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# Adobe PDF Print Engine 2: Powering the Next Generation of PDF Print Workflows

## Executive Summary

The print industry is changing rapidly. Customers provide increasingly complex designs, while demanding faster turnaround times. They want personalized print jobs and shorter print runs. Design software, such as Adobe® Creative Suite®, includes cutting-edge features to help designers stay ahead of the crowd, but prepress professionals face significant challenges in preparing the resulting artwork for print. Despite a printer's best efforts, prepress transformations often compromise the integrity of the designer's intent.

Adobe PDF Print Engine 2 addresses the needs of today's print professionals by enabling a true end-to-end native Adobe PDF workflow, including support for variable data printing (VDP) with the emerging PDF/VT file standard. Adobe PDF Print Engine 2 eliminates the need for early conversions (such as flattening transparency) and ensures reliable, consistent printing while maintaining device-independent content. It leverages Job Definition Format (JDF) to decouple content from process instructions. Because Adobe PDF Print Engine uses a common renderer for both previewing and final output, printers and designers alike can count on reliable soft proofs.

Worldwide, Adobe's print solution partners have embraced Adobe PDF Print Engine and are integrating it into next-generation printing and previewing solutions. Already, thousands of units powered by Adobe PDF Print Engine are in production. When given a choice, customers prefer to have their jobs printed using Adobe PDF Print Engine, because they know that the printing will meet or exceed their expectations. And now Adobe PDF Print Engine 2 brings all the benefits of a PDF workflow to personalized publishing.

## Current Workflow Challenges

Print service providers must constantly adapt to new technology, new design practices, and heightened market demands. At the same time, designers are under increasing pressure to push the limits of creative software, and to find innovative ways to help their customers stand out. In a crowded marketplace, relevant, personalized content is essential to engaging an audience in print, but the promise of variable data publishing has not yet been fully realized.

Ideally, designers should be confident that what they see is what will print, and that the output will match their vision. However, in most workflows today, PDF files must be converted to Adobe PostScript® before processing at the RIP. Because the PDF imaging model is richer than the PostScript imaging model, transparency must first be flattened, fonts may be converted to outlines, device-independent colors are converted to device-dependent colors, spot colors are converted to process, and so on. Often, a file's contents are converted multiple times to prepare it for output to a specific device. In such workflows, trapping, imposition, and color transformations may be applied directly to the PDF file, limiting its flexibility for use on a different press.

Unfortunately, every conversion compromises the integrity of the original design. For example, the RGB color gamut is larger than that of CMYK. Therefore, converting an RGB digital photograph to CMYK constrains the color for output to a particular device. The earlier a conversion occurs in the workflow, the more likely it is to compro-

mise the end result because the content may not be finalized and the target output device characteristics may be unknown. Such compromises create a potential gap between the designer's intention and the printed document. To bridge that gap, printers have developed various strategies and workarounds. But as projects become increasingly complex, existing workflows cannot always compensate, resulting in unmet needs and unsatisfactory results.

Previewing software typically uses a different rendering engine than the RIP, so on-screen soft proofs may be unreliable. Therefore, printers may resort to iterative proofing cycles to ensure that customers know what to expect.

Flexibility and efficiency are especially important with new digital workflows, the growing trend of short-run jobs, and the increasing need to print personalized documents. Printers need to be able to make late-stage changes to content directly in the PDF file, without having to return to the native application. Additionally, scheduling jobs efficiently often requires adjusting the output intent to a different target device at print time; this is especially true in shops that include both digital and offset presses.

Once a file has been prepared for a specific device, it might not print reliably on a different device. For example, a file that was flattened for a printing resolution of 600 dpi will not print well on a 2400 dpi device. Similarly, it is often difficult or impossible to change the content once a job is device-dependent, especially if transparency has been flattened, text or images have been trapped, or the file has been converted to PDF/X.

Variable data publishing (VDP) has generated great excitement for many years, but current VDP solutions haven't fulfilled the potential of personalized publishing. Historically, variable data content formats, proprietary and standard, have been specialized and different from those commonly used in graphic arts. Existing solutions may not provide consistent color management, based on modern methods such as ICC profiling, and jobs are difficult or impossible to preflight. VDP solutions today rely heavily on PostScript, and are therefore constrained by its opaque imaging model.

