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R·I·T Printing Industry Center

for Affiliates this month in Center research:

Web-Enabled Print Architectures

New methods for specifying and producing printed products are emerging as print service providers seek to streamline order management, reduce costs, and improve efficiencies in print supply-chain management. These emerging print production models rely on system architectures that use Web applications to interface with highly automated print production workflows. The application of the Internet in print supply-chain management is not a new concept and has been previously investigated. However, little scholarly research has been published on Web-to-print or Web-enabled print production system architectures.

This month's research monograph, *Web-Enabled Print Architectures* (PICRM-2008-06), is authored by Adam Dewitz, former graduate student in RIT's School of Print Media. The purpose of this study was to analyze the current state of Web-enabled print within the printing industry. The research examined a number of print service providers utilizing Web-enabled print systems. This examination led to the development of an instrument for looking at Web-enabled print service providers. The instrument was then used to analyze a number of print service providers, providing insight into various approaches to developing the Web application processes of a Web-enabled printing system. (The in-depth company analyses are not included in this summary, but may be found in the full monograph available here.)

System Analysis Instrument

In order to compare the various Web-enabled applications deployed by print service providers, an instrument for analyzing the Web-based front-ends to a print production system was developed. The instrument was developed after preliminary analysis of Web-enabled system architectures used within the printing industry, and it provides a list of system-independent attribute descriptions that can be used to describe the Web application of a Web-enabled print production system. The instrument is described in detail below.

Software Application Type
The software application type questions are used to determine where product specification and order management is taking place. Options included Web-based, desktop-based, and a hybrid Web- and desktop-based approach.

- **Web-based application.** Web-based applications are software applications that run completely within the Web browser. The Web applications do not require any non-browser software applications or computer processes beyond the traditional Web-based client/server system methodology. Web-based applications require a persistent Internet connection during

Center Spotlight

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by Twyla Cummings with Bernice Lemaire

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use.

• **Desktop-based application.** Desktop applications are compiled software applications that run natively on a local computer system and are independent of a Web browser. These applications provide all the functionality to specify products and manage product orders. A desktop application may have specific operating system requirements that limit platforms on which it can it can be deployed (i.e. a desktop application that is compatible with the MS Windows or Mac OS platform only). Desktop applications do not require a persistent Internet connection except when transferring data to the print service provider's production system.

• **Web- and Desktop-based application.** A Web- and desktop-based application uses a mixed approach, relying on Web-based and desktop-based software applications to completely specify and order a product. Such as system may use a Web-based application to facilitate account and order management, and a desktop application to handle product design and specification. Depending on the portion of the application being used, a persistent Internet connection may be required.

• **Real-time WYSIWYG Editor.** A real-time "What You See Is What You Get" (WYSIWYG) editor provides an accurate representation of the product during the product design and specification stage. The editor updates the product representation as the print buyer makes changes.

• **Preview-based WYSIWYG Editor.** A preview-based "What You See Is What You Get" (WYSIWYG) editor provides an accurate representation of the product during the product design and specification stage. The editor updates the product representation when the print buyer requests a product preview.

Knowledge and Skill Requirements
The knowledge and skill requirements questions help determine the complexity of the user interface by analyzing the skill sets that a user may need to have in order to successfully specify and order a printed product.

• **Knowledge of printing product specifications required.** This attribute aims to determine if the print buyer using the system requires any preexisting knowledge of printed product specifications. This includes knowledge of document design and layout principles, product limitations, printing process limitations, understanding of design or printing terminology, and other printing workflow-related skills or knowledge.

• **Requires special software.** This attribute determines if all product specification and order facilitation is handled through the primary Web

application or if third-party applications are required to facilitate some part of the process. This includes software applications for handling design and layout such as Adobe InDesign, image and photo editing applications such as Adobe PhotoShop, text editors and word processing applications, and file management applications such as an FTP client. Web browser plug-ins are also included in the special software definition.

• **End user.** The end user attribute provides insight into the intended audience of the Web application and provides insight into the complexity of the system. The end user can be a business (business-to-business, or B2B, model), a consumer (business-to-consumer, or B2C, model), or a combination of both.

Product Formats

Product formats describe what type of products the system is designed to produce and how the system handles product choice. Products can be catalog-based or completely customizable.

• **Catalog-based product formats.** Product formats are constrained to a catalog of product offerings. The products may or may not be template-based. Systems may or may not have systems logic in place to insure product quality. This may include restricting image or graphical elements from bleeding off a page or being placed in locations that will degrade product quality.

• **Customized product formats.** Product formats are not constrained. Products can be as unique as the job being ordered.

Digital Assets Input and Input Methods

Digital assets input analyzes what types of digital assets are provided and how print buyers supply digital assets to the Web application. This includes the file formats permitted by the system and the methods used to transfer the digital assets to the print service provider.

