CHILI
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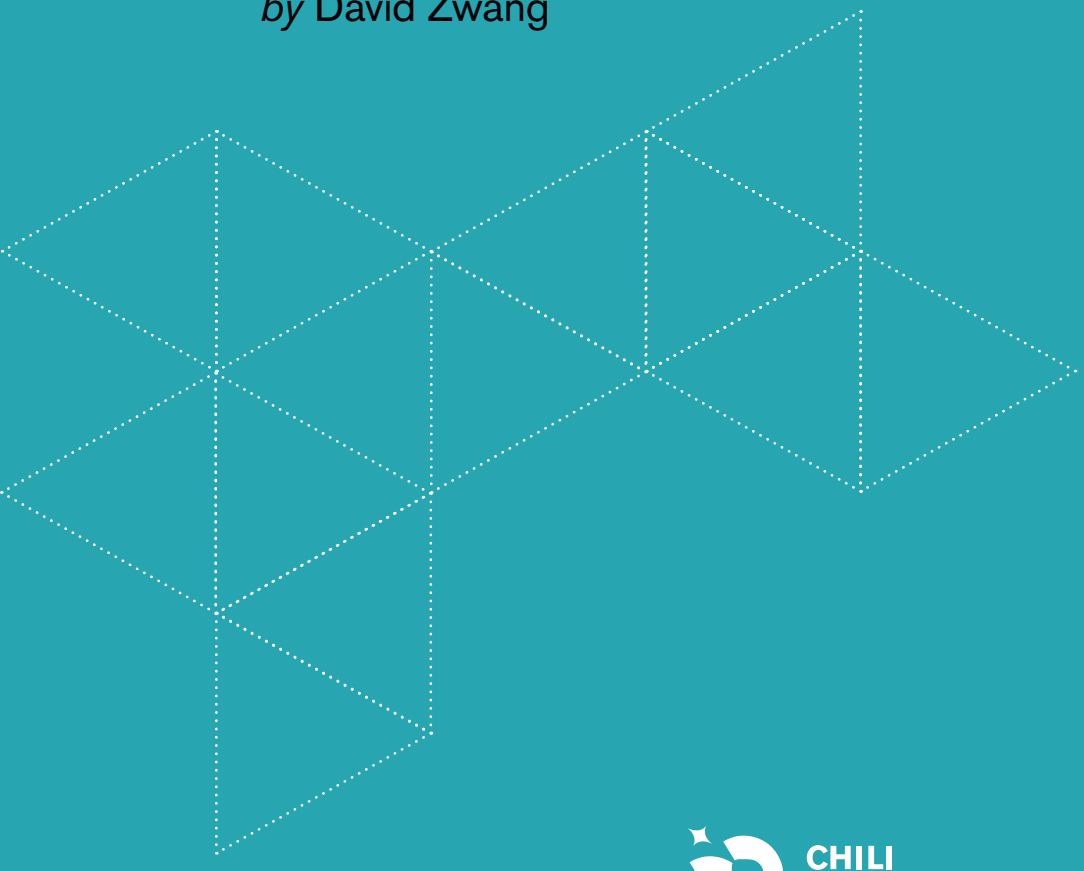
PDF Rendering Technology for Today and Tomorrow

by David Zwang



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PDF Rendering Technology for Today and Tomorrow

The PDF file format was developed by Adobe in 1991 and published as a Public Patent License to ISO (International Standards Organization) in 2008 . Since it's inception it has gone through many revisions as more and more uses and requirements surfaced. It is not only a global standard (ISO 32000-1), and the defacto format for document exchange. It has been adopted and further standardized as subsets by many industries and applications including; PDF/X, PDF/A, PDF/E, PDF/VT, and PDF/UA. In fact it has reached a state of ubiquity.