## Benefits of Adobe PDF Print Engine 2

Adobe PDF Print Engine 2 enables greater workflow reliability and flexibility. Because it processes native PDF files without conversion to PostScript and uses JDF files to keep process-related information separate from the content, the Adobe PDF Print Engine makes it possible to maintain the integrity of the design content throughout the workflow and to publish personalized content using the industry's dominant imaging model: PDF. This eliminates the need for early transformations and compensation because all rendering operations, including color conversion, trapping, and imposition, occur together in an integrated fashion within the renderer. All the advanced attributes of the PDF imaging model, including multiple transparency blending modes and multiple color models, are fully supported by the Adobe PDF Print Engine. Additionally, the document itself remains device-independent until it is ready for final output, making it easy to handle last-minute changes to content or to redirect the job to a different device.

### A Common Rendering Engine Provides Consistency

When you use the Adobe PDF Print Engine, what you see—at any point in the workflow—is what prints. You can preview documents using applications based on the same engine as the RIP, ensuring that on-screen proofs are accurate and consistent, and that designers know what to expect from the earliest stages of the project.

Adobe PDF Print Engine 2 includes a state-of-the-art color conversion model that employs ICC color profiles. In color-managed workflows, the color on a calibrated monitor matches the color in the proof and in the final print output. Because the Adobe PDF Print Engine can handle multiple color models, you don't need to convert RGB to CMYK or vice versa—colors remain as the designer intended them, and the PDF Print Engine color engine maps them to the color space of the target device.

Using Adobe Creative Suite in conjunction with the PDF Print Engine provides even greater benefits. The Adobe PDF Print Engine leverages the same PDF rendering libraries, color management systems, and other technology components used in Adobe Acrobat® and Adobe Creative Suite, ensuring that complex designs and effects, such as transparency, can be consistently reproduced.

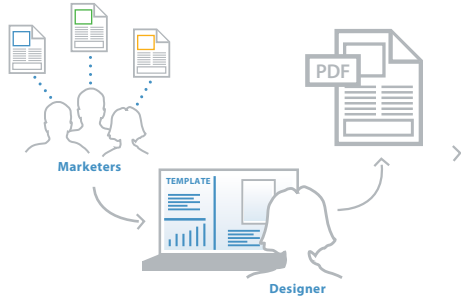
## TODAY'S WORKFLOW CHALLENGES

- *Designers are pushing the limits of authoring software*
- *Customers require fast turnaround times*
- *PDF files must be converted to PostScript prior to rendering*
- *VDP solutions do not leverage the tools, conventions, expertise, and technologies already in use in the graphic arts*
- *Transparency is often flattened incorrectly*
- *Early conversions compromise the designer's intent*
- *Previews and proofs are not always reliable*

## BENEFITS OF USING ADOBE PDF PRINT ENGINE 2

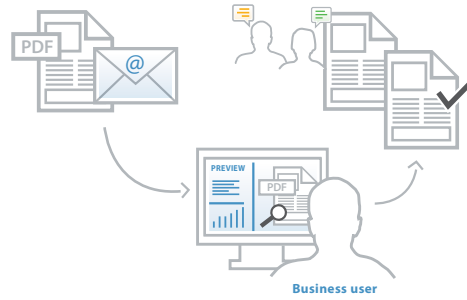
- *Native PDF workflow from creation to final output*
- *No need to convert or flatten content prior to rendering*
- *Consistent rendering engine for preview and print*
- *Processing information is included in the JDF file, leaving the PDF file device-independent*
- *Optimized for offset, digital, and personalized publishing*
- *Accommodates late-stage content edits directly in the PDF file*
- *The same PDF print job can be redirected to different output devices*

1. Create



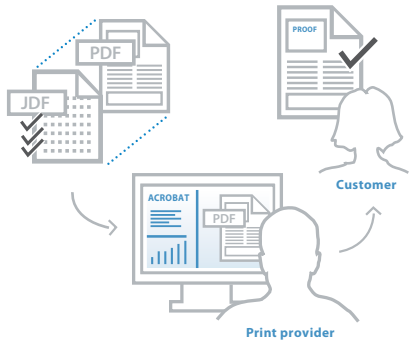
Designer creates artwork and layouts using Adobe Creative Suite® software. Personalized jobs are created using Adobe Creative Suite and third-party plug-ins. Shared presets are used to create consistent Adobe PDF onscreen previews and proofs. Final output is captured in a PDF file.