• **Portable Document Format (PDF).** Does the system allow digital assets to be submitted using the Portable Document Format, including the standardized versions of the format: PDF/X family and PDF/A?

• **Rich Text Format (RTF).** Does the system permit rich text content to be supplied in the Rich Text Format de facto standard word processing exchange format?

• **Microsoft Word Document (DOC).** Can Microsoft Word Document files be supplied?

• **Comma-separated Values (CSV).** Can data be supplied in the CSV format?

• **Cellular Assets Only (JPG, TIFF, ASCII Text).** The system only allows digital assets to be supplied in a cellular form such as images supplied on their own or text elements supplied via ASCII text input via a form field.

Co-Directors (email):
Frank Cost and Pat Sorce

Communications Coordinator (email):
Ashley Walker
(Web site, publications, general info)

Mailing Address:
Printing Industry Center
at RIT
College of Imaging Arts
and Sciences
Rochester Institute of
Technology
55 Lomb Memorial Drive
Rochester, NY 14623

Phone:
(585) 475-2733
Fax: (585) 475-7279

About the Center

Dedicated to the study of major business environment influences in the printing industry precipitated by new technologies and societal changes, the Printing Industry Center at RIT addresses the concerns of the printing industry through educational outreach and research initiatives.

Support for the Center comes from:

Sloan Foundation
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VIGC
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• **HTTP Asset Submission.** Digital assets are transferred to the print service provider using the Hypertext Transfer Protocol (HTTP).

• **FTP Asset Submission.** Digital assets are transferred to the print service provider using File Transfer Protocol (FTP).

• **HTTP and FTP Asset Submission.** Digital assets are transferred to the print service provider using the Hypertext Transfer Protocol (HTTP) and/or the File Transfer Protocol (FTP).

Output Intent
The output intent determines what the desired outcome of the printed product will be. The output intent ranges from a print buyer ordering a pre-specified product to a print buyer specifying a completely customized product.

• **Create a single printed product and purchase it.** Systems using this approach allow a print buyer to specify a printed product and purchase it through the Web application. The digital assets supplied by the print buyer may be archived by the system for future orders.

• **Create a document and merge variable data.** System allows the print buyer to specify a printed product with variable data fields. The print buyer supplies a data list to populate the variable data fields. The digital assets supplied by the print buyer may be archived by the system for future orders.

• **Order managed documents from asset library.** This is a traditional print on-demand order management system for static printed products. A content owner uploads digital assets to a Web-based digital asset library. Printed products are produced as they are ordered. The print buyer making an order does not have to be the content owner supplying the original assets. Product customization is limited.

• **Use templatized documents to create product.** The print buyer uses pre-designed layouts and documents templates to specify the printed product. The print buyer has limited options for personal customization.

• **Select print buyer-submitted digital assets to populate a templatized document.** The print buyer submits digital assets and uses pre-designed layouts and documents templates to specify the final printed product. The digital assets supplied by the print buyer may be archived by the system for future orders.

• **Select print buyer-submitted digital assets to populate a customizable document.** The print buyer submits digital assets and uses customized documents to specify the final printed product. The digital assets supplied by the print buyer may be archived by the system for future

orders.

• **Select stock assets to populate a templatized document.** The print buyer specifies a print product by selecting stock images or graphical elements from a digital asset library to populate a pre-designed layout or document template. The final product specified by the print buyer may be archived by the system for future orders.

• **Select stock digital assets to populate a customizable document.** The print buyer specifies a print product by selecting stock images or graphical elements from a digital asset library to populate a customized document. The final product specified by the print buyer may be archived by the system for future orders.

• **Submit print-ready documents and order product.** The print buyer submits print-ready documents that were created using print service provider-specified design and product constraints. The product design may use a completely customized document or a document based on document template provided by the service provider. The final product specified by the print buyer may be archived by the system for future orders.

Proofing

Proofing provides simulation of the final printed product before it produced. Proofing is traditionally achieved by producing the printed product using the same printing process or a process designed to mimic the production process. The proof provides a contractual agreement between the print buyer and the print service provider. Web-enabled workflows are designed to efficiently produce products in quantities of one or greater. Requiring a physical proof can defeat the purpose of using a Web-enabled print production system. Systems using virtual (soft) proofing methods replace the need for traditional physical proofs.

• **Virtual proofing.** The system utilizes virtual or soft proofing methods to simulate the final printed product. Product approvals are done virtually before final product production.

• **Hardcopy proofing.** The system requires hardcopy proofs of the product to be examined and approved before final product production.

• **No proofing services.** The system provides no formal proofing services or methods.

