infrastructures.

- Enables just-in-time integration

  Collaborations in Web Services are bound dynamically at runtime. A service requester describes the capabilities of the service required and uses the service broker infrastructure to find an appropriate service. Once a service with the required capabilities is found, the information from the service's NASSL document is used to bind to it.

Dynamic service discovery and invocation (publish, find, bind) and message-oriented collaboration yield applications with looser coupling, enabling just-in-time integration of new applications and services. This in turn yields systems that are self-configuring, adaptive and robust with fewer single points of failure.

- Reduces complexity by encapsulation

  All components in Web Services are services. What is important is the type of behavior a service provides, not how it is implemented. A WDS document is the mechanism to describe the behavior encapsulated by a service.

  Encapsulation is key to:

  - Coping with complexity. System complexity is reduced when application designers do not have to worry about implementation details of the services they are invoking.
  - Flexibility and scalability. Substitution of different implementation of the same type of service, or multiple equivalent services, is possible at runtime.
  - Extensibility. Behavior is encapsulated and extended by providing new services with similar service descriptions.

- Enables interoperability of legacy applications

  By allowing legacy applications to be wrappered in NASSL and WDS documents, and exposed as services, the Web Services architecture easily enables new interoperability between these applications. In addition, security, middleware and communications technologies can be wrappered to participate in a Web service as environmental prerequisites. Directory technologies, such as LDAP, can be wrappered to act as a service broker.

  Through wrappering the underlying plumbing (communications layer, for example), services insulate the application programmer from the lower layers of the programming stack. This allows services to enable virtual enterprises to link their heterogeneous systems as required (through http-based communications) and/or to participate in single, administrative domain situations, where other communications mechanisms (for example, MQSeries) can provide a richer level of functionality.

  Examples of this can be found in merger situations, where the resulting enterprise must integrate disparate IT systems and business processes. A service-oriented architecture would greatly facilitate a seamless integration between these systems.

  Another example can be found in the combination of the travel industry with pervasive computing, when largely mainframe-based travel applications can be exposed as services through wrappering and made available for use by various devices in a service-oriented

environment. New services can be created and dynamically published and discovered without disrupting the existing environment.

Web Services is the next stage of evolution for e-business - the result of viewing systems from a perspective that everything is a service, dynamically discovered and orchestrated, using messaging on the network.

In the Web Services architecture, each component is regarded as a service, encapsulating behavior and providing the behavior through an API available for invocation over a network. This is the logical evolution of object-oriented techniques (encapsulation, messaging, dynamic binding, and reflection) to e-business.

The fundamental roles in Web Services are service providers, service requesters, and service brokers. These roles have operations: publish, find, and bind. Operation intermediation occurs through environmental prerequisites, and it introduces aspects such as security, workflow, transactions, billing, quality-of-service, and service level agreements. The mechanism of service description language is key to fundamental operations in Web Services..

# Appendix C: Environmental compliance

For 52 years, U.S. lawmakers have made efforts to protect the environment.[6] Some of the major acts include:

- National Environmental Policy Act of 1969 (NEPA)
- The Clean Air Act of 1970 (CAA)
- The Clean Water Act of 1977 (CWA)
- Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA or Superfund)
- The Emergency Planning & Community Right-To-Know Act of 1986 (EPCRA)
- The Occupational Safety and Health Act of 1970 (OSHA)
- The Oil Pollution Act of 1990 (OPA)
- The Pollution Prevention Act of 1990 (PPA)
- The Resource Conservation and Recovery Act of 1976 (RCRA)
- The Safe Drinking Water Act of 1974 (SDWA)
- The Superfund Amendments and Reauthorization Act of 1986 (SARA)
- The Toxic Substances Control Act of 1976 (TSCA)

## The paper hurricane from environmental laws

Legislative acts to control pollution and preserve natural resources have resulted in a continuous exchange of 18 million reports between industry and government every year. Although the EPA drives environmental legislation, the responsibility for enforcing compliance is delegated to other federal, state, or local agencies. Similar data is collected by different agencies on dozens of unique forms, and then keyed into disconnected systems.

When an agency attempts to improve a process or replace obsolete technology for managing high volumes of data, that attempt is usually isolated – and expensive.

