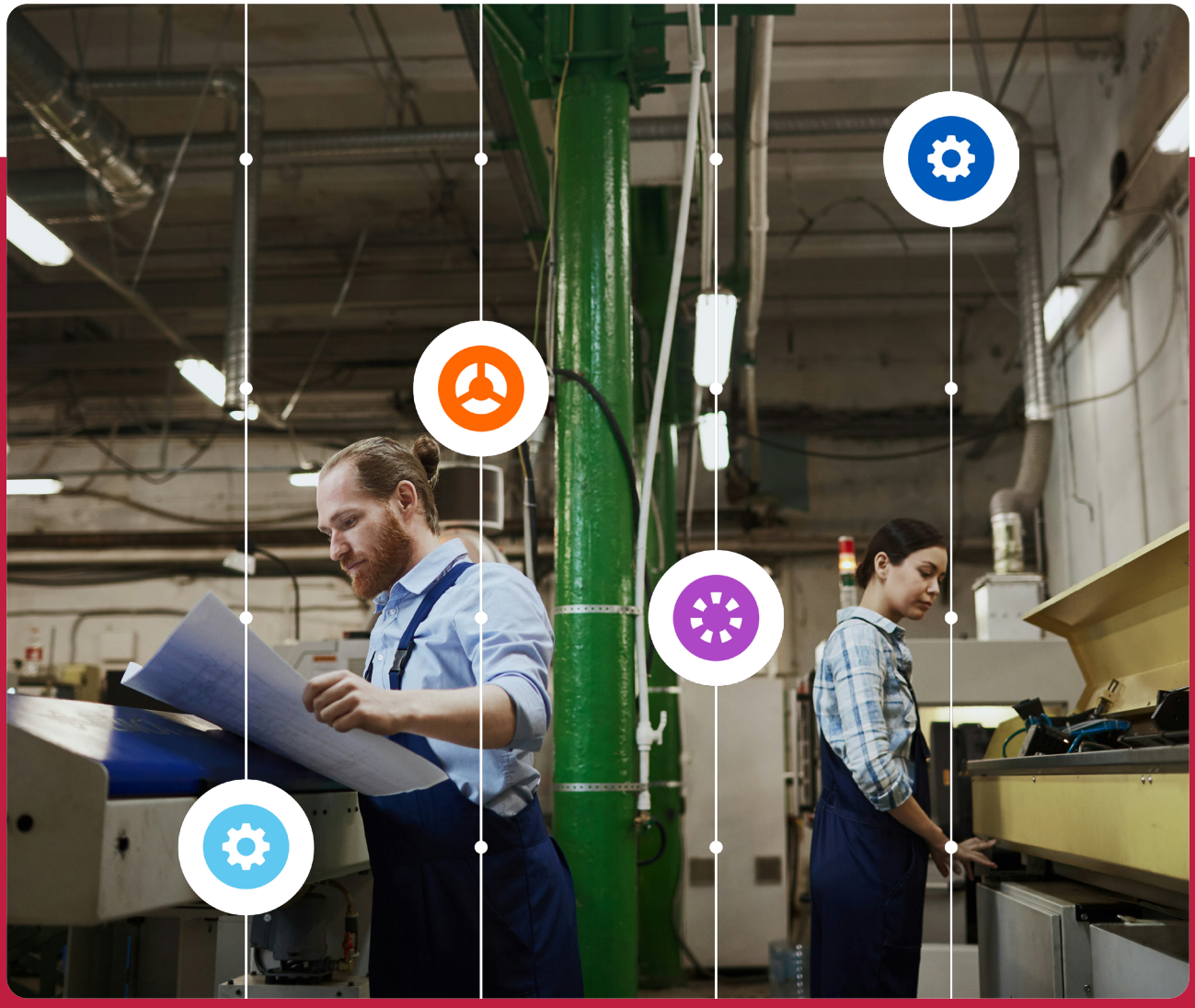
Build or buy for PDF technology in print

How **licensing PDF technology** in print workflows **increases profitability** and **shortens time-to-market**



