About the Center

Rochester Institute of Technology (RIT) was selected by the Alfred P. Sloan Foundation in 2001 to join the family of Sloan Industry Centers located at prestigious universities across the U.S. The Printing Industry Center at RIT is a joint program of the School of Print Media and RIT's College of Business, emphasizing Sloan's long-standing tradition of applying a broad multidisciplinary approach to industry investigations and findings.

Dedicated to the study of major business environment influences in the printing industry brought on by new technologies and societal changes, the Printing Industry Center at RIT addresses the concerns of the printing industry through educational outreach, research initiatives, and print evaluation services. The Center creates a forum for printing companies and associations worldwide to access a neutral platform for the dissemination of knowledge that can be trusted by the industry, to share ideas, and to build the partnerships needed to sustain growth and profitability in a rapidly changing market.

With the support of RIT, the Alfred P. Sloan Foundation, and our Industry Partners, it is our mission to continue to develop and articulate the knowledge necessary for the long-term economic health of the printing industry.

More information on the Printing Industry Center at RIT and its research activities can be found online at http://print.rit.edu.

Industry Partners

Support for the Printing Industry Center at RIT comes from:

- Rochester Institute of Technology
- Alfred P. Sloan Foundation
- Adobe
- Avery Dennison
- Democrat and Chronicle
- GPO U.S. Government Printing Office
- hp invent
- Kodak
- NewPage
- NPES
- Scripps Howard Foundation
- Standard Register
- vigc.be
- xerox

Upstream Database and Digital Asset Management in VDP

While variable data printing is widely recognized as an important adjunct to customer relationship management and targeted marketing, complexities with data and digital content preparation have limited the actual application of the technology. Digital assets and data involve processes closely associated with information technology. Lack of information technology savvy is reflected in how data is handled, what tools are used, and what skills are fostered to work the tools.

The purpose of *Upstream Database and Digital Asset Management in Variable Data Printing* (PICRM-2008-01), by Franziska Frey, Ph.D., RIT School of Print Media McGhee Distinguished Professor, and Nicholas Barzelay, RIT School of Print Media adjunct professor, is to understand the application of database and digital asset management tools, techniques, and skills to facilitate content preparation for variable data printing jobs. This monograph does not address the question of who is responsible for addressing the data and digital asset components in the overall workflow—the customer or the service supplier—as this should be negotiated when starting the service relationship.

Background Theory

Effective VDP is based on three key elements: the physical computing system (the system model), information structure (the information model), and design configurations for different VDP types (basic VDP models).

System Model

The basic system architecture supporting VDP is multi-layered, as

R·I·T **Printing Industry Center**

RIT School of Print Media's
Test Targets 8.0 Now Available!

Interested in color management? How about ink trapping? Do test forms make you smile? Then you might want to look at *Test Targets 8.0*, "a collaborative effort exploring the use of scientific methods for color imaging and process control."

Test Targets 8.0 is the latest version in the *Test Targets* series of publications, which are published annually by the RIT School of Print Media since 2002. The publication is the result of teaching and learning from the School of Print Media (SPM) curriculum. Students, faculty, and staff work together to create content focusing on process control and color management. In addition to research and content creation, the group also performs pre-media, prepress, and printing tasks using facilities at SPM and the Printing Application Laboratory. In 2008, the production of the publication was sponsored by the Printing Industry Center as part of its 2008-2009 research agenda.

Research papers in this year's edition include:
- Effect of Ink Sequence on Offset & Digital Printing
- Predicting Color of Spot Color Overprints, A Quantitative Approach
- Evaluating Dynamic DeviceLink Profile Performance
- Color Gamut Quantified: A New approach to Analyzing Color Gamut
- A Study of Ink Trapping and Ink Trapping Ratio

A "Gallery of Visual Interest" and a section of test forms are also included.

Find out where to buy *Test Targets 8.0* or how to download a free PDF at http://print.rit.edu/research/

2008 Symposium & Planning Meeting

The annual meeting of the Printing Industry Center was held November 17-19, 2008 on the RIT campus. Nearly 70 participants—representatives from Industry Partner companies and their guests, RIT faculty and administrators, and RIT graduate students—came together to learn about the research that was conducted over the past year.