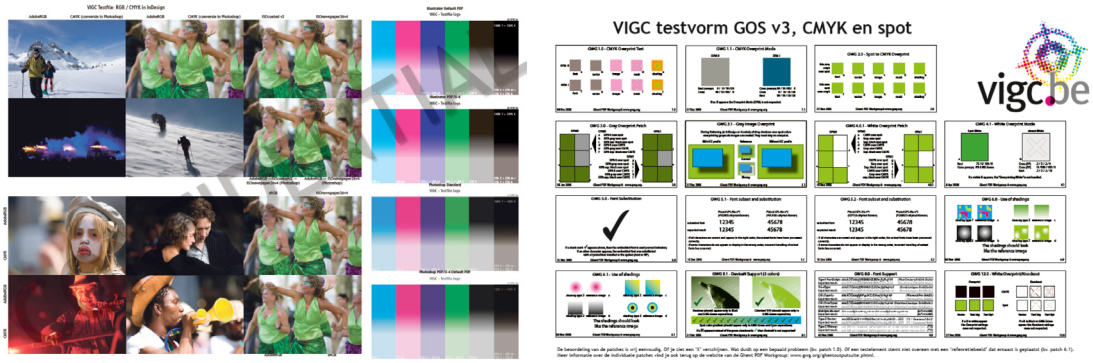
What has made PDF so attractive that it has surpassed many other file format candidates over the years? It is the ability to go beyond just packaging and communicating content. Through it's format, and published standardized reader controls, it is able to do that while still retaining the creator's accuracy of reproduction and context. This can't be said for any other format, except print or a raster format. Ultimately it was designed to be consistently reliable for the exchange and accurate communication of content.

However, the times are changing and the document consumer is moving from print and desktop computers to browsers and mobile devices. Unfortunately while PDF is ubiquitous, the ability to retain that context and accuracy of reproduction on desktop computers and mobile devices has been a real challenge, and almost impossible.

"... reproduction on desktop computers and mobile devices has been a real challenge, and almost impossible"

Desktop Rendering of PDF

Discrepancies between desktop PDF reader applications has always existed, with Adobe Acrobat being the Gold Standard of accurate rendering. You would think that over time these discrepancies would be resolved. The VIGC (Vlaams Innovatiecentrum voor Grafische Communicatie) in conjunction with the GWG (Ghent Work Group) tested 25 of the most popular PDF desktop and browser based readers to try to quantify the state of the industry. What they found was very disappointing, and ran contrary to the intended expectation of PDF rendering.



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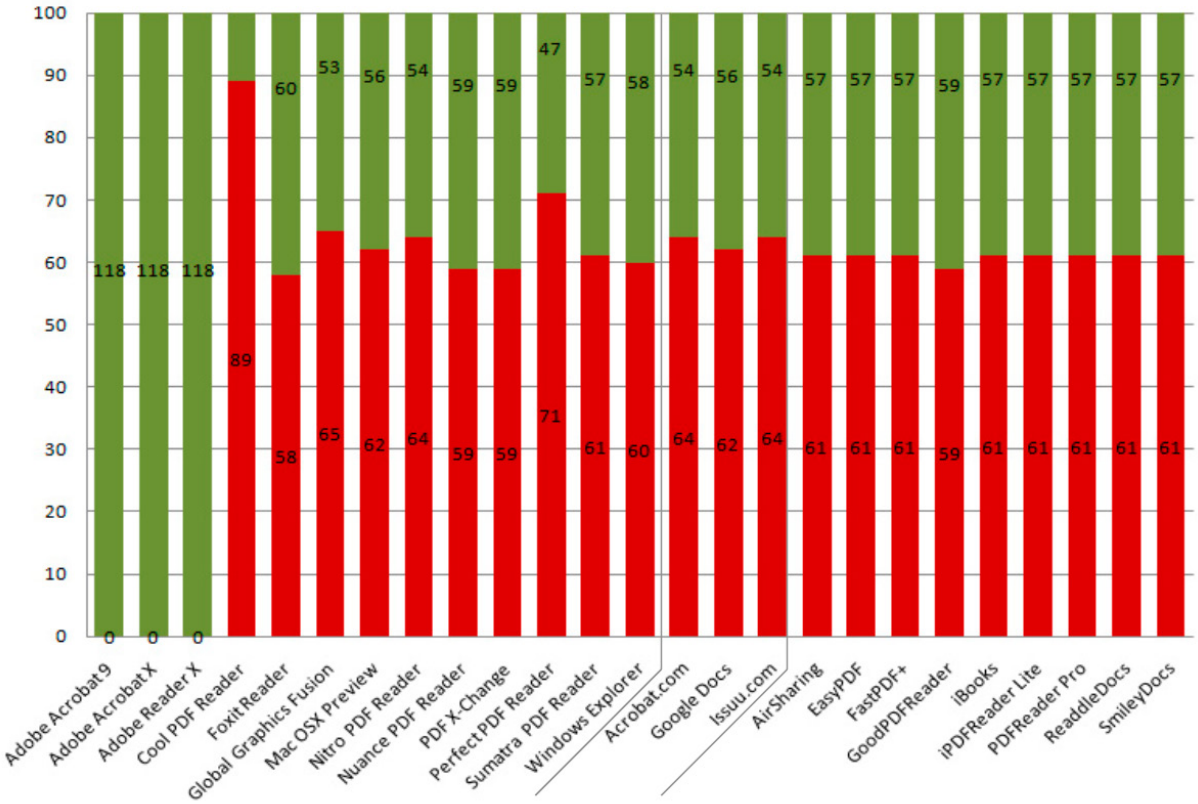
The target files used for the testing were a combination of both raster files assembled by VIGC, and raster and vector test files from the GWG Output Suite as seen below. The GWG Output Suite is a set of testing files developed for software developers and end users to validate their applications and workflows capability to correctly render specific PDF objects.



