**Center for
Technology in Government**

Using XML for Web Site Management
Getting Started Guide

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Introduction

As government Web sites grow in size and complexity, it is important for agencies to develop sounder approaches to Web site management and publication processes. Poor public image, prohibitive maintenance costs, lack of consistency, and limited capacity to provide multiple formats are just some of the problems that many government Web sites are already facing or will face in the near future. The future of e-government will depend in part on the ability of governments to manage their Web sites in a more effective and efficient way to deliver value to citizens.

The standard architecture (HTML) for most existing sites presents serious limitations for managing complex Web sites. A viable alternative to an HTML-based Web site is one rooted in XML (eXtensible Markup Language). Because it is not based on individual HTML Web pages, XML offers an innovative, long-term solution to many of the shortcomings of current Web site design tools, techniques, and publication processes.

The *Getting Started with XML* guide is based on CTG's own experience converting its Web site to XML, along with the experiences of five New York State agencies who participated in CTG's XML Testbed. The research gathered from the Testbed contributed to a greater awareness of how XML can be used for Web site management in government settings. The guide was developed with these lessons in mind, because despite the clear advantages of XML, government confronts many obstacles to the adoption and implementation of XML-based Web site management. By using the guide, government agencies can gain new insights into how they can benefit from XML and develop strategies to address the technical and organizational issues to get started.

To benefit from XML, it is not necessary to overhaul your whole Web site or even a large part of the Web. After reading through the guide, you may find that you want to start small, and then as you progress, migrate more of your Web site to an XML structure, based on the goals you wish to achieve. In both cases, your organization will benefit from the process of analysis you have begun.

This guide can be used by Webmasters, program management and staff, IT management and staff, Public Information Officers — anyone who wants a strong Web presence and an effective way to manage it. The following topics are covered to help you to get started with XML:

- A primer on what XML is and how and why it can be used to more economically and efficiently manage Web site content in a new way.
- Questions to consider before deciding whether or not your Web site can benefit from XML.
- An explanation of when XML works best and the benefits of its use.
- Guidelines on how XML can be adapted in different Web environments.
- A look at some organizational and workflow issues that will affect your XML project.

What is XML for Web Site Management?

Most government agencies have developed and manage one or several Internet or intranet Web sites. As these Web sites grow in size, complexity, and importance, they create growing concerns for Web site management, content management, maintenance costs, and accessibility. Consequently, government agencies find it increasingly difficult to be responsive and flexible in providing new information and Web-based services.

Government Webmasters and system administrators have come to realize that the HTML-based technologies and strategies used in the past to build most Web sites work well for individual Web pages, but present serious challenges when managing complex Web sites. A Web architecture based on individual HTML pages does not:

- provide a structure for easily maintaining entire Web sites,
- contribute to managing the workflow involved in Web content production and maintenance, nor
- facilitate the sharing and reuse of Web site content (see Figure 1).

Figure 1. Web Publishing Workflows using HTML.

XML, however, is not based on individual Web pages; and in fact offers an innovative, long-term solution to many of the shortcomings of current Web site design tools and techniques because it structures Web content in a meaningful way. This creates a workflow characterized by a single source of standardized content (XML), rather than multiple copies of that content in multiple locations (e.g., Word files, HTML files, databases, desktop publishing files all maintained by different persons). In addition, supporting