Research topics for 2008-2009 included:
- Test Targets 8.0
- Further Investigation into the Image Quality Differences Between Digital Print Technologies and Traditional Offset Lithography
- An Examination of Newspaper Business and Workflow Models
- The Open Publishing Guide: Creating a Self-Publishing Website Using Open Source Content Management Tools
- Correlates of Job Satisfaction of Early Career Employees in Printing and Publishing Occupations
- New Skill Sets for the Printing Industry—DAM and Variable Imaging Printing Services
- Personalization: Data-Driven Print and Internet Communications

On the third day of the event, RIT researchers presented their proposed research plans for the coming year, and Industry Partner companies had the opportunity to provide feedback. This collaboration in developing the research agenda results in rich and relevant inquiries into the printing industry.

Based on these discussions, a Center plan of work for 2009-2010 will be released to the community in January. Descriptions of the research and the principal investigators involved will be posted on the Center web site.

A photo slideshow and other session details from this event can be found at http://print.rit.edu/events/symp08/

Images from the 2008 Symposium

Image 1. Bob Chung Presents
RIT Professor Bob Chung presents on *Test Targets 8.0* during the second day of the event.

Image 2. Marcos Esterman & Sandy Rothenberg
Marcos Esterman and Sandy Rothenberg presented the Sustainable Print research agenda and facilitated the discussion on where to go from here.

Image 3. Symposium Attendees
Industry Partner representatives contemplate during the planning meeting discussions.

Benchmarking Insert Advertising Effectiveness Metrics

Benchmarking Insert Advertising Effectiveness Metrics (PICRM-2008-04), is authored by Patricia Sorce, administrative chair of RIT's School of Print Media and co-director of the Printing Industry Center. The purpose of this study was to determine the advertising metrics used to measure the impact of inserted media advertising by retailers. In addition, hypotheses tests investigated whether those retailers who measure results of their advertising make different kinds of decisions than those who do not. (The hypotheses test details are not included in this summary, but may be found in the full monograph available online.)

Introduction

Internet search advertising continues its double-digit annual growth. This new advertising medium is attractive to advertisers for three reasons: it is lower in cost to distribute advertising content than most mainstream media; it uses a "pull" strategy where the media user clicks on the advertising for products of interest to him or her; and it has an immediate feedback measure built-in. All of these benefits provide the medium with unsurpassed return on investment (ROI), and, by contrast, places great pressure on mainstream media to demonstrate their ROI.

There are two ways in which the traditional media are making their cases: they are either trying to prove that advertising in their media is more "engaging" and/or they are trying to improve their metrics of advertising effectiveness. The focus of this research is on the advertising metrics used to assess one long-standing advertising medium: inserted advertising.

There are a variety of formats that fall under the classification of inserted advertising. These include:
- Shopping circulars distributed by the US Postal Service
- Shopping circulars distributed by newspapers
- Coupons distributed by US Postal Service mail (such as Carol Wright packs)
- Free Standing Inserts (FSI) distributed via Sunday newspapers
- Statement stuffers such as those found in credit card bills
- Package stuffers (in shipping bags or boxes)
- "Blow-ins" such as the subscription postcards that fall out of magazines.

Most people think of the national brands' use of FSIs when the topic of inserted advertising is discussed. The DMA estimates that $12.6 billion was spent on direct newspaper advertising, which includes FSIs and local newspaper inserts. TNS Media Intelligence (2007) puts advertising expenditures for local shopper circulars at $11.1 billion and advertising expenditures for FSIs at $1.6 billion. According to the DMA's "Power of Direct Marketing" report (2007), approximately another $1 billion was spent on statements, card deck mailings, and magazine blow-ins in 2006.

While these advertising expenditures are dwarfed by the annual expenditures on direct mail and television advertising, this still represents a large source of revenue for printers who print weekly grocery and drug circulars and for newspapers who sell delivery services. Moreover, these shopping circulars remain an important part of retailers'

advertising media. In a 2006 report, the Electronic Document Systems Foundation (EDSF), in collaboration with Gartner and George Mason University, found that the use of print for periodic promotions dominated all other promotion methods for the 90 retailers surveyed. Table 1 details these results.