2. Collaborate



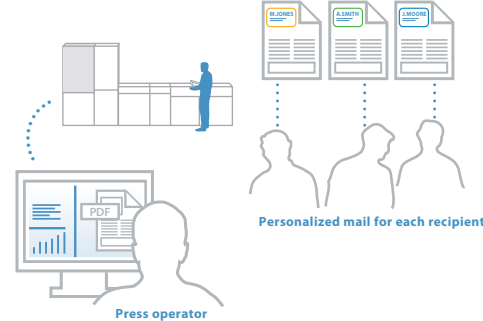
- PDF file is e-mailed to campaign stakeholders or uploaded to an Adobe Acrobat® based review server.
- Business users preview the job using Adobe Reader® software and/or a browser. Hardcopy proofs can be created by printing to a local printer.
- Feedback is incorporated into revision updates, which are distributed and reviewed until the job is approved.

3. Submit and prepare



A digital master PDF is created, which can be repurposed as necessary. For personalized jobs, compositing—merging the personalized data with layout information—is performed to prepare the PDF print stream. Job parameters and instructions are captured and submitted to the print provider, along with the PDF content.

4. Print and deliver



- PDF content is received by the printer, along with the job instructions, which can be converted to a Job Definition Format (JDF) job ticket.
- PDF content is previewed, preflighted, and prepared for output using a PDF workflow.
- Job is rendered for offset or digital printing, or both using a print solution based on the Adobe PDF Print Engine 2. Color conversion and JDF-based trapping and imposition are performed by the Adobe PDF Print Engine.
- Jobs are processed quickly and reliably in systems based on the Adobe PDF Print Engine 2, thanks to an efficient pipeline and support for parallel processing.

JDF Files Keep PDF Documents Flexible

Adobe PDF Print Engine 2 takes full advantage of Job Definition Format (JDF) files. The content of the document, including live transparency and the original color space, is contained in the PDF file, while the device characteristics, such as target resolution and color space, as well as processing information, such as trapping operations, and page-imposition instructions, are characterized in the JDF file. The PDF file remains flexible throughout the process.

The Adobe PDF Print Engine enables hybrid workflows that unify digital and offset processes. Decoupling processing information from the PDF document itself gives printers greater flexibility in managing overall throughput by balancing the load across multiple output devices, eliminating scheduling delays or the need to rework the job for a different device. Adobe PDF Print Engine 2 is equally well-suited for workflows that include both static and variable content.

The PDF document remains device-independent in an Adobe PDF Print Engine workflow. Because no early conversions have taken place—no flattening, no color transformations—you can edit or touch up the PDF file up to the moment you print. There’s no need to return to the original application for minor changes.

Cross-media campaigns are becoming more common, and many customers use their artwork in multiple ways. A native PDF workflow makes it much easier to repurpose documents for differ-

ent devices, different presses, or different media. The content remains device-neutral in the PDF document, so only changes to the JDF file are needed to leverage it for a different use.

Traps and imposition layouts are captured as JDF instructions that are applied to the content as it is rendered, leaving the content device-independent. This makes it easier to accommodate press scheduling changes, which may require different impositions, or stock changes, which may affect trapping.

### The Adobe PDF Print Engine 2 is Optimized for VDP

The Adobe PDF Print Engine 2 brings the benefits of a PDF workflow to VDP production. It enables intelligent caching by a caching subsystem. This can help to deliver the high-speed performance needed to print personalized jobs on digital presses at their rated speeds. With the PDF/VT format, repeating elements in the document content are defined once and referenced multiple times, reducing file size and rendering times. As with other PDF content, you can use ICC color management in a PDF-based VDP workflow, preflight accurately, and use Acrobat or the free Adobe Reader® for review and approval processes. Adobe InDesign® supports several third-party VDP-authoring plug-ins, enabling best-of-breed solutions for personalized publishing.

PDF/VT will support external “Reference XObjects”, which enable a “thin” VDP workflow. Adobe PDF Print Engine 2 can retrieve commonly repeated elements from an external file at print time. If complex graphic elements are maintained in a separate target PDF file, they can be rendered and cached in advance, increasing predictability and shortening the job’s render time.

The print industry depends on the consistency, productivity, and flexibility of PDF for production. Harnessing the power of PDF, Adobe PDF Print Engine 2 brings those same core benefits to the next generation of personalized publishing workflows.

## How the Adobe PDF Print Engine Works

The Adobe PDF Print Engine is a rendering engine technology that Adobe partners use to build tailored solutions for different market segments. Each print partner implements the Adobe PDF Print Engine in its own way. The Adobe PDF Print Engine is the basis for a range of products for previewing and printing PDF documents at different stages of the workflow. In each solution, however, the Adobe PDF Print Engine can interpret PDF directly, thus eliminating the need for conversion to PostScript.