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technologies (such as XSL) enable that Web content to be delivered efficiently in multiple ways and formats (e.g., HTML Web pages, PDF, mobile devices, RTF documents, etc.), while maintaining a single source of standardized content. This framework also enhances consistency of content across Web sites, eliminates unnecessary manual conversions of content from one format to another, and reduces the number of non-value-added, redundant checking tasks associated with the HTML-based workflow (see Figure 2).
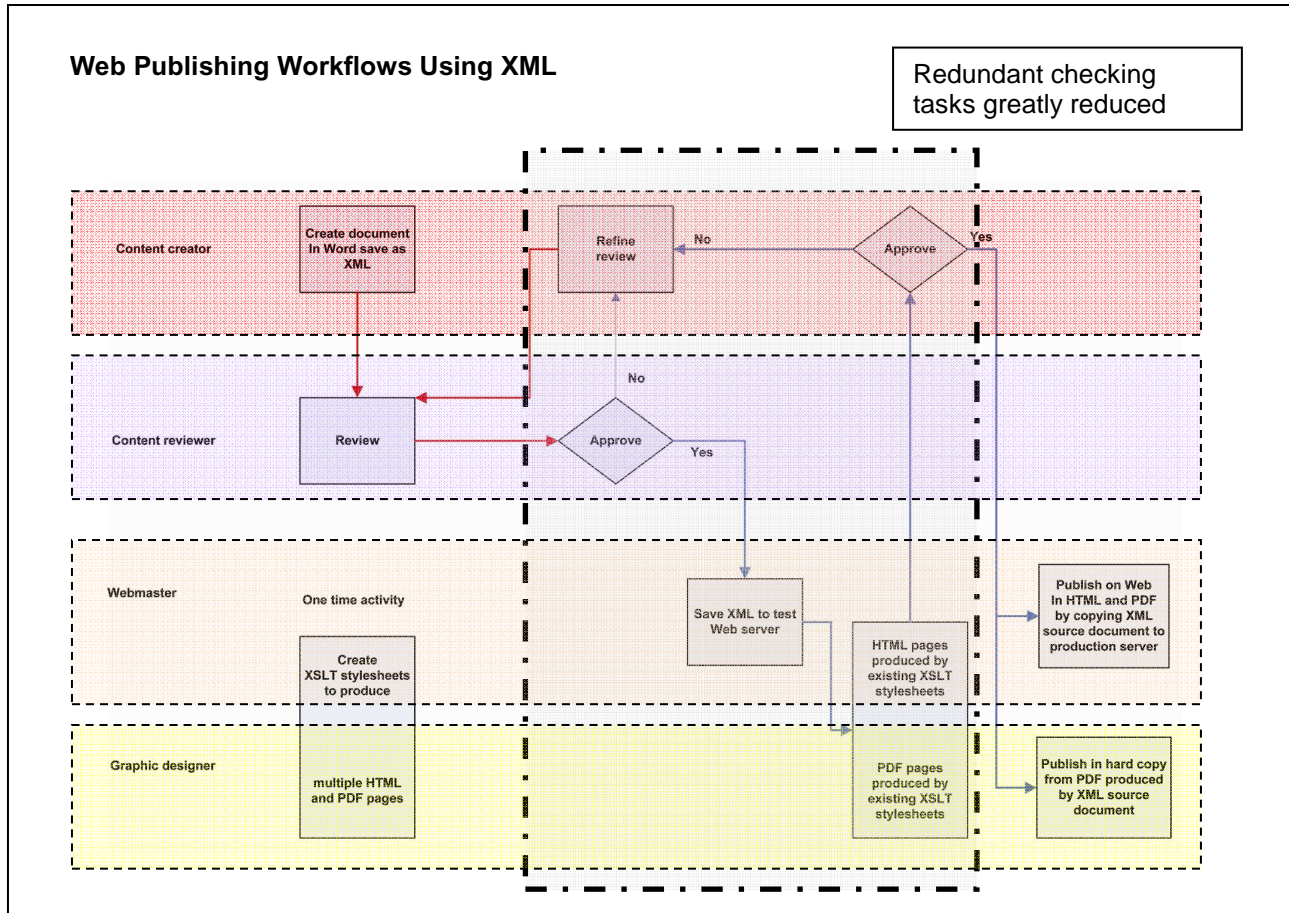

Figure 2. Web Publishing Workflows using XML.

Who Should Consider XML?

To determine if your agency can benefit from using XML for Web site management, it helps to ask some simple questions:

- Does the content of your Web site come from multiple sources (program managers, public information officers, administration, etc.)?

- Does that content exist in multiple formats (e.g., Word files, HTML, database fields, PDF, etc.)?

- Are you creating and maintaining multiple HTML pages one-by-one, even if these tasks are somewhat streamlined within editors such as Dreamweaver or FrontPage?

- Does your Web site contain a large amount of text?

- Does your Web site contain publications of ten printed pages or more that are reformatted for the Web into individual HTML pages linked to one another in a paging sequence?

- Do you encounter difficulty in ensuring consistency of content and applying global modifications across your Web site?

- Are you delivering (or do you plan to deliver) to a variety of formats and platforms such as PDF, RTF, and mobile devices?

- Does your Web site meet federal and state accessibility requirements (such as Section 508) and can you easily maintain these requirements?

If you answer "Yes" to any of these questions, then XML is worth considering because it specifically addresses issues of single-source content management, automatically generated output, consistent information, and multiple delivery formats. The next section details the major benefits of XML that address these questions.

Benefits of XML

The benefits of using XML for Web site management derive primarily from its property of separating a document's content from its presentation. This enables that content to be managed more efficiently in a single source file. The principle behind single source is that one document contains all the content independent of presentation attributes. When a change is made to that content, it is made in only one place and automatically propagated to all the places it is used and displayed (Web pages, PDF pages, etc.)

The following is a list of some of the benefits that CTG and the Testbed participants found in their experience using XML for Web site content management.

Automatic Generation of Multiple Formats

The XML source document is processed with an XSL (Extensible Stylesheet Language) file to produce a variety of outputs including HTML pages, PDFs, and RTFs. This technique is frequently referred to as reusing and repurposing content. The ability to create a variety of outputs from a single source can save time and ensure consistency, which has a direct impact on the return on investment.

Consistency Across Multiple Formats and Devices

In addition to repurposing content, XML's single source capability decreases errors in content and ensures consistency of format throughout entire Web sites and between formats for multiple devices. With today's fast pace of information flow, changes to content can be frequent. Since content often appears in more than one place on a Web site, executing those changes can also be challenging. Without a single content source, a Webmaster might not be able to update all instances of the outdated content and thus risk inconsistency of presentation.

Clear Content Ownership and Coordinated Publication Process

The use of a single source document can also foster collaboration between staff at organizations, which would not be accomplished as easily with HTML. XML encourages version control through the single-source document. This guards against multiple authors using different versions, and against any single individual claiming exclusive control of the content. All stakeholders involved in the publication process need to work together and design a workflow that allows the benefits of XML use to be realized.

Potential for Data Exchange

In addition to content management, there are other general benefits that can be obtained by using XML. For example, XML's data structure requirements provide an effective method to share and exchange data within and across organizations. It also provides a standard mechanism to access data in legacy systems through standard, non-proprietary formats.