[6] The EPA website summarizes the major acts here: http://www.epa.gov/epahome/laws.htm

## ☐ The two-dimensional impact

The table below includes examples of industry and government regulatory activities that occur throughout the lifecycle of an operating facility.

| **A facility operator must:** | **An agency administrator must:** |
|---|---|
| Obtain agency permission to operate within pollutant limits | Assess operational impact, obtain public consent, and issue or deny a permit |
| Notify an agency of specific changes in operations | Acknowledge the notice or approve the change in operations |
| Keep years of self-audit and performance records | Verify the quality and consistency of records |
| Submit incident reports and performance data | Capture the data and monitor impact |
| Allow agency site inspections | Schedule and conduct site inspections |
| Correct, appeal, or pay fines for compliance infractions | Issue warnings, violations, penalties, and other enforcement actions |
| Report prevention measures and contingency plans | |

## ☐ The effect of compliance avoidance

A U.S. Labor executive recently stated that 99.7% of all US businesses are small businesses (defined by Labor as 250 employees or less). They employ 70% of the workforce. Many small businesses may opt out of compliance because of complexity, while large firms navigate compliance through hiring attorneys that the small businesses typically cannot afford.

Compliance avoidance is proportionate with the difficulty and cost associated with complying. The value of a dynamic e-government framework in alleviating the burden of dealing with government in this area is clear.

## Status of EPA Data Standards

The EPA is cataloging some of its information resources in the Environmental Data Registry (EDR). Data standards relevant to compliance and regulation can be found at www.epa.gov/edr/index.htm.

The standards listed below are finalized. **None have been finalized as XML standards or schemas**, but some draft XML tags were published in January 2001.

### ☐ Facility Identification

Core data elements that properly identify the location, the affiliated organizations, individual business activities, and the environmental interest of a facility site. The locational component of this standard has been developed under a separate Latitude/Longitude data standard.

The Facility Identification Data Standard was developed by a state/EPA Action Team chartered by the ECOS-State-EPA Information Management Workgroup as part of the Agency's plan to improve environmental information. With the approval of this standard, the Environmental Protection Agency is taking a step forward in standardizing the collection of identification information related to regulated facilities and facilitating public access to that data.

### ☐ Chemical Identification

Common identifiers used throughout the Agency for all chemical substances regulated or monitored by EPA environmental programs.

A Chemical Data Standard Work Group comprised of representatives from across Agency programs developed the Chemical Data Standard. The consensus standard defines what information is required to identify a chemical substance and how that information should be recorded. It provides for the use of common identifiers throughout the Agency for all chemical substances regulated or monitored by EPA environmental programs.

### ☐ Latitude/Longitude

The group of data elements used for recording horizontal and vertical coordinates and associated metadata that define a point on earth.

The Latitude/Longitude Data Standard group data elements should be used by system developers to create an entity that contains data that identifies the spatial location of a facility. Multiple occurrences of latitude, longitude, and vertical measurement (i.e., altitude) might be collected to identify an area or a line that defines the specific location and geometry of a spatial instance.

### ☐ SIC/NAICS

Ways to classify business activities, including industry classifications, product classifications, and product codes.

The Standard Industrial Classification (SIC) System has been used for many years to provide a code system for the identification of business activities. SIC codes range from two digit general categories to four digit specific categories. SIC codes are

gradually being replaced by the North American Industry Classification System (NAICS) that was adopted by Canada, Mexico, and the United States in 1997. The NAICS codes include updated economic categories.

The EDR standards listed below under development.

### ☐ Enforcement/Compliance

A common language for recording and exchanging enforcement- and compliance-related information between EPA, states, and tribal nations. The Enforcement/Compliance subject area involves standard terminology used in official documents, such as warning or notification letters, enforcement and legal documents, case details, and compliance evaluations such as inspection surveillance, and record review.

### ☐ Permitting

Common data elements for documenting, describing, and exchanging permitting related information between EPA, states, and tribal nations. The Permitting subject area also involves development of standard terminology used in official documents and permit names.

### ☐ Geolocational

Common latitude/longitude formats for representing both linear and polygonal features in Geographic Information Systems (GIS). This standard includes details regarding the secondary use of latitude/longitude data.

# Appendix D: Project contributors

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