The Adobe PDF Print Engine comprises the following components:

- The JDF Print Processor, an innovative front end that accepts and processes JDF files
- The Adobe Common Renderer, a scalable engine that renders final form documents for previewing and printing
- Core Adobe technologies, including Adobe Graphics Model and Adobe Color Engine (ACE).

The device-specific back end rasterizes the document in accordance with settings and characteristics implemented by the device manufacturer.

### JDF Print Processor

The front end of the Adobe PDF Print Engine is the JDF Print Processor. Unique to the Adobe PDF Print Engine, the JDF Print Processor leverages the JDF industry standard, which specifies rendering parameters, including imposition, trapping, and color space conversion. This use of JDF goes beyond the JDF files users create in Acrobat to convey intent (for example, to specify how many pages are in a file or what paper stock to use). With the Adobe PDF Print Engine, the JDF file specifies nearly every aspect of how a job is to be processed, leaving the content device-independent. The JDF Print Processor is key to run-time flexibility. For example, you can modify the JDF file to output the same PDF file to either a four-color or six-color press, or to change trapping parameters, without changing the PDF file itself. Additionally, JDF controls can be used to print different layers from the same PDF document for versioned publishing.

The JDF Print Processor receives the JDF job ticket file generated by the workflow system, either manually or through a watched folder. It then interprets the JDF file, retrieves the required pages or layers of the PDF document(s), and conveys the job to the Adobe Common Renderer (ACR) in a language it understands. As it processes the job, the JDF Print Processor produces progress audit messages.

### THE PROMISE OF VDP DELIVERED BY PDF

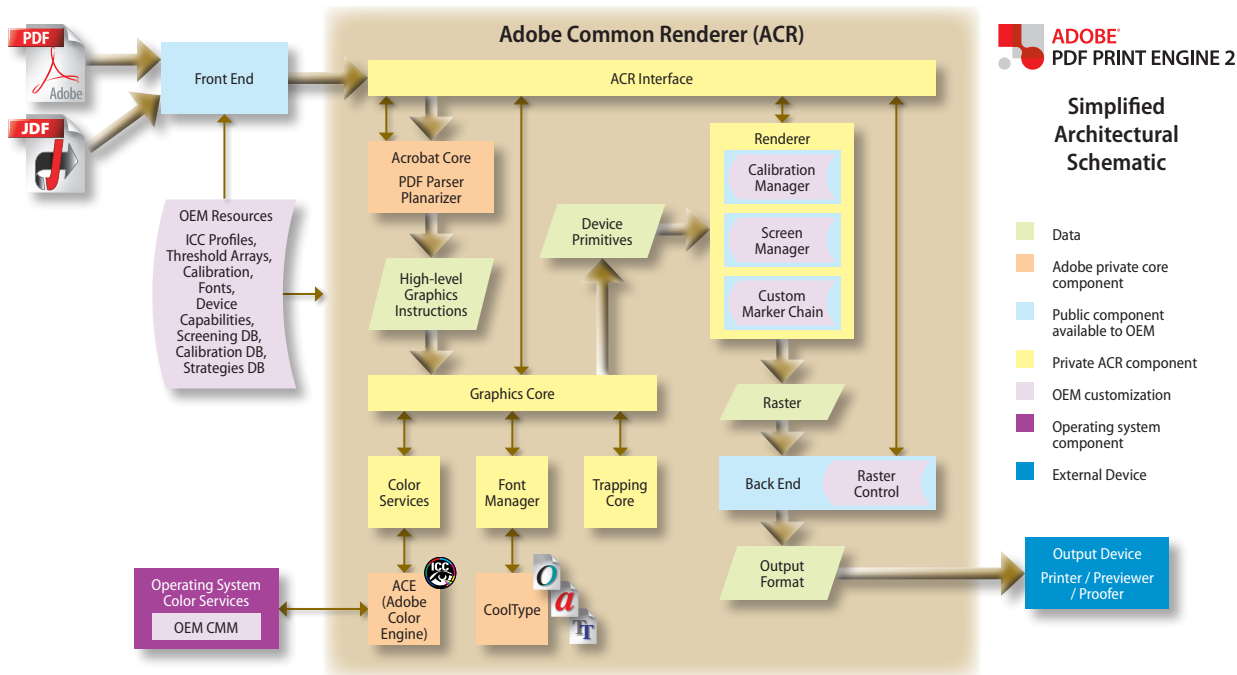
*All the benefits of a PDF workflow are now available for personalized publishing. Adobe PDF Print Engine 2 takes advantage of the emerging PDF/VT standard. PDF/VT files define recurring elements as XObjects, which need not be repeatedly rendered for each document instance in the print run. Adobe PDF Print Engine 2 makes it possible to efficiently cache repeating elements and merge variable elements. A scalable architecture enables Adobe’s print solution partners to build parallel systems that can drive a high-speed digital printer at its rated speed.*