Accessibility Compliance

Using XML can also have a direct effect on accessibility. Converting and maintaining thousands of HTML pages to be in compliance with Section 508 regulations (http://www.section508.gov/) that "require Federal agencies to make their electronic and information technology accessible to people with disabilities," can be an imposing task. However, a typical XML-based Web site, in which thousands of HTML pages are automatically and consistently produced by a few dozen XSL files, can make this task highly manageable. Changing one XSL file can immediately bring hundreds of HTML pages produced by that XSL file into compliance. Also, multiple formats (HTML, PDF, printer friendly, etc.) that increase accessibility options are more easily created and maintained in an XML-based environment.

Device Independence

XML is device independent, which is growing in importance as wireless, mobile, and portable devices enter mainstream use. XML/XSL can deliver to PDAs, cell phones, and other wireless devices with the same ease as to desktop computers.

Content Personalization

XML allows for the potential to personalize data. Because XML separates content from presentation, different stylesheets can be applied to customize data for different audiences. XML also increases the speed and aggregation of content. For instance, RSS (Real Simple Syndication / Rich Site Summary), which is an XML-based format, can locate and deliver updated content immediately to users' Web browsers, email clients, or mobile devices — based on their preferences and customizations.

Standard Format

Because XML, by definition, stores content in a standardized, open format, it offers greater long-term benefits for information longevity and value. The Computer Age has already experienced many examples of "data obsolescence" — think of 5.25 inch floppy tasks, DOS files, or early word processing formats. Because XML is not proprietary, any software that recognizes the XML standard will be able to view and process XML files well into the future. Furthermore, because XML separates the content from the presentation, that content can be preserved as presentation technologies change over time. Since HTML is primarily intended to display content in a Web browser, its format mixes the content with the presentation in a way that makes it difficult, if not impossible, to separate out only the content for preservation.

Costs and Time Savings

Any agency that produces several publications understands the challenge of managing multiple versions. Each time a content author changes the text, the Web pages must also be edited. This can take a Webmaster hours searching for the exact places where the changes were made both in the text and in the HTML document. Again, with XML, the Webmaster needs only to change the XML source document. This significantly reduces time spent on changes to existing publications.

As Figure 3 illustrates, under existing HTML-based Web technologies (bottom figure), the Web team's resources are increasingly used up in routine maintenance and operational tasks. Eventually, resources for new development opportunities are completely squeezed out. Using the new XML-based Web technologies (top figure), routine operational and maintenance tasks are increasingly automated and demand less time, so the opportunity for new development increases dramatically. The Web team can devote more time to higher-skill, higher value development projects. (This data is based on CTG's ROI analysis of its own Web site conversion to XML, which is covered in more detail in CTG's publication, *Return on Investment In Information Technology: A Guide for Managers,* http://www.ctg.albany.edu/publications/guides/roi)
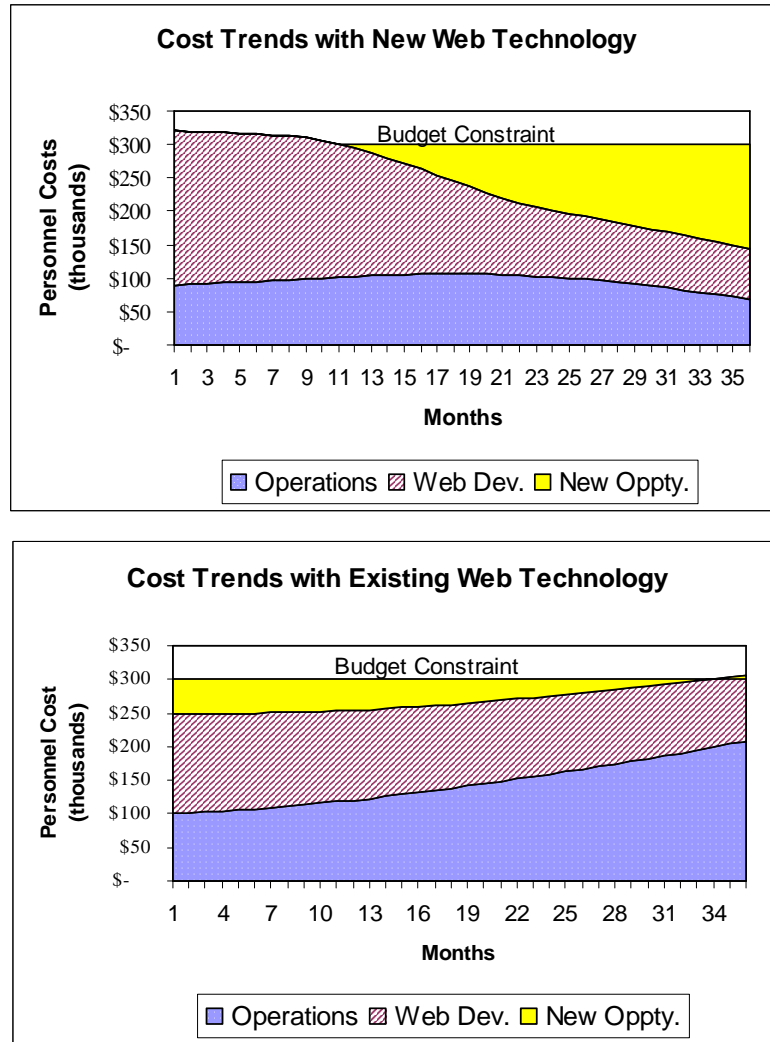
Cost Trends with New Web Technology

Cost Trends with Existing Web Technology

Figure 3. Costs Trends Analysis of XML Implementation.

