



PDF/VT: Overview and Practice

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1 Introduction

The purpose of this white paper is to highlight important information regarding the PDF/VT standard and how this standard can be used in variable data printing scenarios.

1.1 About the Ghent Workgroup

The Ghent Workgroup (GWG) is a worldwide assembly of graphic arts stakeholders (user associations, vendors, consultants, educational institutions, service providers, and end users) founded in 2001. It was formed in response to increased needs for standardization of the different processes in graphic arts workflows, especially in an increasingly globalized service provider landscape. The rules of the group have been carefully conceived to ensure that the group remains practically oriented, and the priority is focused on the needs of the end users.

The GWG focuses on developing best practice guidelines and specifications for graphic arts workflows. While initially focusing mainly on quality control and preflight for PDF workflows in commercial print, that focus has broadened to also include metadata specifications, workflow test suites and increased support for market segments such as packaging.

All material created by the GWG is disseminated free of charge through the website of the GWG (www.gwg.org) and through the vendors and user associations partaking in the work of the group. Development happens through quarterly face to face meetings and intermediary online discussions.

The mission statement of the Ghent Workgroup states that the group will “establish and disseminate process specifications for best practices in graphic arts workflows”. In practice this means that the group:

- Develops and maintains process specifications and associated documentation for best practices in graphic arts workflows.
- Develops and maintains *reference implementations* to ensure the specifications it develops are usable in the real world.
- Actively promotes adoption of its work in both the graphic arts user and vendor communities.
- Streamlines and coordinates the decision process between its members.

While the group started its work developing guidelines for PDF quality control, it has expanded its scope. The group is now involved in magazine, office, and packaging specific specifications, the development of job ticket metadata specifications for delivering PDF files for advertisements, preflighting PDF files, and in developing test suites to ensure workflows and applications are configured and used correctly.

Much of the work of the group is done through teleconferences and e-mail discussions. Three times a year, the members come together for a three-day face-to-face meeting. To streamline the work and decision process, subcommittees have been organized around specific topics do the actual work. To learn more about the different subcommittees, or to find out how you can contribute to this effort, visit the Ghent Workgroup website (www.gwg.org).



1.2 About PDF/VT

PDF/VT is an ISO PDF standard (ISO 16612-2:2010) developed to offer the reliability and predictability of a PDF/X workflow specifically for variable data and transactional (VT) projects. It is designed to enable a unified workflow for conventional static as well as variable printing in a variety of environments as opposed to other existing variable data formats that can be quite vendor and/or processes specific.

Although PDF/VT may be viewed and/or printed by any PDF 1.6 compliant renderer, it is designed to work optimally with native PDF Interpreters that can take advantage of PDF's XObject structures and PDF/VT-specific metadata to minimize file size and maximize performance for repeating objects.

1.3 About This Document

The purpose of this whitepaper is to provide an overview of the PDF/VT standard, how it works, and how it can be used in variable data printing applications.

1.4 More Information

The GWG website contains a lot of useful information regarding the GWG, its specifications and deliverables, and caters to vendors, associations and end-users alike. It also features a user forum where you can interact with your peers and ask questions.



2 PDF/VT: An Overview

2.1 What exactly is PDF/VT?

The ISO 16612-2 document published at the end of the summer in 2010 provides the specifications for the PDF/VT standard. While PDF/X standards are geared more towards conventional printing applications, PDF/VT's primary focus is on variable data and transactional printing, as defined by ISO 16612-2 document:

[ISO 16612-2] defines the PDF/VT document format and methods to enable reliable document exchange for variable data and transactional (VT) printing. It uses the Portable Document Format (PDF) Version 1.6, as restricted by PDF/X-4 and PDF/X-5, for the representation of such documents. It allows the specification of document structure and layout, content data, and interaction of graphical objects in a graphics model that supports transparency and both device-dependent and device-independent color spaces. All elements are either included or provision is made for unique identification of externally supplied graphical content or ICC profiles (ISO 16612-2:2010, p.1).

The above excerpt from the ISO document highlights some key information worth noting. First, PDF/VT is governed by the same rules and restrictions as a PDF/X-4 file. This means that PDF/VT files have all the functionality of PDF/X-4 files (layers, transparency, color management, etc.) remaining predictable for output because of the rules inherent in the PDF/X-4 specification that ensure reliable and predictable output. Second, the statement alludes to the importance of document structure and metadata as they relate to the enhanced output relative to variable data and/or transactional printing. The chart below offers a brief comparison of PDF/VT to PDF/X-4 and PDF/X-5.