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The testing consisted of rendering 99 different PDF objects across 25 different PDF readers. The results were plotted in the following chart. Green designating that the object was correctly rendered, and red identifies that it wasn't. As you can see that all of the PDF readers tested, except for Adobe Acrobat Desktop readers failed at rendering more than 50% of the PDF objects.

It should be noted that while the PDF reader applications only needed to render the objects according the PDF specification, the browser based readers had to render those same objects into its own compatible HTML variant as well, which adds an additional level of complexity. In fact, since most browsers can be found to reproduce content of all types, beyond just PDF differently, 'accuracy of reproduction and context' is almost an oxymoron.

Enter HTML5. The fifth revision of HTML was designed to try to standardize browser interpretation and rendering, as well as potentially supporting application development, amongst other things. However, even with some of the browser implementations of HTML5, the accurate and consistent rendering of PDF files is still at the mercy of the PDF libraries used and their implementation. In fact, PDF conversion to HTML5 is all over the map, depending on the OS and reader technologies.

Mobile Rendering of PDF

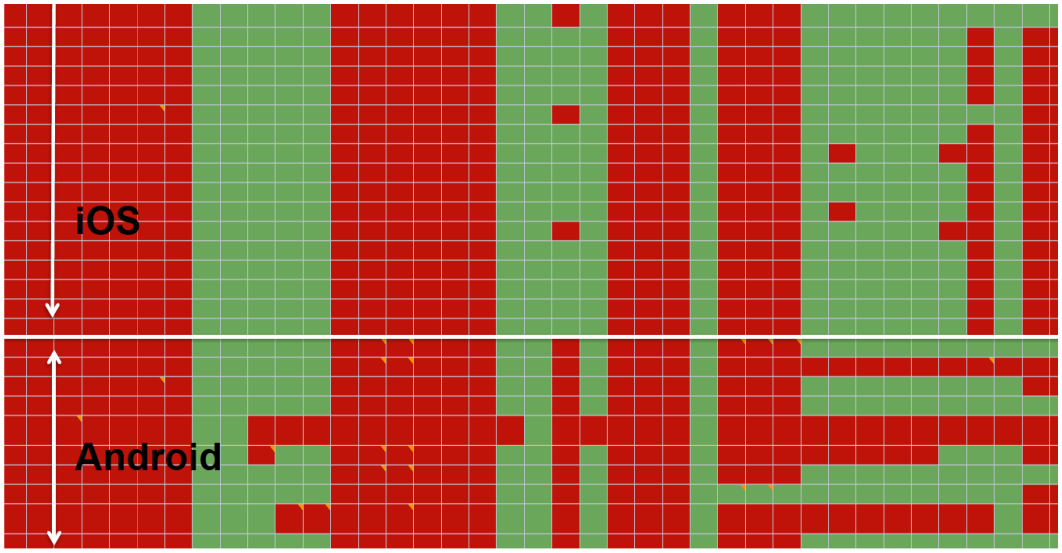
According to the GSMA (Groupe Speciale Mobile Association), over 50% of the world's population has a mobile subscription, up from 20% ten years ago, and they project that by 2020 that rate of global penetration will be approximately 60%. That being the case, the accurate and consistent rendering of PDF files on mobile devices is crucial.