Implementing XML in Your Web Site Environment

Benefiting from the use of XML does not require complete replacement of an existing Web site environment (such as .NET, PHP, JSP, Java, ColdFusion, Dreamweaver, etc.), nor even altering it significantly beyond the addition of some XML. It is more important to determine *where* to incorporate XML within the Web site to make the greatest impact.

Implementing XML on part of a Web site, rather than the entire Web site, often proves to be the most advisable first step. It makes more sense to focus on those areas of a Web site that are not managed efficiently and seem to be appropriate for an XML approach, such as those containing:

- publications or large amounts of text organized into pages and linked;

- repetitive content or similar formatting;

- identical information in different formats (such as HTML, PDF, printer friendly) or for different devices (computers, PDAs, cellphones).

In this approach, parts of the Web site may be developed as XML, while the other parts remain unchanged. This "mixed" arrangement may be the best solution in some cases, especially where the non-XML-based areas are already highly efficient and would not really gain much value from a conversion to XML.

However, in other cases, the benefits derived from the partial implementation lead to expanded uses of XML in additional areas of the Web site. The efficiencies derived from using XML in one area creates opportunities to apply those efficiencies in other, less obvious areas. Ultimately, the entire Web site may be converted to XML. (This is exactly what happened in CTG's experience with XML, starting with its publications area and moving out to the entire Web site.)

This complete transformation of a Web site to XML means that all the content originates from an XML format, either as static XML files or as dynamic data retrieved from a database and reformatted as XML. Likewise, all the HTML pages (and potentially PDF and other pages) that comprise the Web site are produced automatically from XSL files.

In other words, the individual HTML files are not created by Web developers and saved on a Web server (or generated dynamically via script files as in database-driven sites), then retrieved as visitors request them via their browser – which is what happens in a typical Web environment. Instead, an XSL file selects content from a designated XML file (or files), transforms it into the appropriate format and appearance, and delivers an HTML page to the Web visitor's browser (see Figure 4).
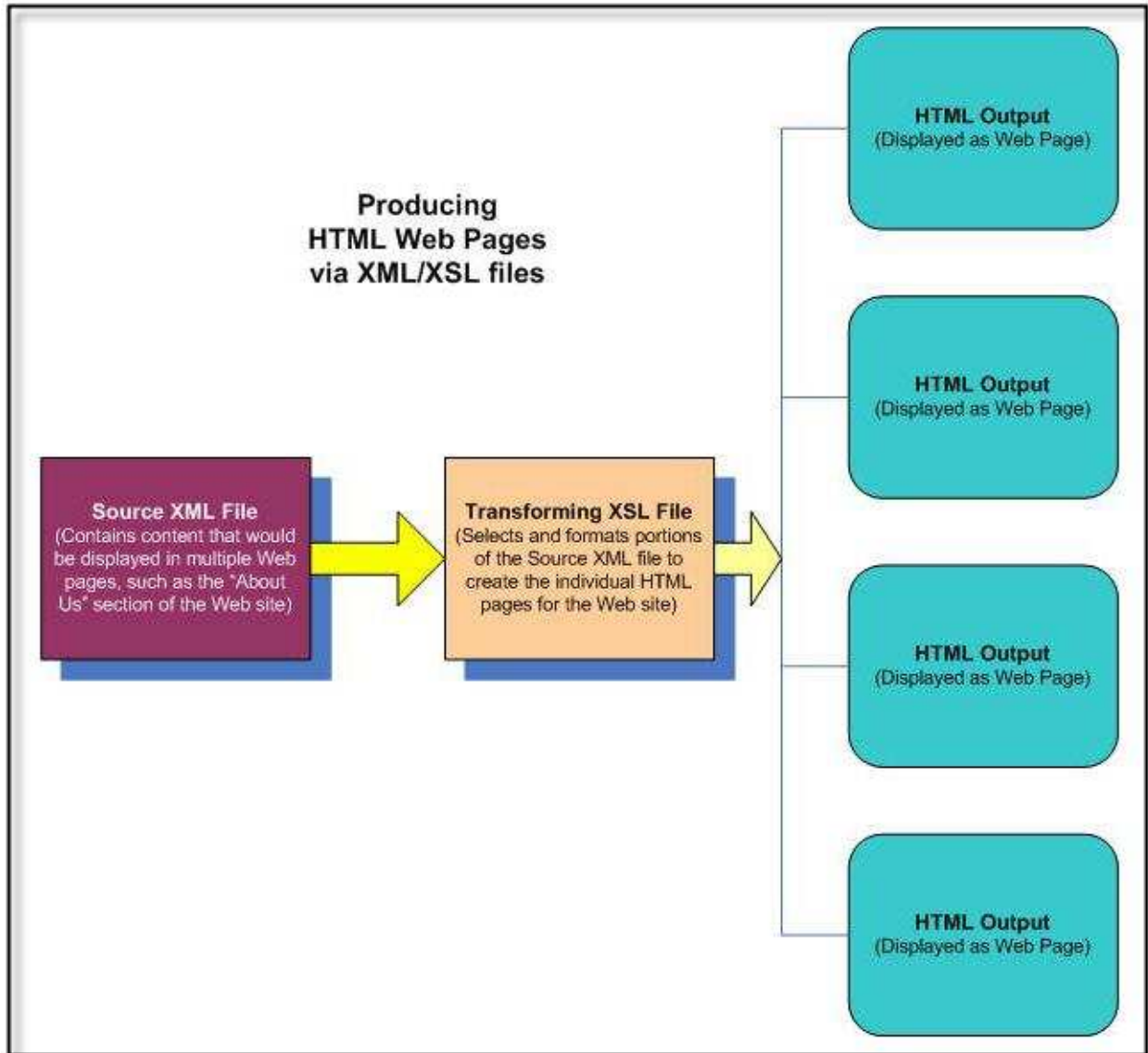
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Figure 4. Creating and Maintaining HTML Web Pages via XML/XSL Files.