The ISO 16612-2 (PDF/VT) standard defines three conformance levels for PDF/VT as outlined in the table below.

PDF/VT Conformance Levels [†]		
	Conforms to...	Admissions and Restrictions
PDF/VT-1	PDF/X-4	Complete data exchange – All objects, resources and metadata representing graphical content must be defined in the PDF/VT-1 file, and guided by PDF/X-4
PDF/VT-2	PDF/X-4p PDF/X-5g PDF/X-5 pg	Partial data exchange – One or more objects representing graphical content and/or ICC profiles required for the file can be externally referenced in a PDF/VT-2 file, as guided by PDF/X-4p, PDF/X-5g and PDF/X-5pg
PDF/VT-2s	PDF/X-4p PDF/X-5g PDF/X-5 pg	Same structure as PDF/VT-2, but allows multiple compound entities representing graphical content to be streamed before the entire PDF/VT instance has been generated

[†] This table is adapted from ISO 16612-2, section 5.1, p.5, Annex B, p.18



2.2 How Does PDF/VT Work?

PDF/VT has been designed for maximum efficiency in variable data and transactional print scenarios. There are three significant elements in the PDF/VT standard that enable this.

1. PDF/VT uses Forms XObjects, Image XObjects, and Reference XObjects (PDF/VT only) to manage recurring graphical content. ISO 16612-2 recommends that all significant graphical objects that are referenced more than once should be encoded as XObjects. A PDF/VT optimized RIP with optional assistance of PDF/VT XObject recurrence metadata hints caches recurring XObjects so that they do not need to be reinterpreted or re-RIPped for each reference to the XObject. Furthermore, XObjects that are used frequently by multiple PDF/VT files may be cached by the RIP and recalled on demand for even better performance. This is crucial because rendering times for variable data printing must be fast – especially when dealing with variable data image objects – so that the RIP can keep up with the output engine.
2. PDF/VT files can deviate from the structured access to page objects via the pages tree defined in the PDF Reference 5th Edition by allowing a PDF/VT conforming reader to access page objects indirectly through the DPart leaf nodes of the document (ISO, 2010). The DPart structure allows a reader efficient random access to pages relative to the record and component context to which they belong, and “provides an ideal page content resource format for job-ticket-based workflows where the order of page processing by a conforming reader can be different from the order presented in the PDF/VT data” (ISO 2010, p.9).
3. PDF/VT separates page content from production information. In order to comply with job ticketing formats such as JDF, PDF/VT uses Document Part Metadata (DPM) that can contain important information about the document that can be used by a production workflow. For example, DPM could be referenced by JDF to vary process attributes during production. One example of this would be using DPM to identify different parts of a book being printed on a digital press so that the paper feed will change to accommodate a different stock for the cover as opposed to the inside pages. PDF/VT with its use of DPM, along with a document part hierarchy is “analogous to a structured database of final form variable content pages. This structuring and use of DPM allows a job ticket to refer to the PDF/VT pages in a way that is conceptually similar to a structured database select or query” (ISO, 2010, p.9).

2.3 PDF/VT Versus Other Variable Data Formats

One look at the output format list from a product that produces VDP files will tell you one thing – there are many different formats to choose from. Protocols such as PPML, Metacode, VIPP, VPS and more are common. Often there are separate files for static versus variable elements. Further, all of these formats attempt to overcome the limitations of PostScript when it comes to caching and merging data. In some instances, such as with formats like VIPP and VPS, Proprietary vendor extensions to PostScript are used for caching of repeated objects. What follows is a brief description of each of these formats.

2.3.1 Personalized Print Markup Language (PPML)

PODi (the Digital Printing Initiative) developed the Personalized Print Markup Language (PPML) in 2000. PPML is based on XML (Extensible Markup Language) which has become an industry standard for metadata and data exchange.

PPML is device independent and non-vendor specific. PPML can achieve output efficiencies by separating variable and static objects, and caching static objects for repeated use. According to PODi, “PPML’s Reusable Object feature optimizes file size for print jobs with high graphical content. Parts of pages that will be used repeatedly can be



sent to the printer once and accessed repeatedly from the printer's memory. Then, complex variable print jobs can be executed by simply sending layout instructions and each document's unique data, instead of re-sending graphics that were used before." (PODi, 2003 p.3)

2.3.2 Metacode

Metacode is a variable data language developed by Xerox, and is closely related to their Line Conditioned Data Stream language. Metacode uses its own proprietary metalanguage to define such things as color, fonts, and page orientation.