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Executive summary

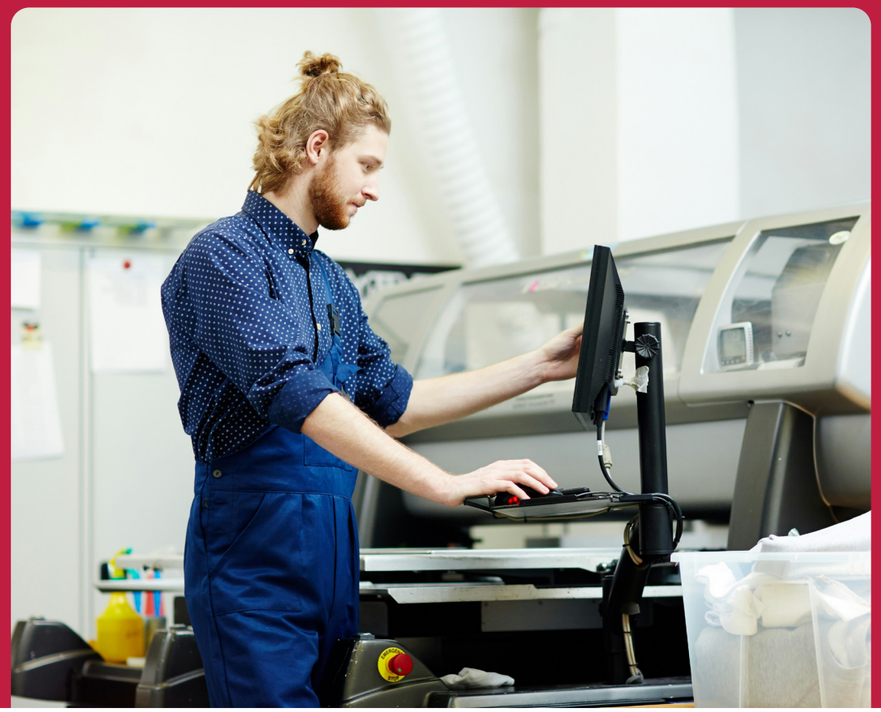
Theoretically, it is entirely possible to develop PDF-based technology for quality control, corrections, imposition, color management, or rasterizing PDFs into images from scratch. PDF is an international standard managed by the International Standards Organization (ISO), and the technical specification for the format is open and well-defined.

The reality, as this paper will explore in detail, is very different. While the PDF specification is open, it remains a highly condensed and technical document of well over a thousand pages. Implementing PDF technology requires an intimate familiarity with this document and several standards and technologies it relies on, such as the **ICC profile format** for color management, the **definitions of different font formats**, and **compression and encoding filters**, among others.

This multitude of standards and ad-hoc formats is managed and developed by various organizations, including **ISO**, the **Ghent Workgroup**, the **PDF Association**, different web and image consortiums, and the **International Color Consortium**. Providing solid support for current and upcoming PDF technology requires active involvement in at least some of these organizations.

Over its 30 years of continuous development, the PDF file format hasn't always been implemented in strict accordance with these standards. A robust implementation of PDF technology, therefore, must account for these variations and deviations. While strictly speaking, one could dismiss non-compliant PDF files as 'incorrect,' it is not good business practice in real-world workflows to do so. Especially because several existing applications and workflows are quite lenient in what they accept as 'good' PDF.

This white paper discusses the history of PDF and the supporting standards. It also describes **how callas software's PDF technology can help address implementation challenges** and **reduce time-to-market** for solutions that require robust PDF support while delivering excellent return on investment. It details the key capabilities of callas PDF technology, how it can be integrated into OEM products, the markets it serves, and how callas software, as a strategic partner, can contribute to your success.

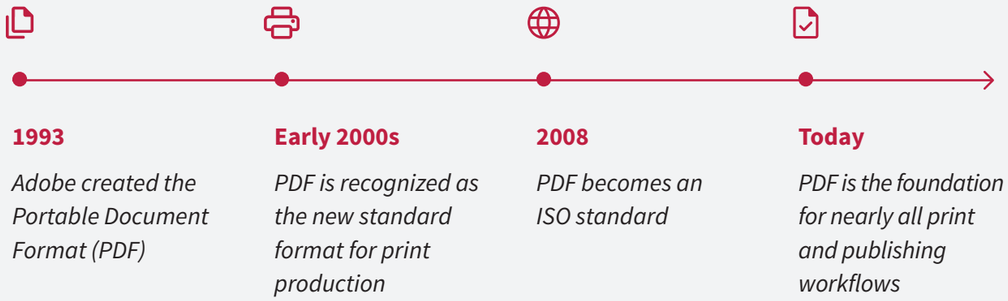


We're here to help

If you would prefer to have an in-person conversation about the topics described in this white paper, please feel free to reach out to us. You can contact us by using the **oem@callassoftware.com** email address or by visiting **oem.callassoftware.com**.