The difference is that one XSL file can produce multiple HTML pages, and one XML file can also be transformed into multiple HTML pages. Hundreds or thousands of individual HTML files are replaced by dozens of XML and XSL files, which reduces the maintenance effort and enhances consistency.

However, for both partial and complete implementations, certain technical steps need to be taken because no currently existing Web environment is completely "XML ready." Most Web servers, for example, are not currently configured to automatically process XML files and produce the desired output (HTML pages) for the user. Some browsers, on the other hand, can process XML and produce HTML, but this processing ability is limited and unpredictable.

Fortunately, Web servers can be configured to support XML. There are three basic approaches:

- Implementing an XML framework, which is software designed to handle the XML/XSL processing for a Web server. Apache Cocoon is an example of a Web development framework. (CTG uses Cocoon for its XML-based Web site: http://www.ctg.albany.edu.)

- Employing configuration files and server-side scripts to dynamically intercept and transform Web requests and responses (HTTP). These are relatively simple scripts that tell a Web server how to find and process XML/XSL files. Different scripts (written in ASP, PHP, JSP, C#, ColdFusion, or Java, for example) will be suited to different Web environments

- You may also incorporate XML via "include" files and other insert capabilities native to Web design environments such as Dreamweaver or ColdFusion. In this case, you would not be changing your current Web practices at all, but just enhancing its capabilities.

Note: CTG's XML Toolkit Web Site, http://www.thexmltoolkit.org is a good source for coding samples and tips to assist developers learning how to use XML in Web sites. The code samples are provided for a variety of Web environments in a modest, moderate, and elaborate framework with clearly explained learning steps that address specific topics (see Figure 6 on page 15).

The Bigger Picture

Choosing to implement XML for your Web site occurs within a larger context that involves your entire organizational structure and business workflow process. The technical implementation of XML, like all IT initiatives, does not occur in a vacuum. With this in mind, this section outlines some key factors to help keep that bigger picture in view when implementing XML.

Note: CTG's publication, Making Smart IT Choices: Understanding Value and Risk in Government IT Investments, contains a wealth of information and guidelines for evaluating IT decisions. Use it as a resource for more detailed examination of the points outlined below. Specific references to Making Smart IT Choices and other CTG publications are provided where appropriate below.

Know Your Environment
Implementing XML is a technical undertaking, but it occurs within a larger organizational environment that contains many layers including:

- *technical infrastructure* (hardware, software, networks),
- *business processes (*how work gets done, workflow for getting content to the Web)
- *organizational setting* (executive sponsorship, stakeholders, warrants, mandates, accountability/ownership issues), and
- *program, policy and politics* (information use, information sharing, confidentiality, regulatory, statutory, best practice.)
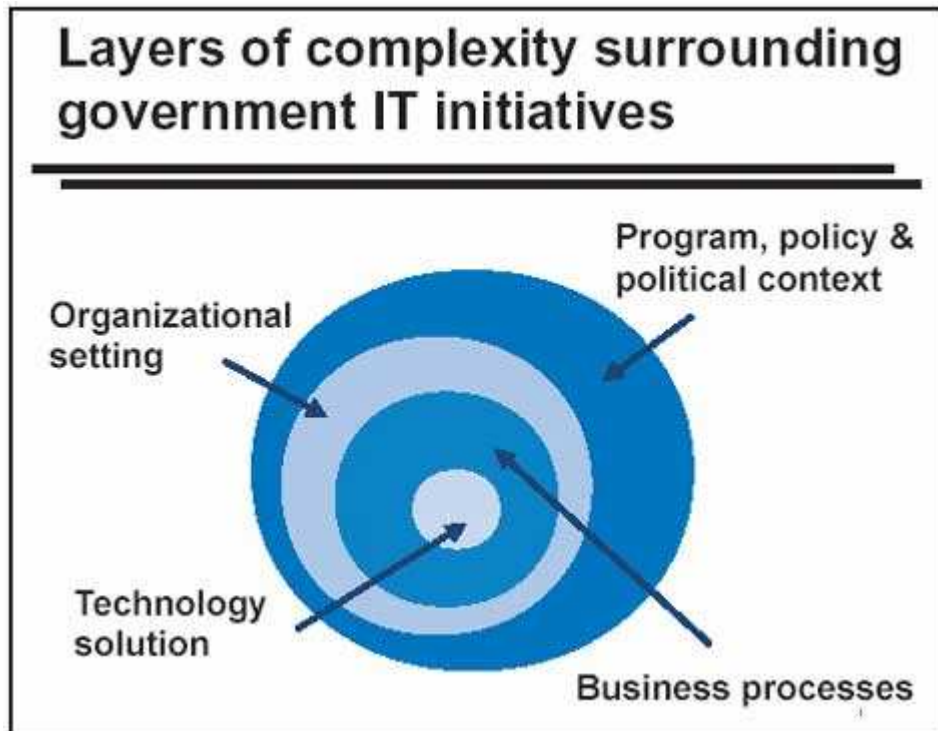