Table 1. Percent of retailers using certain types of marketing promotions

Type of promotion	Usage rate
Periodic print promotions	98%
Direct mail	76%
Print coupons	71%
Internet promotions and coupons	56%
Print catalogs	51%

Periodic print promotions by retailers are still a popular means of advertising. However, their continued use is being questioned by retail advertising managers who are looking to justify their spending on these forms of advertising. What are they getting in return? The issue of measuring the return on advertising investments is increasingly important in this cluttered media climate.

The purpose of this research is identify the threats to the continued use of printed inserted media by assessing retailers' perception of the effectiveness of printed circulars and their plans to increase or decrease the amount of advertising they will commit to this medium in the near future. One factor in the continued use of these media is the ability (or inability) of the retailer to assess the direct return on the investment in these media forms. Advertising effectiveness measurement across all forms of media is addressed in the next section.

Methodology

In May of 2007, 263 retailers were contacted by e-mail and asked to participate in a study on the impact of advertising inserted media. The sample was provided by a leading vendor of printed inserted media, and included current and prospective retail customers. The individuals on the list represented marketing, advertising, and print production managers for these retailers. The e-mail soliciting their participation included a link to an online survey. They were offered a copy of the final results as an incentive to participate.

A total of 78 retailers completed the survey. They represented a variety of store types, as shown in Table 2.

Table 2. Profile of respondents by store type

Store type	Number
Office supply, furniture, electronics and camera	19
Drug, party, dollar and variety	7
Clothing, sporting goods, shoes	16
Grocery	27
Home and hardware	5
Auto parts	4
Total	78

Results

Use of Inserted Advertising

The respondents were heavy users of inserted advertising. Almost all (94%) used newspaper inserts or circulars, with a somewhat smaller percentage (82%) reporting they used in-store distribution as well. Just over three-quarters of the respondents used direct mail distribution (78%), and 71% used online distribution. These retailers were also users of run-of-press newspaper advertising, with 77% indicating they

Insert Advertising *continued*

used this kind of advertising. However, on average, 80% of the expenditures for newspaper advertising went into inserts or circulars.

When asked if this level of expenditure will change in the coming year, 64% said it will remain the same. Of the approximately one-third who indicated it would change, 33% indicated they would increase the spending for inserted media, while 67% reported a decrease. In other words, 75% (52 of 69) will maintain or increase the proportion of spending for this medium in the coming year. Factors that correlated with the increase and decreases will be discussed later in this section.

When compared to the other advertising media the retailers were using, 45% of respondents reported that inserted advertising performed better, 40% reported that it performed the same, and 15% reported that it performed worse than other advertising media.

Assessment Tools
A large proportion (81%, or n=55) of the 68 respondents who answered this question indicated that they measured the effectiveness of inserted media advertising. They used the following metrics:

Table 3. Most frequently used advertising effectiveness measures

Type of measure	Usage rate
Change in same-store sales	75%
Sales on advertised items	73%
Response rate to a coupon distributed in insert/circular	40%
Media mix modeling	18%

We also asked them to describe in detail their methodology as an open-ended question, and a number of respondents provided a good level of detail. A few examples are presented below. These indicated that a number of retailers are employing rigorous methods to assess advertising effectiveness.

- "We measure the lift in sales and customer transactions for each retail location for each advertising period. We also measure the performance of each advertised item against historical data and current performance projections, identifying the lift by category/department."
- "We measure advertised items sold vs. a control group … as well as total store sales lift vs. a control group."
- "Sales lift by geographic zone against cost of insert."
- "Same period sales over a two week window (from previous year) for advertising cost/benefit analysis + a multiplier coefficient of effectiveness (customers returning to our stores instead of competition)."
- "Store sales increases against same store's previous year, campaign, etc., and against 'control' group of stores with differing media plan."
- "Sales lift of advertised items. Customer surveys conducted through in-store and telecommunications. Coupon redemption analytics. Itemized breakout of various media effectiveness (both quantitative and qualitative). Focus Group studies."
- "Cost to print and distribute vs. dollars spent in-store on a zip code of card holders."
- "RFM analyses; same-store sales; average order size; media efficiency (ad-to-sales ratio); brand tracking studies."
- "We measure online traffic and faxed information request forms and Amex spending."