*In addition to serving as the digital master for personalized publishing, PDF/VT files can be viewed in the free Adobe Reader, making it easy for business users to participate in distributed reviews.*

### HOW IT WORKS

*The Adobe PDF Print Engine includes three main components: the JDF Print Processor, the Adobe Common Renderer, and back-end technology.*

- *The JDF Print Processor (the front end) accepts, interprets, and processes the JDF file.*
- *The JDF Print Processor prepares the job for processing by the Adobe Common Renderer.*
- *The Adobe Common Renderer parses the designated PDF files and reduces high-level vector objects to low-level geometries.*
- *The Adobe Common Renderer simultaneously processes graphics, traps the document, performs color management, and processes transparency stacks.*
- *The entire job is rendered in a single, integrated operation.*
- *The back-end raster buffer manages page bitmaps and transports them to the output device.*



## Adobe Common Renderer

At the heart of the Adobe PDF Print Engine is the Adobe Common Renderer (ACR), a scalable engine that renders final form documents for previewing and printing. The ACR determines how objects appear on the screen or in print. By acting as a common renderer at all points in the PDF workflow that require rasterization, the ACR eliminates the visual inconsistencies that can occur when different renderers are used at different points in the workflow. All software products developed with the Adobe PDF Print Engine share this rendering engine, so they uniformly handle transparency and color, thus eliminating geometry and color differences between screen-based displays of PDF files and their printed output.

Additionally, the ACR shares common rendering technology with Adobe Creative Suite. Both use core rendering libraries such as the Adobe Graphics Model and Adobe Color Engine to ensure consistency throughout the workflow.

The ACR is a native PDF renderer. The PDF itself remains device-independent; all device-dependent features (usually thought of as RIP configuration) are managed separately in the JDF file, and the JDF Print Processor passes those instructions with the file content to the ACR.

The ACR parses the PDF file and, in a series of operations, reduces high-level vector objects to lower-level geometries, and eventually pixels. It dissects overlapping transparent objects, mapping their colors and merging their shapes into discrete opaque components that simulate the appearance of the original transparent objects. It then simultaneously applies trapping, color conversion, graphics handling, font processing, and other processes, to render the entire job in a single, integrated operation.

Transparent data is rendered simultaneously with all other content. One of the major challenges with printing transparent content using a traditional RIP is that rasterization is inherently dependent on resolution and color space. Because the Adobe PDF Print Engine renders the content for the final output device, the right resolution and color space are assured, avoiding any mismatches. And because it's rendered concurrently with the rest of the job, transparent content prints predictably.

## PDF/VT files

The International Organization for Standardization (ISO) is drafting a standard to define a VDP exchange format. This format, called PDF/VT ("V" for variable and "T" for transactional) defines how to use PDF to specify the content metadata needed to produce graphically rich personalized publishing. The draft PDF/VT-1 and PDF/VT-2 standards are designed to enable VDP printing in a variety of environments, from the desktop to digital production presses. For example, they can convey "TransPromo" content, combining color promotional graphics with monochrome statements.

PDF/VT builds on the PDF/X-4 and PDF/X-5 formats. It supports the full graphics model of PDF 1.6, which includes transparency, ICC-based color management, and layers. Using PDF/VT as the digital master enables printers to leverage the tools, conventions, and methods used in existing PDF-based prepress workflows for VDP jobs.

Adobe PDF Print Engine 2 can print any PDF files in a VDP workflow, but it's optimized to leverage PDF/VT files for efficient VDP printing. In a production environment, PDF/VT requires the use of a job ticket format, such as the JDF format consumed by Adobe PDF Print Engine 2, to define a print product and corresponding processes. The PDF/VT standard guarantees that VDP content and metadata is portable across conforming digital printing systems. The JDF file defines the job and draws upon PDF/VT for the content and metadata resources.

