Building PDF/VT compliant systems using the Harlequin RIP

Technical Note Hqn079

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1 Introduction

The International Standards committee ISO TC130 has delivered a new standard based on PDF for delivery of content for variable and transactional printing, called PDF/VT (ISO 16612-2:2010). Martin Bailey, Global Graphics' CTO and the principal UK expert on the standards committee, believes that the advent of PDF/VT offers a significant opportunity to inform the marketplace of the opportunities and value of optimizing creation of work for digital production print, and to recommend the use of additional metadata that can be used to accelerate rendering.

This document describes how a PDF/VT compliant solution can be built around a Harlequin RIP. It applies equally to both the Harlequin PLUS Server RIP and to the Harlequin PLUS Host Renderer.

2 PDF/VT conformance levels

The current standard defines three PDF/VT conformance levels designed for use in workflows with different characteristics:

PDF/VT-1 — Each print job is fully encapsulated within a single file that contains all pages of the job including all required resources (images, color profiles, fonts and so on).

All PDF/VT-1 files are also compliant with PDF/X-4.

PDF/VT-2 — A print job comprises a primary PDF/VT-2 file and other files providing additional resources, collectively referred to as a 'file set':

- Secondary PDF files containing graphical content for re-use multiple times on the same or different pages of the print job. Each "page" in a secondary file may be used as a partial page in the final print job in a similar

way to the use of Marks in PPML. The connection from the primary file to a page within a secondary file is made with PDF reference XObjects.

- ICC profiles referenced by the primary file's output intent.
- The primary file must be compliant with one of PDF/X-4p, PDF/X-5g or PDF/X-5pg. Secondary files containing re-used graphical content must be compliant with PDF/X-1a, PDF/X-3 or PDF/X-4.
- The same secondary PDF file may be used in multiple PDF/VT-2 file sets, enabling it to provide re-used content for multiple primary files. This can provide an efficient mechanism for a "chunking" workflow, where a very large print job is delivered as a series of primary PDF/VT files, each of which need only include graphical content that is only used once. Shared content can be read from a single instance of a secondary file.

PDF/VT-2s — A print job comprises one or more PDF/VT-2 file sets, encoded into a single stream using MIME. This enables streaming workflows in environments where delivery, discovery or management of a set of multiple files would be problematic.

3 PDF/VT features

The PDF/VT standard extends the underlying PDF/X standards with the following features:

3.1 Page range metadata

A PDF/VT file contains data in a "DPart" structure that enables all pages in the print job to be separated into a hierarchy of page ranges. As an example, for a direct marketing job where each recipient is to receive a personalized catalog and cover letter these might allow the pages to be split by:

- country/state/prefecture

- zip code
- recipient
- letter, catalog cover, catalog contents

The metadata may be used to manage the job in many ways, either on its own or in combination with a job ticket of some form; this is a very incomplete list of the potential uses:

- splitting a job over multiple print sites (for example, by state or zip codes)
- splitting a job over time (for example, printing for all recipients in some states today and other states tomorrow)
- splitting a job over multiple presses (for example, by printing on different media on each press)
- determining which page ranges need to be imposed together, and how
- controlling gathering, stitching, folding, cutting and other in-line or near-line finishing equipment

Metadata can be added at every level in the DPart hierarchy custom, enabling product-specific functionality to be controlled.

3.2 Object re-use hints

Graphical content that will be re-used multiple times is encoded in the file as PDF Form or Image XObjects. The standard defines new keys that may be included in those XObjects to inform the Digital Front End (DFE) whether that XObject is re-used, and whether that re-use extends over multiple pages, multiple jobs and so on. A DFE *may* be able to make use of this information to improve cache management.

3.3 MIME encapsulation rules

A set of rules define aspects of MIME encoding for PDF/VT-2s files such as the order and content type of files within the stream.

4 Addressing PDF/VT requirements

4.1 References from PDF/VT-2 to secondary files

In order to incorporate graphical content in secondary files for PDF/VT-2 the RIP must be able to identify the reference XObjects used, and to understand the current graphics state at the time of the reference. That graphics state includes the scaling and rotation at which the content from the secondary file should be used.

Both the Harlequin PLUS Server RIP and Harlequin PLUS Host Renderer support reference XObjects in order to support PDF/VT workflows. In addition, support for the extra validation that the correct secondary file has been added to both flavours of the RIP. Support is present in Harlequin PLUS Server RIP version 8.2 and in version 9.0 and later, and in the Harlequin PLUS Host Renderer 1.3 and later. This last requirement is needed for strict conformance with PDF/VT-2, but in practice should not be necessary in a properly designed workflow.

4.2 Color management using output intents

Harlequin RIPs have supported color management of print jobs using output intents in PDF/X-3 and PDF/X-4 files for some time. This support is sufficient for PDF/VT-1 print jobs.

Support has also been added for the use of external ICC profiles in output intents as defined in the PDF/X-4p and PDF/X-5pg standards. Support is present in the Harlequin PLUS Server RIP version 8.2 and in version 9.0 and later, and in the Harlequin PLUS Host Renderer 1.3 and later. These versions include everything required for PDF/VT-2 compliance.

4.3 Reading the DPart structure

As described above (see “Page range metadata” on page 3), the page range metadata in the DPart structure is intended for a number of purposes that extend well outside the RIP within a DFE. They may be required for splitting a job or generating imposition layouts upstream of the RIP, or for press and finishing equipment control downstream of it. In some cases the DFE may wish to split a single very large PDF/VT file across multiple RIPs; if the DPart were

to be processed within a RIP it is clear that there could be situations where one document in, for example, a direct mail job, could be split over two or more RIPs, making a RIP-centric response to the DPart contents difficult to manage.

As a result Global Graphics believes that the best place to read DPart data from a PDF/VT file is before the file is submitted to the RIP, probably as part of the process of receiving it and creating a job ticket (or associating it with a pre-created one), in the OEM partner's code.

If you require assistance with parsing the PDF structure to read the DPart, Global Graphics may have technology components that would be suitable to assist with that process.

4.4 Decoding MIME streams

If a PDF/VT-2s stream is received then the MIME wrapper must be processed before the DPart structure can be accessed, and before the component PDF files are submitted to the Harlequin RIP. As described above (in "Reading the DPart structure" on page 5) the DPart structure must be read upstream of the RIP in a DFE, which therefore means that MIME decoding must also be performed upstream of the RIP in the OEM partner's code.

4.5 Accelerating processing based on usage hints

Global Graphics works continuously to accelerate Harlequin RIPs, including changes specific to variable data print jobs based on PDF. A result of this work is the PDF Retained Raster feature included in the Harlequin PLUS Server RIP v8.0 and later and the Host Renderer v1.2 and later, but much of the time the improvements are more general and therefore not specifically highlighted as a new feature.

This acceleration work applies to PDF/VT in exactly the same way that it applies to all PDF files. Global Graphics also expects that baseline PDF files will continue to outnumber PDF/VT files in variable data printing for several years to come. Therefore, further general optimizations of VDP PDF files are currently being treated as a higher priority than specifically addressing PDF/VT performance. The potential advantages from acting on the usage hints in PDF/VT acted on in a future version of PDF Retained Raster.

4.6 Product-specific requirements

Global Graphics develops many features of the Harlequin RIP proactively on the basis of market knowledge and the expectations of future developments in the digital production ecosystem as a whole. Many OEM partners, however, could make use of additional functionality in a Harlequin RIP that would not be generally applicable to other partners. If you think Global Graphics might be able to help you to build a more successful product by extending the Harlequin RIP to fit better with your unique capabilities, please contact us.

5 Document history

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