The history of PDF and the standards based on it

Adobe created the Portable Document Format, or PDF, in 1993. It was **originally designed as a digital documentation standard** and a compact, layout–oriented format for use on the Internet. However, due to its versatility, **it quickly transformed into much more**. A decade later, it was firmly recognized as the new standard format for print production across most print sectors, even becoming an ISO standard itself in 2008. Today, this standard has penetrated even the most niche market segments and serves as **the foundation for nearly all print and publishing workflows**.



This flexibility comes at a cost: the PDF standard supports five different font formats, over ten color space formats, and ten encoding and compression algorithms, to name a few aspects that contribute to its complexity. Supporting all of this while keeping up with new features added to the PDF standard by ISO is no simple task.

PDF-based ISO standards

Additionally, simply supporting the PDF standard is often not sufficient. In many implementations, it is also necessary to support application-specific standards that are built upon the PDF standard.

ISO has developed several such application-specific standards. They are:

- **PDF/X**: for the exchange of print and publishing files
- **PDF/UA**: for documents where universal accessibility is important
- **PDF/VT and PDF/VCR**: for variable data and transactional workflows
- **PDF/E**: for engineering workflows
- **PDF/A**: for long-term archival workflows
- **PDF/R**: for scanned documents

And it doesn't even stop there: over time, ISO also created standards that use and extend the PDF file format to handle specific use cases. Two good examples of this are:

Processing Steps

This ISO standard provides a way to label parts of the PDF page content associated with different processing steps of printed products. This allows for easy identification and handling of items such as cutting, folding, and gluing lines; Braille; information panels; and indicators of physical dimensions, among others. This standard primarily targets packaging and label workflows.

Print Product Metadata

An ISO standard used to communicate the intended appearance of print products and their components. Examples of intended use include direct interpretation within a production process, creation of job tickets such as XJDF, or populating records in an MIS.

In a strange turn of events, **PDF/X and PDF/A became ISO standards long before PDF itself was standardized**, making them ISO standards based on a proprietary, albeit openly specified file format (from Adobe). This issue was resolved in 2008 when Adobe transferred the PDF specification to ISO, and it became **ISO standard 32000**.

Other PDF-based standards

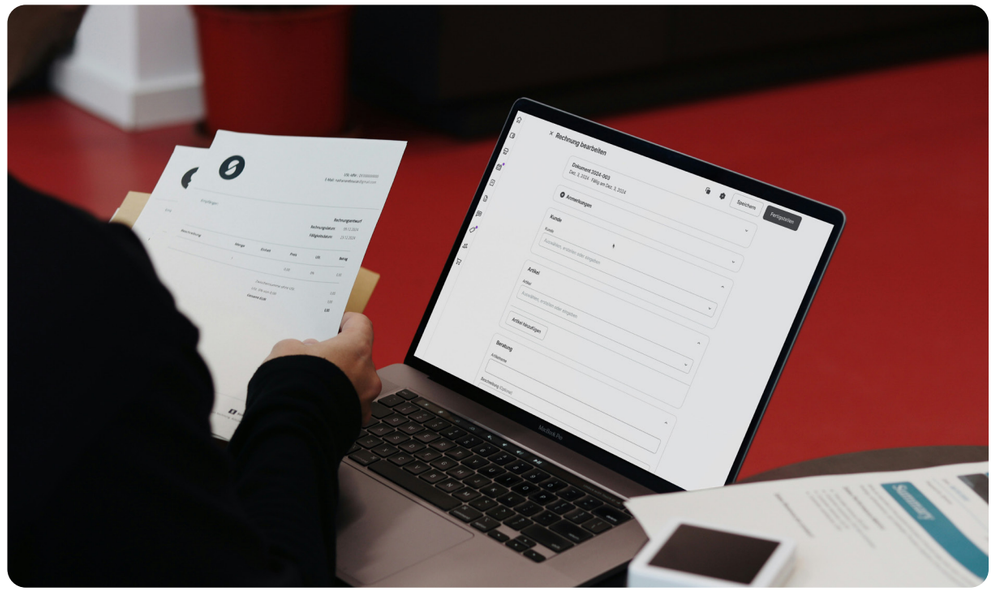
ISO is not the only organization that has PDF-based standards; other standards are also important depending on the application.