"In fact, we found 'no' fast and reliable PDF renderer for mobile devices."

With that in mind, the GWG did further testing of PDF rendering on mobile devices, and while we saw many discrepancies between desktop computer PDF readers, we saw even more problems on mobile devices. **In fact, we found 'no' fast and reliable PDF renderer for mobile devices.**

Even the Adobe Acrobat Reader mobile doesn't render the same results as their version for desktop. We assumed that the differences in the Adobe desktop application vs. their mobile application we would see would be speed related, and attributable to the differences in hardware processing capabilities. However, what we found were differences in rendering objects regardless of processing speed.

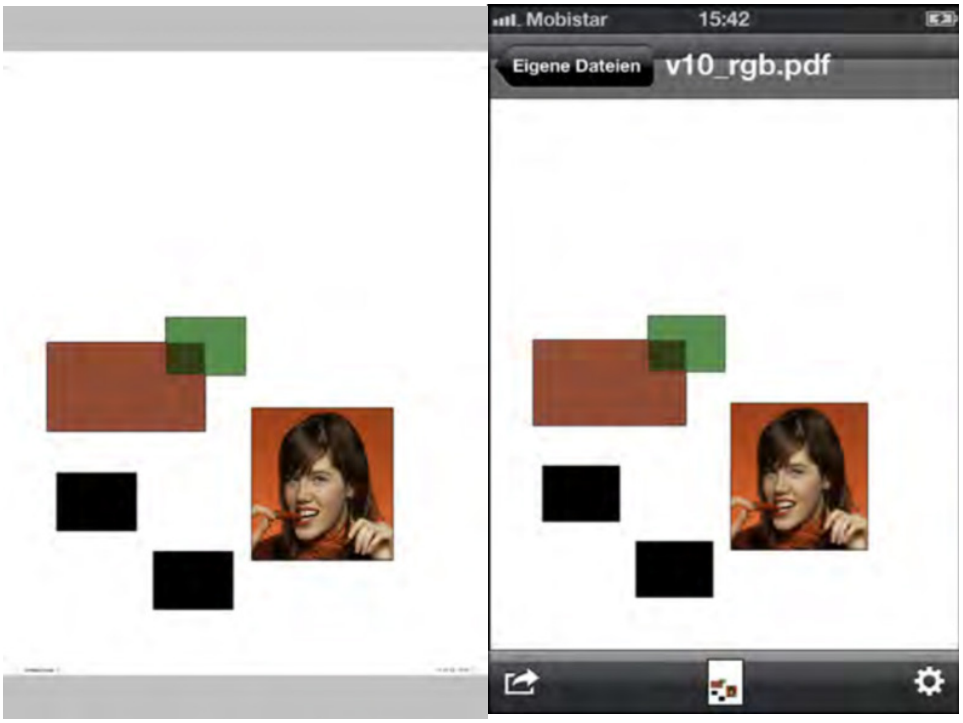
The tests performed by the GWG on mobile readers were similar in nature to those performed on the desktop readers. The summary of results can be seen in the chart below. As in the case of the desktop testing, Each square represents a different object type. Green designating that the object was correctly rendered, and red identifies that it wasn't.