Business Transaction Complexity

The complexity of the business transaction can vary from simple payment by credit card to more traditional purchase orders or lines of credit provided by the print service provider.

• **Credit Card.** Payment for the print services can be done via a credit card.

• **Purchase Order.** Payment for the print services can be done via a purchase order.

• **Net Billing.** Payment for the print services can be done via lines of credit established between the print buyer and the print service provider.

Distribution

Distribution plays an important role in the print supply chain. If a printed product does not arrive at its destination, it has failed to provide value or communicate its message. Distribution can also define how a printed product is specified and produced. A system designed to produce products of personal nature may differ from a system designed to make the product available to the open market.

• **Direct Distribution.** The print buyer specifies the product. It is produced and shipped directly to the shipping address supplied at the time of the order.

• **List Distribution (Push).** System utilizes list distribution methods to produce the product order and then ships the products to a list of recipients specified by the print buyer at the time of the order.

• **Private Distribution to Order (Pull).** System uses a distribution method that permits only authorized buyers to order a print product. The content owner manages the authorization list.

• **Public Distribution to Order (Pull).** System uses a distribution method thatpermits open access to the printed product. Anyone interested in buying the product is permitted to do so.

Ancillary Services

The use of a Web-enabled print production system removes many of the activities that provide little or no value to the product specification, production, and fulfillment processes. Use of these highly automated systems does not necessarily prohibit print service providers from providing ancillary services. There are opportunities to provide ancillary services that can be requested, purchased, and fulfilled directly through the main Web application or through a website or Web application integrated within the primary Web-based product specification system.

• **Storefront Services.** Storefront services provide a Web-based marketplace where the content owners can sell their printed products. The print service provider furnishes the storefront and payment processing system.

• **Electronic Product Ordering.** A print service provider furnishes the infrastructure to facilitate electronic distribution in an electronic format, such as an eBook or some other digital file format. Digital Rights Management (DRM) services can also be provided for electronic distribution.

• **Digital Asset Management Services.** Once a print buyer has submitted complete or cellular digital assets, the print service provider manages the digital assets.

• **Design Services.** Graphic design services are available to enhance the print buyer's final product or to provide design concepts for products

under development.

• **Publishing Services.** The service provider provides publishing services, such as editing, proofreading, International Standard Book Number (ISBN) distribution, and product marketing.

• **Distribution Services.** The print service provider provides professional distribution services. This includes making the product available through wholesale channels and distributors.

A graphical representation of the system analysis instrument is shown in Figure 1.

Figure 1. Graphical representation of system analysis instrument
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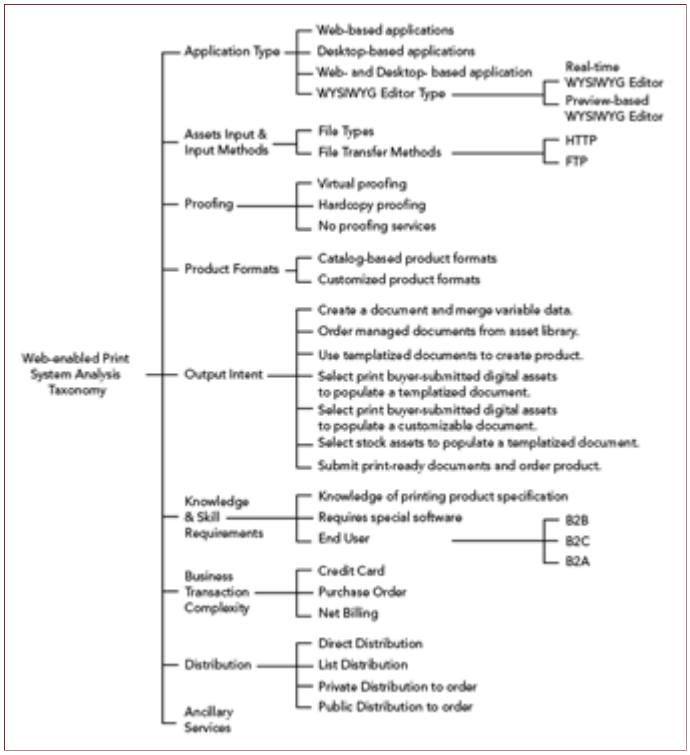

Site Analysis

The goal of the site analysis was to determine if the System Analysis Instrument provides the vocabulary to accurately describe the Web application used in a Web-enabled print workflow. Additionally, the site analysis provides an overview of seven different approaches to Web-enabled print. Although each Web-enabled print service provider analyzed took a unique approach to build its service offerings, there are some similarities between each system.