These quotes also indicate the variety of methods being used, which ranged from sophisticated statistical modeling that includes the cost of the advertising medium used to simple traffic measures. Eleven of the respondents (20% of the 55 who answered the question) indicated that their stores used an enterprise-wide supply-chain management software system such as AD Works, Imagine, SAP, and Logility. These systems are capable of generating a sales analysis by item and by store that could be used to correlate with specific advertising campaigns used.

Discussion
The purpose of this research was to benchmark the methods used by retailers to assess inserted media advertising impact. We found that approximately 80% of the retailers surveyed measured the effectiveness of inserted advertising. In this age of accountability, we expected this figure to be 100%. The two most popular methods used were the assessment of a change in same-store sales and in the sales of the featured item. For same-store sales, the detailed responses revealed that the retailers used comparison figures from sales in the same week as last year or in the week prior to the distribution of the inserts.

The details provided by the respondents showed that many retailers are quite sophisticated in their analytical approaches. However, only a small proportion (18%) of retailers used media mix modeling, one of the more statistically sophisticated methods of determining advertising impact that often includes other advertising media in the models. We checked to see if this was related to the use of an enterprise-wide inventory management system, but found that only two of the

ten who used media mix modeling also had an inventory management system. We did not ask if the retailers used any campaign management tools, but, judging from the open-ended responses, some retailers in the sample were using these tools.

We also assessed the differences between those who will increase versus decrease the proportion of advertising spending for inserts on the other questions in the survey. We did not find a lot of differences. The profiles of the stores were quite similar except on two measures—those that reported they were going to decrease their spending:
- Tended to buy proportionately more ROP ads (63% of decreasers vs. 38% of increasers).
- Were more likely to use an enterprise-wide inventory management system (23% of decreasers vs. 0% of increasers).

In summary, this exploratory study revealed that the majority of retailers sampled do assess the effectiveness of inserted media using a wide range of methods. However, changes in media expenditures for the coming year were independent of whether or not they measured the impact of inserted advertising. The changes in advertising expenditures by retailers are affected by many more business factors than the use of good metrics. As is usually the case in business research, the environment proves to be much more complex than the models we initially test.

To read about this research in detail, download the monograph from: http://print.rit.edu/pubs/picrm200804.pdf

Upstream Database *continued*

shown in Figure 1. Primary layers, from the bottom up, concern connectivity, hardware, system software, and application software.

Data and digital content sources may include mainframe systems, minicomputers, or servers of varying power. Client-server architecture is generally multi-tiered, spreading selective functionality across different platforms or processors. DAM capabilities can reside on a different server than the database management system, though this is not a necessity. The two content sources feed a large storage-capacity workstation, which may be used for both data preparation and document design.

The VDP system is facilitated by a local area network (LAN), which requires networking skills in addition to application and data handling skills. Networking is limited to connecting the proofing printer, the workstation, and the digital front end (DFE) of the digital press or high-speed ink jet

printer. Customer-supplied data may eliminate some complexity, because the customer is responsible for assembling data and content. The customer, not the printer, has to deal with IT infrastructure. But this means that the printer has to assume the data is clean, organized, and usable – a potential risk for both the customer and the printer. The provided data and content may or may not reflect the customer's business or campaign objectives. It may be nothing but a mailing list of unknown quality from some commercial source. Whatever the source and whatever the content, the immediate need is to understand it, determine its level of quality, and then deal with it. This means that it is necessary to have some capabilities and facilities for examining the data and other content (digital images and potentially text), which can be very time-consuming.

Information Model
Information may consist of data in the form of facts or figures, digital content such as text, images, and

photographs, or metadata (data about data). Information modeling is building information structures by categorizing, grouping, and organizing data elements for effective and meaningful accessibility – usually in the form of a tree of some type. It can be as common as preparing a report, or as esoteric as creating an object-relational database with XML (eXtensible Markup Language) components.