© GWG

Mobile device hardware is getting more powerful, and available mobile bandwidth is increasing, but if the move to correct the desktop rendering of PDF is any example, short of the standalone desktop version of Adobe Acrobat, there is no way to consistently and accurately render PDF content.

It should be noted that the rendering of an RGB input file with overprints across different devices wasn't that bad as seen below, although not necessarily color consistent or accurate.



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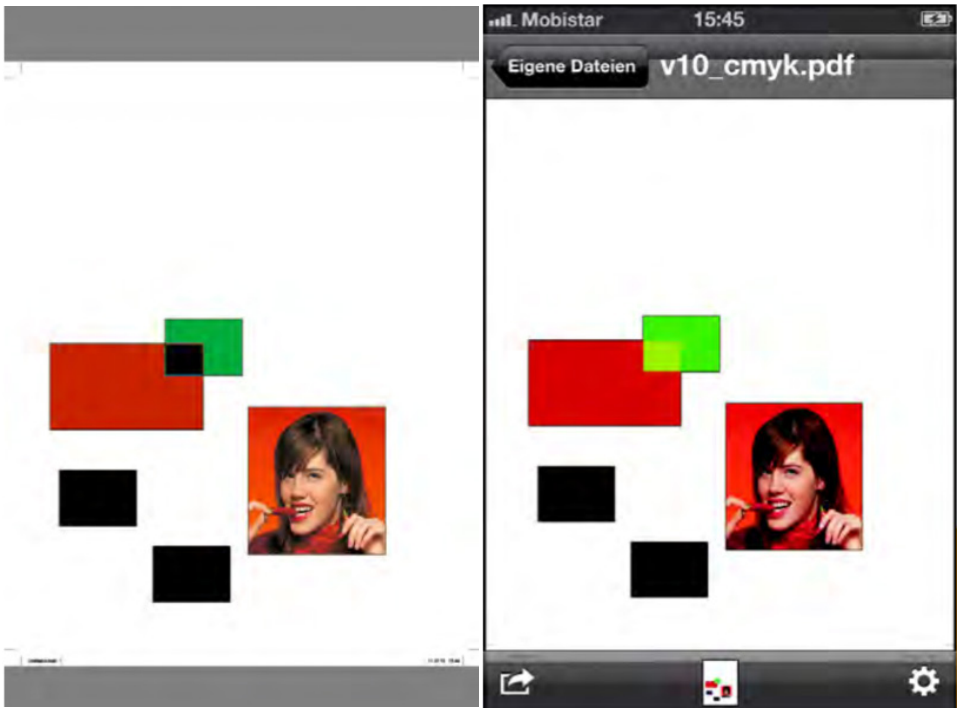
On the other hand, CMYK overprint support is even worse, as seen below.



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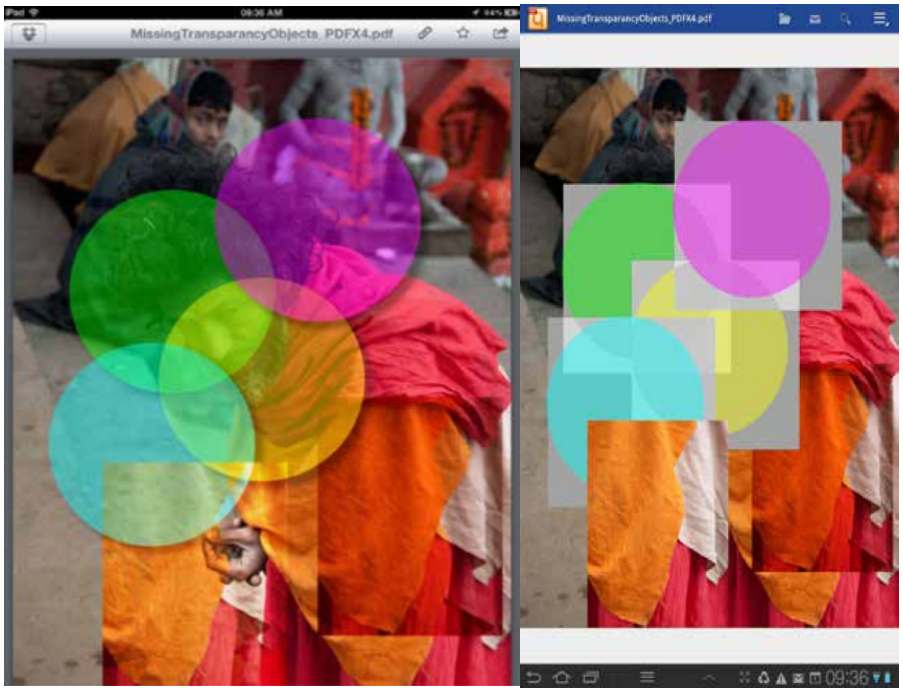
Differences in Transparency rendering was evident