Figure 5. Layers of Complexity Surrounding Government IT Initiatives.

Understanding the overall project from these multiple perspectives will guard against applying a technical solution without first understanding the full context within which the solution must live. Implementing XML

for Web site management may require a change in how people work, the tools they use, or the functions they perform. Changes to these areas may require a policy change or an organizational change. This type of change may require executive support and sponsorship. The success of the XML implementation depends on the successful implementation of these personnel, policy, and management commitments.

Making Smart IT Choices provides several "tools" to help you gain a better understanding of this complex environment. Two of the tools that were particularly useful during the XML Testbed project are:

- Strategic Framework, which helps you to identify the resources, partners, and innovations that can contribute to a successful XML implementation.
- Stakeholder Analysis, which helps you to identify the individuals and groups who are affected by or have influence over your XML initiative. Every project needs a careful assessment of stakeholders in order to understand who cares about it, how they can affect it, and how they will be impacted by it.

Build an Effective Project Team
Using XML for Web site management impacts major job functions such as content developers, content reviewers, and Web developers. The people performing these functions bring unique perspectives to the overall workflow and business process. Ensuring that team members come from each of these functional areas provides a full perspective on the current environment and what needs to be changed for the new environment.

Creating a representative team is the first step; creating a shared vision among its members is the next step. Once again, Making Smart IT Choices offers a helpful tool called the *service objective,* for creating this shared vision. A service objective is a structured way to express the goals of a project. The process of creating a commonly understood and agreed upon service objective often reveals differences in thinking, different assumptions, and conflicting perspectives that all must be discussed and resolved before the service objective statement is complete. The process will help to bring a team to common understanding and helps them work toward a common goal.

Designate a Project Manager
A project has little chance of success if it is not recognized as a legitimate project within the organization. Assigning a project manager — that is, someone with project management skills, and not just the technical team leader — is critical to establishing this project legitimacy. The project manager ensures the project stays on track and remains focused by:

- holding team members and users to commitments;
- ensuring the necessary executive support is solicited, communication plans are developed and used, and a task plan and project scope are developed and monitored;
- keeping the project organized and focused on the final goal; and
- settling conflicts within the team and sorting out competing priorities.

Plan and Analyze as a Team
Project planning and analysis involves everyone on the team, not just the project manager. The project manager may guide the work, but everyone should participate to gain the benefits of the various perspectives and areas of expertise that the team members provide. Knowing your stakeholders, understanding your risks, creating risk mitigation plans, and setting up the evaluation criteria should be done as a team. Part 2 of *Making Smart IT Choices* offers many tools and techniques for group facilitated activities that assist in organizing this analysis.

Analyze your Business Process

The "process" of studying the way work is done is called business process analysis or process modeling. The study of business processes, or workflow, is a very important part of understanding how organizations do their work. (See Making Smart IT Choices, Process Analysis for more details.)

One of the best ways to document and analyze a business process is by talking to the people who actually carry out the work. How does the content get from the author to the Web site? Who is involved and what are the decision points within the process? What are the business rules governing the process?

Through facilitated discussions, a work process can be documented using graphical representations or models to formulate a collaborative view. These graphical representations (or models) of business processes allow organizations to learn more about the specific steps within a process: what tools are used, what information is created, and what information is changed along the way. This baseline knowledge allows organizations to understand and potentially measure existing processes and to consider alternative ways of improving or changing them. If the business process analysis reveals underlying problems, implementing XML should not be expected to solve all those problems on its own.

Focus on the Business Goal

One way to keep the business perspective in sight is to continue using the service objective as a guide and to ask pertinent questions such as:

- What outcome do you expect?

- How will the stakeholders be impacted? Will they be impacted?

- What is the business case for this initiative? Have you developed one yet?

If you do not have a business case, you should develop one that details the costs, benefits, and risks associated with this initiative. Chapters 3 and 4 of Making Smart IT Choices focus specifically on preparing and presenting a business case. Even though the case is being made to use XML for Web site management, the emphasis should not be on its technical features and functions. Use language that emphasizes the business advantages of XML such as *opportunity costs*, *streamlined processes*, *quicker turnaround time*, and *content consistency* rather than technical XML jargon.