VDP Models
Data-Driven Print: Strategy and Implementation lists six types of variable printing: versioning, mail merge, personalized printing, transaction printing, Internet-on-demand, and fully customized communications.

Each of the six types is detailed below:

Versioning. An example of this would be mail order catalogs being prepared for different areas of the country. The variability would be in the catalog content.

Mail merge. An example of this is a mailing campaign using letters printed on an offset press. The letters would then be addressed in a second run on a digital press. Addressing could also be completed in-line with a high-speed ink jet print head.

Personalized printing. An example of this would be individual store advertisements with coupons that are prepared for each customer based on their buying habits.

Transactional printing. An example of this would be individual monthly investment reports that were prepared based on month-end status and the past month's account activity for each investor.

Internet-on-demand. There are several approaches to this type of solution. One approach is to use the Internet as the request medium for a common print-on-demand (POD) solution. Another approach is using the Internet as the distribution vehicle for a standard advertisement prepared at corporate offices. The advertisement would be sent over the Internet to product distributors who customize the document to reflect their distributorship and, potentially, tailor it for their individual customers as well.

Fully customized communications. This is the most complex type of VDP. An example is an automobile dealer who sends out advertisements about the new model year to current customers. The content would reflect the age of their current automobile, its color, model, accessories, and remaining lease or payment amount. The advertisement would contain an offer for a new car purchase, showing pictures of the new vehicle with interior and exterior pictures that match the customer's tastes.
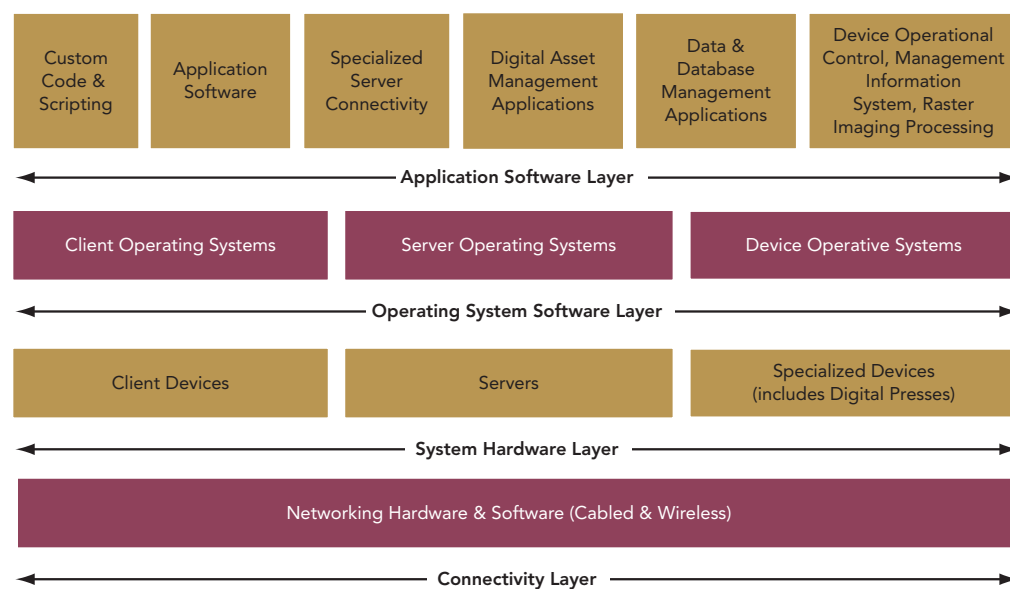
Data-Driven Workflows
There are three basic workflows that need to be addressed for VDP: data, images, and text. These are discussed below.