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None of the mobile devices tested did very well with complex vector files.

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Difficult or Missing PDF feature support

Rendering PDF files becomes more difficult when you add the complexity of overprints, blends and transparency, objects that are regularly found in office documents and commercial design and print production.

"Rendering PDF files becomes more difficult when you add the complexity of overprints, blends and transparancy."

However, the requirements for packaging bring the complexities of PDF rendering to a whole other level. Packaging regularly uses spot colors, and many PDF rendering engines can recognize them and use the alternate color space (CMYK, RGB) for rendering purposes, but what if the spot colors are used as a process replacement, or in blends with CMYK? What about support for NColor profiles as an output intent, or ink opacity or laydown order? Using and visualizing white and metallic inks, foils, etc., is impossible with most PDF rendering solutions. Each of these can significantly affect the ability to meet the expectation of the creator or brand owner. While many applications only require many of these on an infrequent basis, to those who design and produce packaging they are a staple requirement.

Anyone who needs to support multi lingual applications, whether they are documents or design applications, can appreciate the need to support 'layers' also known as optional content in PDF specification vernacular. And what about all of the technical, non printing features, like die

outlines, Braille, embossing/debossing, etc.? All of these can be very necessary to the specific PDF file, its rendering, and it's subsequent production, but these processing steps can't currently be embedded in any standardized way in a PDF or PDF/X file for print production.

Standardization and application support

In order for these difficult or missing features to be supported by the PDF format, and/or the software and workflow applications in a standardized and a vendor independent exchangeable way, it takes standard development efforts.

Organizations like the GWG and ISO focus on these issues to ensure that their global constituencies are able to work together ensuring accuracy and consistency with minimal effort. In the graphic arts industry, the ISO has developed the PDF/X and PDF/VT formats have contributed to that effort. The GWG 2015 PDF/X Plus and Packaging Specifications 2015 help further define and ensure that the requirements are met.

The GWG Processing Steps specification (ISO 19593-1), were developed to address the requirements surrounding the technical non printing, and optional content features. The GWG Softproofing specification(ISO 19445) was developed to ensure that a file recipient and the corresponding PDF rendering viewer could see the intended color as the creator did. In fact, each of these standards and specifications were developed to foster vendor independent, accurate, and exchangeable file rendering and production.

" Many, if not most, developers don't have the resources to develop their own PDF rendering libraries, so they license and integrate the best they can find."

As a result of the PDF format's flexibility and adoption, application vendors have found ways to capitalize on those opportunities, and have become very good at developing workflow and device support technology solutions. However, as we have seen, not all software and workflow solution developers have the resources to address all of these rendering issues, nor can many of them even justify meeting individual requirements that may or may not be useful to their customers.

Many, if not most, developers don't have the resources to develop their own PDF rendering libraries, so they license and integrate the best they can find, and settle for the level of object rendering support available in those libraries. And most don't realize they have specific rendering issues, until a client runs into an issue and reaches out to the software or workflow solution vendor. The GWG recognized this issue years ago and started the ongoing process of developing a test suite that can be used to ensure correct rendering of PDF objects. Some, but not most, try to validate their solution against this test suite.