Gain Executive Support

Executive management is a key stakeholder in any organizational initiative, so gaining their support is a critical success factor. One of the project manager's first tasks is to determine where to gain this support. The business case may be the mechanism used to solicit and ensure executive support. And because leadership often changes and priorities shift, executive support must be continuously monitored. In this case, the team's communication plan will help maintain consistent support and interest in the project. It may also be helpful to find someone who can "champion" the project at the executive level. This champion does not necessarily need to come from within the team; it may be a manager who sees the value in the overall project for the organization and can promote those benefits.

In addition, everyone on your team should be able to discuss the progress being made. The project manager can spearhead this by creating bimonthly briefings that team members can use when speaking to their various colleagues. Since a project such as this crosses organizational boundaries, it is important for each team member to discuss the value in terms meaningful to their division, department, or unit. This ability is a direct result of participation in the shared vision and project analysis.

You can refer to CTG's newsletter article in Innovations 2003*, CTG Leveraged Innovative XML Solutions,* and to Return on Investment In Information Technology: A Guide for Managers, for examples of how to discuss the value of XML in business terms to your executives.

Start Small, Think Big
As pointed out earlier in this guide, transforming an entire Web site to XML can be a daunting task. So, start out small by converting a small section of your Web site to XML. This approach gives your team the opportunity to explore and learn. From this first step, you will then be able to apply the knowledge gained to expand and enhance the XML implementation.

Consider a "Modest/Moderate/Elaborate" approach to the overall project, which allows the project manager to balance the team's ability with organizational support for the effort. (CTG's publication, *Opening Gateways: A Practical Guide for Designing Electronic Records Access Programs*, offers a thorough explanation of this approach in its "Program Design Tool" section.) Also refer to CTG's Web site of XML resources, www.thexmltoolkit.org, which contains code samples and explanations based on the modest/moderate/elaborate approach(see Figure 6).
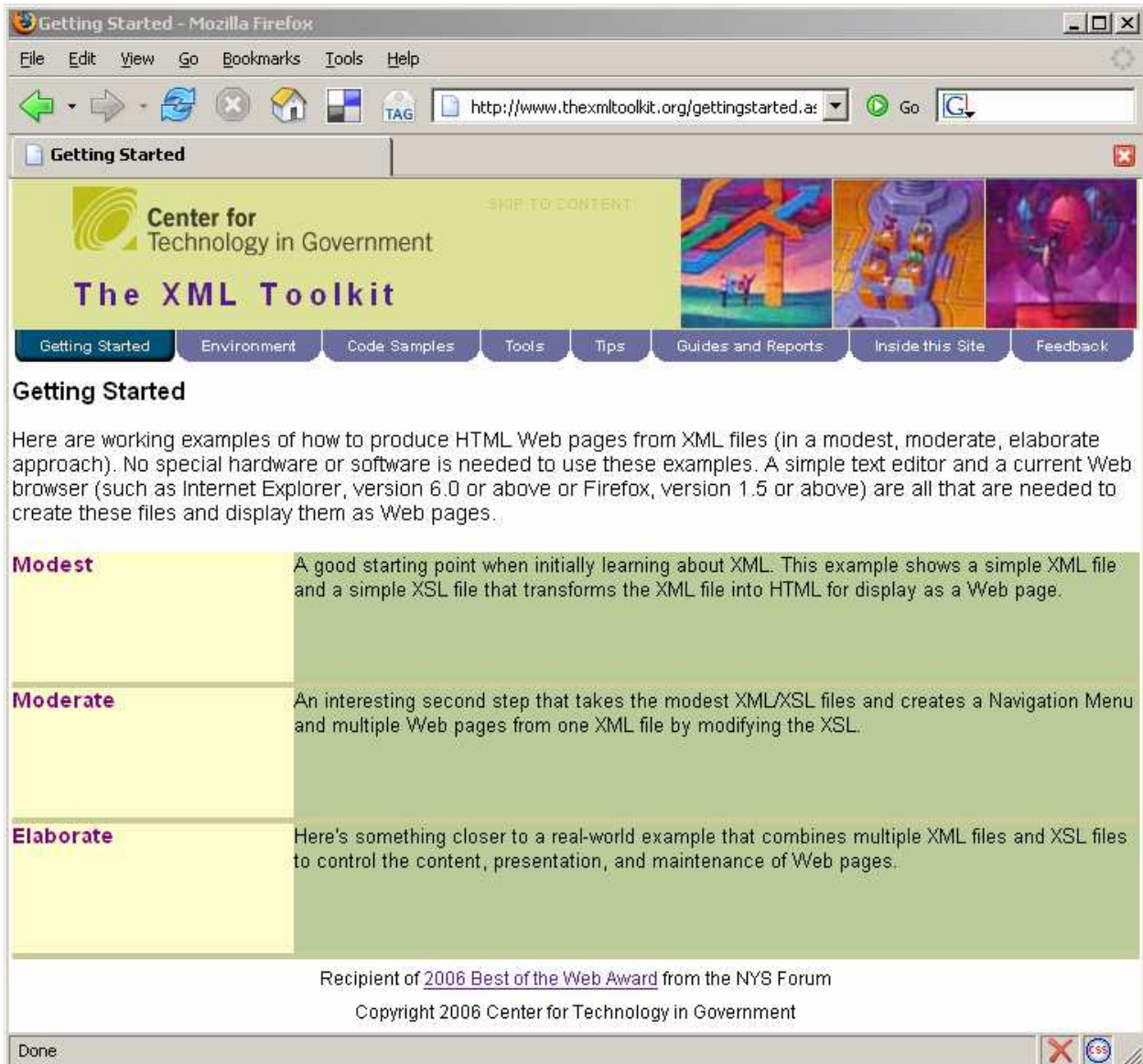

Figure 6. An Example "Modest/Moderate/Elaborate" Approach.