Data Preparation
Data drives VDP quality and affects results. Given the potential scope of problems and applied solutions, and considering the likely large number of records or rows in the dataset, a considerable amount of functionality is needed to manipulate and structure the data for successful VDP production. The

Figure 1. Basic system architecture
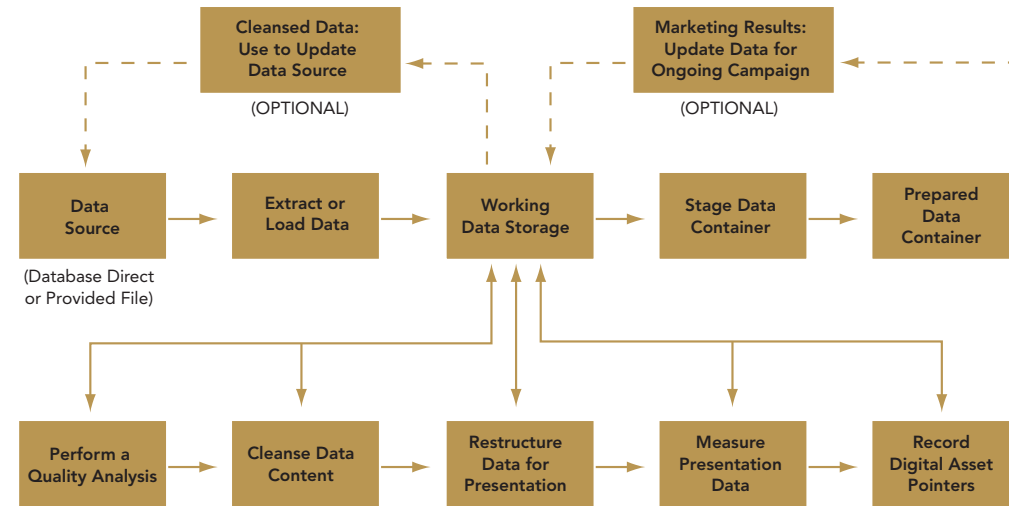

Custom Code & Scripting	Application Software	Specialized Server Connectivity	Digital Asset Management Applications	Data & Database Management Applications	Device Operational Control, Management Information System, Raster Imaging Processing

— Application Software Layer —

Client Operating Systems	Server Operating Systems	Device Operative Systems

— Operating System Software Layer —

Client Devices	Servers	Specialized Devices (includes Digital Presses)

— System Hardware Layer —

Networking Hardware & Software (Cabled & Wireless)

— Connectivity Layer —

Upstream Database *continued*

data preparation workflow is illustrated in Figure 2.

Figure 2. Data preparation workflow

This is not a workflow to delay until data and document design are merged. The activities that compromise the data preparation workflow are significant. Data acquisition processes involve more than just getting the data:

- Capture or load
- Transform, organize, and store in a standard storage format
- Eliminate superfluous data
- Administer or manage, providing security and recoverability

The objective is to ultimately work with a single set of data, but the data may come from multiple sources or reside in multiple datasets that present integration issues.

Digital Image Preparation

Digital assets are usually prepared in a design, pre-media, prepress sequence. VDP presents an additional issue because images are manipulated and placed on documents according to business logic based on a data stream. Therefore, digital images should be prepared iteratively and in parallel with data. Digital image preparation, illustrated in Figure 3, can be very complex in terms of the types of issues encountered and the "repair work" potentially needed. The workflow is similar to that for data, but is further complicated by color management requirements to ensure desired colors at press-time.

Problems requiring digital content preparation may have a variety of causes, but usually relate to embedded color profiles, embedded fonts, copyrighted fonts and images, file formats, file sizes, and assumptions about appropriate color space. Images that have already been processed as a result of artistic work may still require corrective action to make them usable and/or the desired results achievable.

Digital Text Preparation

Further complicating content preparation is the need to deal with the digital text assets, which may have their own unique, processing requirements such as XML-based content. A text-based workflow is pictured in Figure 4.