Ghent Workgroup

In print and publishing workflows, the Ghent Workgroup—a standardization organization founded in 2002, comprising vendors, users, and educational organizations in print—establishes market-segment-specific standards. This enables billboards to require a different minimum image resolution than business cards, or for newspaper ads to have distinct maximum ink usage requirements. The Ghent Workgroup specifications are **built upon the ISO PDF/X standards**, ensuring no conflict between the two approaches.

EN 16931 (e-invoicing)

In the entirely different world of electronic invoicing, the European Union developed the EN 16931 norm. This **e-invoicing standard** outlines how member countries must support invoicing conducted through electronic means. A significant aspect of this norm involves using PDF documents that contain a **hidden XML payload** (as originally implemented by the German **ZuGFeRD** or French Factur-X standards). While it is less likely to encounter a need to support such "foreign" standards in the print industry, wanting documents that are simultaneously suitable for print and other uses, is not at all unheard of.



Where callas software originated

callas software was founded on October 19, 1995, in Berlin, Germany. From the beginning, it focused on enabling the use of PDF, particularly in automated scenarios. In those early years, PDF was just emerging and had been adopted by the graphic arts industry as an interchange format. callas released the pdfInspektor, pdfCorrect, and pdfColorConvert products to assist industry professionals in performing quality control, fixes, and color conversion of incoming PDF files. These three products formed the foundation of what is now known as the pdfToolbox technology platform used by numerous OEM partners.

Participation in standard development

As mentioned previously, the evolution of the PDF specification was driven by various organizations. **Originally a file format developed by Adobe, its future was soon placed in the hands of ISO**. The callas team contributed to the development of the PDF standard at ISO from the very beginning, and its leadership team holds positions on the **board of the PDF Association and the Ghent Workgroup**. This enables callas to collaborate on the strategic direction of all relevant PDF standards and ensures quick support for these standards in pdfToolbox.

Focus on OEM and software integrations

Where other software vendors focused more on manually editing PDF documents, callas **resolutely chose to support automated processes**. The pdfToolbox product was optimized for these types of corrections from the outset. The software's capability for automation and integration into automated workflows gave it an advantage for use by OEM partners. In 2006, this resulted in callas providing OEM technology to Adobe; today, callas still offers the **Preflight plug-in**, which can be found in **Adobe Acrobat Pro**.

OEM partnerships at the core of the company

Since that time, callas software has consistently increased its OEM relationships. In 2025, **more than 75 OEM partners** integrate various aspects of the PDF technology provided by callas. The technology integrated by OEM partners ranges from 'merely' rendering PDF files, to quality control, fixing, handling color management, and producing archivable PDF files, along with all possible combinations of these functions. Its OEM partners are **located around the globe**, and the software is used in both on-premise and cloud-based solutions.

75+
OEM partners

30+
years of experience working with those partners

Part of the Durst ecosystem

Since late 2024, callas software has become part of the Durst ecosystem. This integration provides the company with **long-term stability and support**. At the same time, its independent status within the Durst Group – contractually secured at the time of the acquisition – guarantees the continued availability of callas technology for all current and future OEM partners. Strategically, **callas software remains independent**, with a clear focus on driving the development of its own technology for end-users as well as for OEM partners, both technically and commercially.

Complexities beyond standards

In a “Build or Buy” decision, the first option means that the relevant technology needs to be built once and supported moving forward. In many cases, the ongoing support of a rapidly evolving file format and the standards based on it incurs a higher cost than the original build process. However, it doesn’t stop at supporting existing and upcoming standards. Most PDF-based workflows require additional technologies to be supported as well, and this should be factored into the decision. This chapter examines some of the core technologies used in PDF-based workflows by callas OEM partners.

Support for the PDF file format and its related standards

As outlined in the previous chapter, the **PDF file format is quite complex, as is the ecosystem of PDF-based standards** surrounding it. In most implementations, certain aspects of the PDF file format will be more relevant than others. However, when the workflow necessitates reading (understanding) arbitrary PDF files, most of the PDF file format must be supported. Quality control of PDF documents to ensure compliance with relevant PDF-based standards **involves substantial implementation and ongoing support costs** due to the continuous evolution of these standards.