Closing Tips (A Five-Step Plan)

The table below summarizes some of the basic steps for getting started, along with links to references and resources to aid in those steps.

Step	Description of process	Tools
Think about what you want to do with your Web Site. Investigate the possibilities and the gaps of where your Web site is today and where you want to be in the short and long term.	Use tools, such as brainstorming, not only with the technical teams but also with the program teams who create content for your Web site. Investigate what is currently being done within your industry (Justice, Library, Health and Human Services, etc.) by doing a current and best practice research.	Making Smart IT Choices – Part 2 – Tools for Phase 1 & 2 ▪ Visioning ▪ Current and best practices ▪ Environmental Scans
Analyze your process from content origination to final publication on the Web and elsewhere.	Develop an understanding from multiple perspectives of how content is developed to how it gets published on the Web. Involve multiple actors – content developers, content reviewers, and Web developer.	Making Smart IT Choices Part 2 – Tools for Phase 2 ▪ Business process analysis and process modeling
Sign up for XML / XSL training; or if you've been to training – apply what you have learned.	Explore possible training opportunities through state organizations and private training organizations, both from a technical and non-technical perspective. Look for expertise within your area – forums, user groups, communities of practice.	▪ Government-sponsored training, private training organizations. ▪ Talk to those who have done it before – CTG technical team, Testbed participants, others within NYS who are currently working with XML and others outside of NYS who are known experts. ▪ Use CTG's XML Toolkit Web site.
Understand your technical environment.	First, understand the technical infrastructure that supports your Web site (hardware, software, network, etc.) How will XML and XSL work within your unique environment (not just from a technical perspective but also from the production perspective)?	Making Smart IT Choices Part 2 – Tools for Phase 2 ▪ Business process analysis and process modeling. The XML Toolkit

Step	Description of process	Tools
Think beyond your Web Site.	Consider where your content is currently stored and how it is stored (proprietary formats? multiple versions?). Consider how you can design your Web architecture so that you can grow and change functionality without having to change the framework. How can you organize your content so that changes to the framework will not impact the content?	▪ Making Smart IT Choices Part 2 – Tools for Phase 2 ▪ Business process analysis and process modeling. ▪ Web Content Mapping ▪ Information Architecture

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XSL-FO. Dave Pawson. O'Reilly & Associates, Inc. Sebastopol, CA. 2002.

Cocoon: Building XML Applications. Matthew Langham and Carsten Ziegler. New Riders Publishing. Indianapolis, IN. 2003.

Practical Guides

Making Smart IT Choices: Understanding Value and Risk in Government IT Investments
http://www.ctg.albany.edu/publications/guides/smartit2

Opening Gateways: A Practical Guide for Designing Electronic Records Access Programs
http://www.ctg.albany.edu/publications/guides/gateways

Return on Investment In Information Technology: A Guide for Managers
http://www.ctg.albany.edu/publications/guides/roi

On-line Resources

The XML Toolkit
http://www.thexmltoolkit.org/

Opening Gateways: The Guide and Online Workbench
http://www.ctg.albany.edu/publications/online/gateways/portal

Web Sites

http://www.bloomington.in.us/~mongin/xml-tutorial/index.htm Dated material (last revised in 2000), but still helpful for basic information on XML.

http://www.xml.com/ A very comprehensive, authoritative, up-to-date source for all things XML (O'Reilly). The Apache XML Project

http://xml.apache.org/#xmlsecurity/ Open source XML site with wide ranging information on developing standards.

http://webreference.com/xml/reference/standards.html/ Good quick reference for various XML standards and acronyms.

http://www.service-architecture.com/xml/articles/ Good reference site for various industry-specific XML vocabularies.

http://www.xmlfiles.com/xml/ Helpful, simple tutorials on XML topics; good place to learn XML.

http://www.w3.org/ The primary source for all things web related.

http://xml.silmaril.ie/ Another helpful site for answering basic XML questions.

http://www.oasis-open.org/home/index.php Standards body for DocBook and other XML-related activities; very technical but important.

http://www.xml.org/ Covers industry-specific content on XML standards, hosted by OASIS.

http://www.xml.gov/ Covers XML use in government.

http://www.softwareag.com/xml/about/glossary.htm General reference site on XML; extensive glossary, article, expert opinions.

http://www.xmlhack.com/ Good news site for XML developers.

http://www.devx.com/xml Another good site for XML application developers.

http://www.xmlfiles.com/ Good articles for XML developers.

http://www-130.ibm.com/developerworks/xml/ Loads of information on XML, helpful to newbies up to experienced programmers.

http://www.docbook.org/ Official site for DocBook, including full documentation.

http://msdn.microsoft.com/xml/default.aspx Information on XML in the world of Microsoft.

http://www.useit.com/ Jakob Nielsen is an author and known expert and resource on user interfaces, especially Web design strategy and Web usability

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