Digital asset preparation that addresses textual content issues is relatively simple, although it can be time-consuming when reviewing text and making necessary corrections or when structured and tagged text components such as XML are involved. Editorial and technical functions that check accuracy, appropriateness, and wording, spelling, grammar, and punctuation, formatting and capitalization, and compliance with XML structure and process conventions are all necessary.
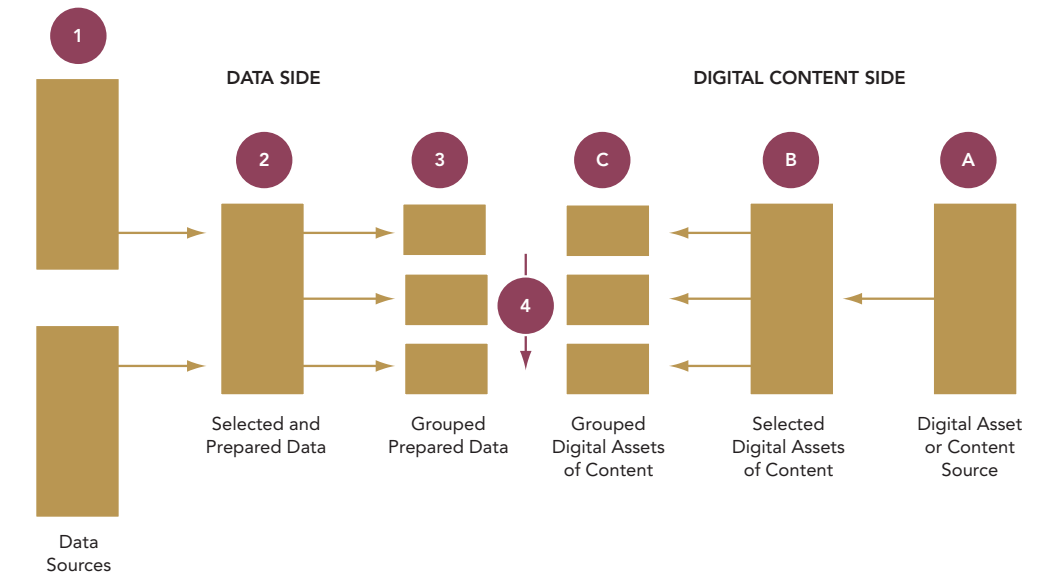
Putting It All Together

Once data and digital assets have been prepared and moved into a production staging area for data and digital assets, they need to be synchronized. If they were already synchronized during a prior step, then the synchronization needs to be validated. The choreography of data and digital assets (shown in Figure 5) can be complex. Potential benefits need to be researched and quantified.

Conclusions

A VDP solution requires the interplay of topical knowledge about business and marketing, information content (data and images), and printing applications across the entire print production workflow from inception to delivery. All these topics come into play at conception, and continue to operate together iteratively over the life of the

Figure 3. Digital image preparation workflow

Figure 4. Digital text preparation workflow

Figure 5. Data and digital content choreography

1. Data is selected from multiple sources.
2. Data is merged and cleansed, preparing it for ultimate design application.
3. After analysis, data is grouped into logical levels based on postal, RIP, and response optimization strategies.
4. Matched data groups with digital asset and content groups are ready for use in document design and print submission.

A. Digital images and textual content are selected.
B. Digital images and textual content are groomed and edited to meet design requirements.
C. Digital images and textual content are grouped to match associated data elements.

project. Design concept, knowledge acquisition from data, and graphics modify each other as a design emerges.

It does not matter who is responsible for addressing the data and digital asset components in the overall workflow, be it the customer or the service supplier. It only matters that the work is done in conjunction at the proper time. This requirement presents an opportunity for the service supplier to expand the range of services offered, the duration of service delivery, and the degree to which the customer relationship can be enhanced.

Constraining the number of tools involved and using the right tools in the right sequence not only streamlines VDP processing, it makes finding the right skill combination simpler. It also simplifies the need to keep technical experts up-to-date with rapidly advancing technologies. The following is a preliminary list of skills needed to adequately support VDP solution delivery:

- Information, knowledge, and application architecture skills
- Networking and systems integration skills
- Business and requirements analysis skills
- Imaging, color management, and DAM skills
- Text manipulation processing skills (including XML and Perl)
- Desktop or server database administration, design, and SQL programming skills
- General object-oriented design and programming skills using compiled and interpreted languages
- Web design and cross-media development skills (including XHTML, CSS, and scripting)

To read about this research in detail, download the monograph from http://print.rit.edu/research/picrm200801.pdf