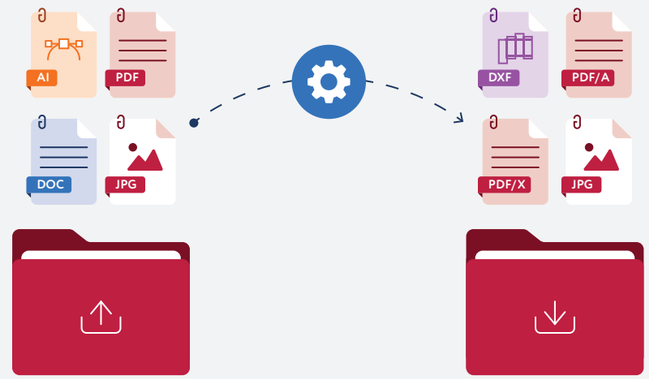
Engaging in relevant associations such as the PDF Association or the Ghent Workgroup is **essential for accessing their expert community, documentation, and test materials**. For that reason, callas contributes significantly to that technical community.

Conversion to (and from) PDF

As the name implies, pdfToolbox excels at manipulating PDF documents. However, it also supports several conversions to PDF and allows the creation of derived formats from PDF documents.

pdfToolbox supports the conversion of commonly used image formats, including **PNG, GIF, JPEG, TIFF, HEIC, and native Photoshop files**. But it goes beyond that, with built-in conversion for **PostScript and EPS files, HTML, and SVG**. Additionally, if the correct native applications are available on the system running pdfToolbox, it also supports **Microsoft Office and OpenOffice** file formats.

At the other end of the spectrum, pdfToolbox offers rendering of PDF files into various image file formats for the purpose of creating thumbnails, preview images, or even full-resolution color-separated images ready to supply to output devices. Couple that with export support to **DXF, CF2, and SVG, and print-and-cut workflows** are also fully supported right out of the box.



Automation-first technologies

Standardization is essential for automation. While all automated workflows experience a certain percentage of problematic PDF files, minimizing that occurrence is key. To achieve this, callas invested in developing what it calls “Context-aware Preflight,” also known as “Sifter.” **Sifter** is an **intelligent preflight (quality control) engine that reduces the number of false positives**. It does this by not considering each element on a PDF page in isolation, but by examining the relationships between them. Is an image completely hidden by other page elements? Does a piece of text come (too) close to a cutting line?

The Sifter engine and its context minimize the need for manual intervention in a workflow. While Sifter significantly enhances the

quality control process, it needed extensive optimization to ensure it is resource-friendly and fast enough for production work.

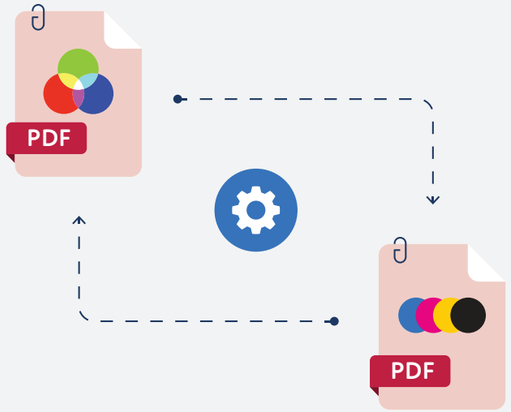
callas **invests heavily in developing its technology to be as robust and fast as possible**. In OEM contexts, the callas technology is often hosted on the same platform as the OEM solutions, which is only feasible if it is foolproof. Regardless of the platform on which the technology operates (it supports macOS, Windows, and any Linux distribution), **the goal is to ensure that the software functions correctly at all times**.

Rendering and color-management

The PDF specification features an incredibly rich imaging model, making the rendering of PDF files (converting elements on a PDF page such as images, vectors, and text into pixels) a daunting task.

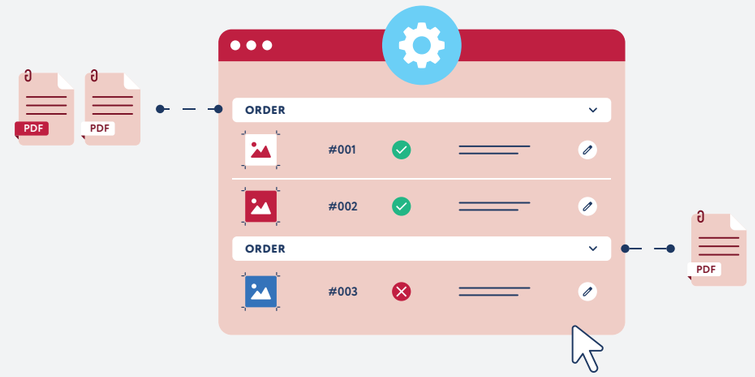
A rendering engine must account for **transparency, overprint, special color spaces**, and **different rendering modes** while adhering to strict color management policies.