2.3.3 Variable-data Intelligent PostScript Printware (VIPP)

VIPP is a PostScript-based language for variable data printing developed by Xerox. VIPP is designed to take advantage of the benefits and power of PostScript while at the same time overcome the limitation of PostScript in a VDP environment. Like other VDP languages, VIPP takes advantage of caching pre-rasterized repeating objects. VIPP is also capable of interpreter level document composition, although few software solutions take advantage of this feature, preferring to use their own compositor, or page layout application instead.

2.3.4 Variable Print Specification (VPS)

VPS was originally developed by Scitex and currently owned by Kodak. VPS is based on PostScript, and uses an imaging model that is constructed of pages. Each page is constructed of elements, and there can be two types of elements: reusable and non-reusable.

2.4 Advantages of PDF/VT For Variable Data Printing

There are many aspects of PDF/VT that make it an attractive solution for variable data and transactional printing, especially as these market segments become more complex and demanding. PDF/VT offers several advantages over other VDP file formats and languages.

2.4.1 PDF/VT is not Vendor Specific

PDF/VT is not proprietary and is not owned by a vendor. It is an open standard that can be used for a wide variety of static and variable print applications. PDF/VT files do not require vendor-specific technology to be processed. This means that there is no risk of vendor lock-in, and that the same file can be used on different output devices.

2.4.2 Unified Workflow with Traditional Printing

PDF/VT files allow for a truly unified print workflow, enabling existing static printing processes to be readily extended for variable data printing taking advantage of the full PDF print publishing workflow ecosystem. VDP with PDF/VT doesn't require significantly different workflows than static printing.

A significant advantage of PDF/VT for digital and transactional printing is the very fact that these files are PDFs. This means that all the tools used every day in a print environment can be used with PDF/VT files. PDF/VT files can be opened in any PDF/X-4-compliant viewer for simple viewing, searching, and non-optimized print operations. Preflight tools are now available from multiple vendors validating PDF/VT files before print. RIPs from multiple vendors are available to take advantage of the PDF/VT architecture. With no need to invest in proprietary hardware or software to manage and process PDF/VT files, adopting PDF/VT for variable data printing can be very cost effective and result short learning and ramp up curves.



2.4.3 PDF/VT-1 is a Single File

PDF/VT-1 has the benefit of being one single file for both static and variable elements. It offers all the advantages of a PDF workflow already discussed, with the added benefit of an architecture that is optimized for PDF native rendering. This means that documents can be printed efficiently, consistently, and predictably. Because the final file is a PDF with all necessary resources embedded, there is true blind exchange of that file.

2.4.4 Color Managed Reproduction and Transparency

Given the increased demand for color accurate reproduction in variable data printing, PDF/VT has an advantage over other formats because of its well-established color management features. Unlike some other VDP formats, where color management is optional or not considered, PDF/VT requires color management to be used. PDF/VT is also capable of representing high quality color/design content through its support for a color managed transparency-based graphics model that is not available in other VDP formats because of their PostScript-based architecture. Also, PDF/VT files can be preflighted and verified using industry-standard, non-specialized PDF tools.

2.4.5 Consistent and Uniform Implementation

One concern with VDP standards, such as PPML, is that they are not always implemented the same by different Vendors. This can result in inconsistencies in how these files are run. PDF/VT is an ISO standard that can be checked for conformity using a wide array of readily available tools often found in a print production environment. PDF/VT files can be RIPped consistently by any native PDF interpreter.

2.4.6 Production Refinement and Enhancement

The production benefits of a PDF/VT workflow for variable data can be considerable. VDP jobs that rely on preprinted shells on which VDP data is overprinted can be reworked to be a single-pass full color output. This would eliminate the need to manage and warehouse stocks of preprinted shells, and reduce waste. By integrating the variable and static elements in a single pass, VDP presentations can be more graphically rich and the amalgamation of the static and variable data can be more creative and more seamless. Further, matching color between static and variable elements will no longer be an issue as they will be printed together on the same print engine, with mandatory color management.

2.4.7 File Legacy and Archiving

There is another advantage of PDF/VT as a format for variable data and transactional printing that relates to archiving. PDF/A (ISO 19005) is a universal standard for file archiving that is used by many government agencies and companies around the world. PDF/A-2 is a subset of ISO 32000-1: Document management — Portable document format — Part 1: PDF 1.7. This can be significant for organizations that use PDF/A for file archiving, as the PDF/VT-1 files can be simultaneously tagged as both a PDF/VT-1 file and a PDF/A-2b file. Note that is not possible with PDF/VT-2 files because they are not self-contained.