Sites analyzed included the following (organized based on the product specification and distribution methods):

Order cataloged products with templatized customization using Direct Distribution
• MagicPrints
• Blurb

• ShutterFly
• Moo

Order cataloged products with design/content customization using Direct Distribution
• Lulu
• VistaPrint

Order cataloged products with templatized customization using List Distribution (Push)
• Cardstore.com

(The in-depth company analyses are not included in this summary, but may be found in the full monograph available here.)

Table 1. Tabulated results from site analysis
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Software Application Type	Count	Proofing	Count
Web-based application	6	Virtual proofing	7
Desktop-based application	0	Hardcopy proofing	0
Web- and Desktop-based application	1	No proofing services	0
Real-time WYSIWYG Editor	2		
Preview-based WYSIWYG Editor	5	Business	
		Credit Card	7
Knowledge and Skill Requirements		Purchase Order	0
Requires special software	1	Net Billing	0
Product Formats		Distribution	
Catalog-based product formats	7	Direct Distribution	7
Customized product formats	0	List Distribution (Push)	1
		Private Distribution to order (Pull)	1
Digital Assets Input and Input Methods		Public Distribution to order (Pull)	1
File Formats	6		
Cellular Assets Only (JPG, TIFF, ASCII Text)	1	Ancillary Services	
		Storefront Services	2
HTTP Asset Submission	6	Electronic Product Ordering	1
FTP Asset Submission	0	Digital Asset Management Services	7
HTTP and FTP Asset Submission	1	Design Services	1
		Publishing Services	1
		Distribution Services	

Application Type
A majority of the print service providers utilize completely Web-based applications to handle the product specification and order management tasks. Blurb uses a desktop-application to handle product specification, but relies on a Web-based application to manage account and order management tasks. Rich Internet Application (RIA) technology has reached a point that many features and functionality traditionally associated with desktop applications such as drag-and-drop can now be deployed within the Web browser. Many of the features found in Blurb's BookSmart application can be implemented within the Web browser using standard Web technologies such as HTML, CSS, JavaScript, and XML. Embedded Web browser plug-ins can be utilized to address any shortcomings of the standard Web technologies. Completely Web-based applications provide a number of benefits over desktop applications. Bug fixes and new features can be silently released without having to update software on the user's computer.

Knowledge and Skill Requirements
All of the print service providers analyzed have built workflows

that minimize the knowledge of printing product specification required to successfully order some or all of their print services. Lulu provides both print services that can be used without any special skills and print services that are designed to meet the requirements of users with design and printing product specification knowledge. The analysis of all the systems shows that requiring no special software and using a completely Web-based approach almost eliminates all special knowledge and skill requirements needed to successfully use the system.

Product Formats
All of the print service providers analyzed constrain product offerings to a limited number of products and product formats. This approach is essential not only in building low-barrier-to-entry Web applications, but also in designing process-integrated production systems that can efficiently produce products.

Digital Assets Input and Input Methods
Digital asset formats are constrained to a select number of formats. PDF, JPEG, GIF, and PNG formats are utilized by a number of the systems. These are popular business and consumer formats, and a number of propriety and open source software libraries exist to manipulate these file types. While Hypertext Transfer Protocol (HTTP) can be a slower protocol for data transmission, it is being successfully used by all the service providers analyzed. Lulu provides an additional File Transfer Protocol (FTP) submission for large files.

Output Intent
All the systems allow the print buyer to specify a printed product and purchase it through the Web. Using templatized documents to create product is the common approach. This enables the service provider to use a more streamlined order specification workflow. Highly constrained template-driven workflow enables complete specification of the printed product in three or four steps. None of the service providers allow completely customized products to be specified. Building automated systems for these types of products is not commercially possible at this time.

Proofing
All of the print service providers use virtual (soft) proofing methods to replace the need for traditional physical proofs. None of the services offer hardcopy proofs. If the print buyer requires hardcopy proofs, a single copy of the product must be ordered.

Business Transaction Complexity
A business relationship can be established with all of the service providers over the Internet. This process is as simple as creating an account by filling out an HTML form. All the service providers require payment for the print services to be done via a credit card.

Distribution
The most common distribution method is to produce the product and ship it directly to the shipping address supplied at the time of the order. The book publishing services (Lulu and Blurb) also provide storefronts for the content owner to sell their products. These two services use both private distribution-to-order methods that permit only authorized buyers to order a print product and public distribution-to-order methods that allow anyone interested in buying the product to do so.

Ancillary Services
A number of the service providers provide digital asset management services to assist the print buyer in re-ordering

products. However, the capabilities of the digital asset management services are limited. Most of the systems do not provide download access to the digital assets once submitted to the system. A popular service is providing Web storefronts that enable customers to sell their products. The print service providers furnishing storefront services have further opportunities to generate revenue by placing a service fee on each product a customer sells.

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