Both PDF/VT standards define XObjects, which are objects that appear in multiple instances of a document, so that they need only be rendered once. Additionally, PDF/VT-2 files may include external references, so that the XObjects may be stored in and retrieved from separate PDF files, enabling "thin" VDP workflows and the opportunity to pre-render complex graphics. PDF/VT-2 files may also include print production metadata that partitions the job by specifying which pages are part of the same record and clearly defining a group of records (such as those with the same postal code). This metadata enables a press management system to manage paper stock, reprint a section that jammed, facilitate binding, and reconcile the printed records to the job manifest.

As a structured page description format, PDF/VT encodes the pages of a document in a way that gives Adobe PDF Print Engine 2 efficient access to random pages. The JDF file determines the specific page order and processing requirements, so the PDF/VT file can be retargeted or recombined late in the process without the need to regenerate the PDF/VT stream.

A VDP-optimized PDF workflow, like most VDP workflows, begins with a data source or repository. The VDP campaign can be planned and designed in Adobe Creative Suite applications or another VDP application. From the design stage, the document moves to a compositing engine, such as InDesign Server or a third-party application, which produces a PDF/VT file. (The leading VDP applications are expected to generate PDF/VT output in the near future.) After compositing, the file progresses to preflight, prepress, and finally to the Adobe PDF Print Engine 2 system, which renders the job for output to a digital press.

PDF/VT files can be previewed, proofed, searched, filtered, annotated, and approved across distributed workgroups using Acrobat or Adobe Reader, either independently or in collaborative, server-based reviews. The same file used to review a VDP job can be used to render it for a digital press.

## Implementation

Adobe PDF Print Engine 2 is distributed as a software development kit (SDK) to Adobe's print solutions partners. It has a modular architecture, so that each partner can adapt the technology for current usage and future industry trends. Transparency, trapping, color management, and other modules work together to provide a range of printing options. The Adobe Common Renderer uses ICC profiles to transform profiled and calibrated color spaces.

Many industry leaders are integrating Adobe PDF Print Engine into their printing solutions. Systems are currently in production or will soon be available from Agfa, DALiM, EFI, FFEI, Fujifilm, GMG, Heidelberg, Kodak, Océ, Screen, Print On-Demand Solutions (Kodak), Xanté, and Xerox. Adobe partners integrate Adobe PDF Print Engine in several ways, including building it into a digital press or incorporating it in a digital front end (DFE), in which the renderer is separate from the digital press. Adobe PDF Print Engine may drive a computer-to-plate (CTP) platesetter, or it may drive a proofer that simulates final output. Some partners include Adobe PDF Print Engine in soft-proofing systems, either server- or workstation-based. Many products today combine PostScript and Adobe PDF Print Engine in a single system.

Adobe PDF Print Engine 2 supports open standards, which enable workflow evolution and interoperability: PDF for describing content, ICC profiles to characterize color information, and JDF for job control. Additionally, Adobe PDF Print Engine 2 can natively render jobs in the PDF/X-4 and PDF/X-5 formats, which support live transparency, as well as layers and external Reference XObjects.

## PDF/VT

**PDF/VT is an emerging standard designed for the exchange of variable data printing (VDP) jobs. It builds on the PDF/X-4 and PDF/X-5 format standards, and supports the full graphics model of PDF 1.6, which includes transparency, ICC-based color management, and layers.**

**Using PDF/VT as the digital master enables printers to leverage the tools, conventions, and methods used in existing PDF-based prepress workflows for VDP jobs.**

**PDF/VT files can be easily previewed, proofed, searched, annotated, and approved using Acrobat or Adobe Reader, independently or in collaborative, server-based reviews.**

Adobe PDF Print Engine 2 supports PDF 1.3, 1.4, 1.5, 1.6, and 1.7; and is compatible with JDF 1.1, 1.2, and 1.3. It is also compatible with the best practices standards defined by CGATS and the ISO: PDF/X-1a, PDF/X-3, PDF/X-4, PDF/X-5, and the draft specification of PDF/VT.

Adobe PDF Printer 2 can be deployed on several platforms, including Microsoft Windows XP and Vista, Windows Server 2003, Linux, Solaris, and Mac OS X, including support for some 64-bit operating systems. For more information about Adobe PDF Print Engine 2, visit Adobe's website at [www.adobe.com/products/pdfprintengine/](http://www.adobe.com/products/pdfprintengine/).



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