3 PDF/VT in Practice

PDF/VT is still early in the technology adoption phase, however, there are several vendors that are currently shipping products that can create PDF/VT files, and other vendors have made a commitment to do so in the near future. As for PDF/VT consumers, the basic requirement to take advantage of PDF/VT is a RIP with a native PDF interpreter that supports object caching; however, RIPs that also support Document Part hierarchy and metadata (DPart metadata) offer even greater efficiencies for processing PDF/VT files.

3.1 PDF/VT Forecasts

PDF/VT has received a lot of publicity since its release in 2010. In 2011 PDF/VT won a Printing Industries of America InterTech Technology Award for Innovative Excellence. Several leading companies in the printing industry are either shipping products with PDF/VT capability, or have committed to do so.

PDF/VT can be classified as a disruptive technology, and like all disruptive technologies it can take time for market share to reach critical mass. Mark Lewiecki, a senior product Manager for Adobe, estimates that it will likely be sometime in 2015 or 2016 before PDF/VT establishes a critical mass in the industry. In the meantime, however, more and more products are coming to market that can either create, read, preflight or convert PDF/VT files. PDF tools from callas, Adobe and Enfocus all have the ability to manage PDF/VT files.

At present, with more and more products shipping with PDF/VT support, PDF/VT is undergoing extensive real-world testing that will benchmark the file format against trusted standards being used today. The early adopters of PDF/VT are playing a critical role in proving the merits of the file format that will ultimately build the trust needed for others to explore the technology.

3.2 Markets Ideal for PDF/VT

There are many different market segments that can benefit from the advantages of PDF/VT. One of the most obvious markets would be direct marketing print campaigns. Another is the world of transactional printing. Yet there are many other viable uses for PDF/VT. For example, label printers may benefit from the versatility of PDF/VT. There are several packaging applications where PDF/VT could be used effectively as well.

There are also many specialized printing applications that seem well suited to PDF/VT. Credit Card printing, prepaid phone cards, gift cards, scratch cards, transit passes, sequential numbering, tickets, and other unique printing applications could all benefit from PDF/VT.

Another industry segment that might benefit from PDF/VT is long document digital printing. Printers that use digital output engines to produce multi-page, multi-section documents can use the Dpart data to separate records, pages, and sections so that each one can be processed differently. For example, Dpart data could be used to separate the cover of a book from the inside pages so that the cover stock is retrieved from different paper cassette than the inside pages. Further, page of images could be printed on a high-gloss stock from a separate paper source than the uncoated text pages, and so on.

Because PDF/VT utilizes Dpart metadata and a job ticket driven workflow, metadata can be used to manage records in advanced ways.



3.3 The Future of PDF/VT

Early adoption of PDF/VT has already begun in the industry, and there is commitment from many of the key industry players to integrate the PDF/VT file format into their products. It won't be long before PDF/VT ramps up in the market, and real-world results are actualized in significant ways. PDF/VT has had significant media coverage since its inception, and so far it has all been positive. With all things considered, PDF/VT has the potential of a strong future ahead.



4 Conclusion and Further Information

4.1 Conclusion

PDF/VT has been a standard since 2010; however, it is only recently that vendors have begun to incorporate the standard into their products. Over the next little while, PDF/VT uptake will increase, and the benefits of PDF/VT will be actualized in real-world production settings.

PDF/VT has the potential to improve upon existing procedures and processes for many different market segments that require the use of variable data. From marketers to transactional printer, digital book printers to packagers, and all sorts of unique printing applications in between, there is a lot of potential for PDF/VT to revolutionize the way variable data is managed for print.

4.2 Further Information

There are several resources where you can learn more about PDF/VT, including but not limited to:

- PODi, The Digital Printing Initiative (<http://www.podi.org>)
- The PDF Association (<http://www.pdfa.org>)
- PDFlib (<http://www.pdflib.com/fileadmin/pdflib/pdf/whitepaper/Whitepaper-Technical-Introduction-to-PDFVT.pdf>)
- PDF Tools AG (<http://www.pdf-tools.com/public/downloads/whitepapers/Whitepaper-PDFVT-Standard-ISO-16612-2-EN.pdf>)
- Adobe (<http://www.adobe.com/ca/products/pdfprintengine/pdf-for-vdp.html>), and (<http://www.adobe.com/ca/products/pdfprintengine.html>)

You can find much more information on the work of the Ghent Workgroup and on delivering print ready PDF/X files that comply with the Ghent Workgroup specifications on the Ghent Workgroup website: www.gwg.org. You can also get in touch with someone at the Ghent Workgroup via the online form found under the contact area of the website. Here you can ask specific questions and get feedback.



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