Enter CHILI rendro

One of the most exciting and unique solutions to begin to resolve these rendering issues is CHILI rendro, a new technology from the Belgian developer CHILI Publish. CHILI rendro utilizes the internally developed PDF libraries that were initially developed for CHILI publisher their HTML5 based document editor. For CHILI rendro, they further extended their libraries to ensure a complete and accurate PDF rendering solution for use by developers of software and workflow solutions with a need for full, accurate and consistent rendering of PDF files.

The real difference between this and other PDF rendering libraries is that with CHILI rendro, they are developing against a much broader set of requirements. They aren't just looking at minimum requirements or the requirements of a specific niche market. In effect, it addresses a complete set of PDF requirements. Since CHILI rendro fills a very specific need, and they don't have to worry about other specific software and workflow requirements, they have been able to concentrate on PDF rendering.

With a fully compliant PDF reader like Adobe Acrobat for the desktop, accurately rendering in CMYK requires applying the blending formulas to the CMYK values and then converting the result to RGB for display. While it seems as though this may be a fairly straight forward approach, in today's environment as we found in the GWG testing, that isn't the case if you want full, accurate, and consistent rendering.

The problem is that while HTML supports RGB, it doesn't understand CMYK. So it has to convert the CMYK to RGB and then apply any blending based on its own rules. This arbitrary method creates many of the issues previously described in existing solutions.

"CHILI rendro utilizes an HTML5 canvas that is supported by a JavaScript SDK, and an API "

CHILI rendro utilizes an HTML5 canvas that is supported by a JavaScript SDK, and an API to ensure fast and easy integration. However to address these HTML limitations, it calculates every single pixel internally as a combination of CMYK, alpha and spot plates, which then allows it to perform any blending or overprinting calculation. Additionally it is able to parse and process ICC profiles for output intent (eg. Fogra 39, SWOP, etc.), and then generate a display RGB image which gets passed to the HTML canvas providing the expected rendering.

In order to maximize the speed of rendering, and address the hardware limitations of current mobile devices, the solution is designed to process the PDF locally or process it on a server and stream the resultant rendering. The technology was designed to be both scalable and modular.

Additionally, to further address the packaging design and production market, the solution has an optional 3D module that simulates the PDF content in the actual application scenario. When integrated into an editing tool, updates are rendered both on screen and on the 3D module.

To ensure that CHILI rendro does render the PDF objects completely and accurately, they have validated their software against the GWG Output Suite. This is the same tests that were used to test the rendering accuracy of the previously mentioned desktop, browser and mobile applications.

Additionally, with CHILI rendro, they have implemented support for the latest standards developed to facilitate communication of technical non printing, and optional content features. These have been developed against
GWG Processing Steps (ISO 19593-1). The solution is
also compatible with GWG Softproofing (ISO 19445).

CHILI rendro is designed to be licensed and integrated, so they developed this technology into a scalable application independent solution that can be easily integrated into software and workflow solutions.

Summary

PDF has proven it's importance as the global content packaging and communication format. We see it used well beyond a way to proof or exchange files destined for printing. In fact it is the defacto format in most enterprises around the globe. It is also becoming the mandated format for many governments, including the European Commission, and many US government departments. It is also extensively used in the burgeoning online education market, since it allows content to be shared across media, and still maintain it's intended context.

As the format continues to evolve, and the market shifts to browser and mobile PDF consuming, the rendering demands and challenges will expand as well. Having a complete and easy to integrate PDF rendering solution will offer software and workflow solution vendors, crossing all market requirements, a way to focus on their strengths and differentiation in an effort to deliver better solutions to the market.

About the Author

David Zwang, travels around the globe helping companies increase their productivity, margins and market reach. With over 40 years of industry experience, David specializes in process analysis, and strategic development of firms in the fields of publishing, design, premedia, and printing across the globe. His experience includes expertise in pre-media and cross media publishing, with an extensive background in digital, offset, and flexo printing processes. His expertise in production optimization, strategic business planning, market analysis, and related services to companies in the vertical media communications market has transformed many businesses. He sits on many international standards groups, and is the Chairman of the Ghent Workgroup.

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