The callas technology enables **rendering to various output formats**: some OEMs require high-resolution TIFF files for specific separations to send to a printing device, while others may need low-resolution PNG files for displaying thumbnails in a web portal. All these capabilities are integrated into the technology, which also supports ICC profiles and DeviceLink profiles for color transformations, TAC control, or ink savings.



Workflow logic and user interface

With the **pdfToolbox Portal** technology platform, callas offers a ready-to-use print solution that can be **administered and used through a web browser**. This on-premise client-server application heavily builds on other callas technologies, providing a user interface and workflow logic out of the box. This can drastically shorten the time to market for OEM partners who need this **workflow logic and a UI platform for their end-users**.



Barcode discovery and creation

1-D and 2-D barcodes are commonly utilized in PDF-based workflows. Imposed sheets in a print workflow may receive a data matrix code to identify the sheet or provide instructions for finishing equipment.

In certain instances, solutions aim to generate such barcodes, while in others, they may seek to detect and verify them.

The callas technology includes **two libraries for barcode support**:

The first **detects the most commonly used barcodes and identifies essential features** such as the encoded value, quiet zone, color, and bar width reduction.

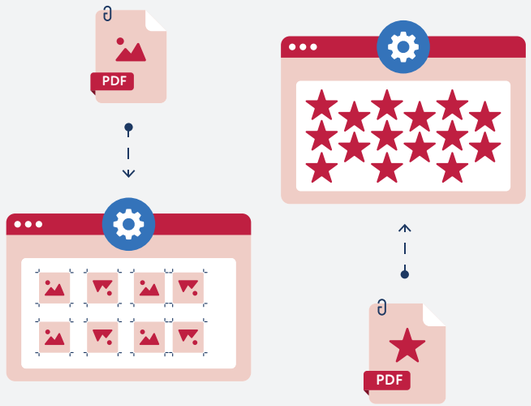
The second library can **generate over a hundred different types of barcodes** as high-quality PDF objects. Together, both libraries offer robust, **out-of-the-box barcode support**.

Imposition, PDF decoration and PDF creation

callas offers two different imposition engines embedded in its technology. The imposition engine within pdfToolbox is driven by a configuration file, suitable for real imposition tasks such as **step-and-repeat, folded jobs using signatures, tiling, and cut-and-stack, as well as more specialized tasks**. In contrast, pdfToolbox Portal provides a parameter-driven approach for **tiling, ganging, and true-shape nesting**.

callas also pioneered an **HTML to PDF conversion** engine that takes an HTML template, including CSS and JavaScript, and converts it into production-quality PDF content (including everything needed for print workflows, such as support for overprint, transparency, complex color spaces such as CMYK and spot color, standards support…).

This technology can be used to **add decorations to PDF documents** (such as color bars, barcodes, registration marks, fold-and-cut marks) or to create complete PDF documents from scratch. This allows the callas technology to be a PDF-generating back-end of an imposition or variable-data solution.



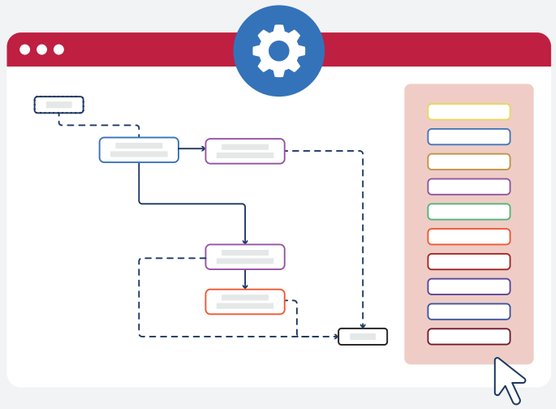
Workflow technology

Two key technologies developed by callas – **process plans and variable support** – make the solution extremely flexible, allowing it to be configured with granular control for various applications.

Process plans are created using a **visual flow editor** that enables the placement of **various PDF checking or fixing steps in a specific order**. They also offer conditional "if—then—else" processing to analyze PDF documents and take action based on the results. Process plans can generate multiple PDF output files (for example, a high-resolution print file and a low-resolution RGB proof file), split PDF files, generate images, create output JSON or XML files, and much more.

The variable support **allows for input from external sources** (such as an MIS system, which injects job type and expected number of pages). It enables the callas checking and fixing engine to utilize that information. Since variables can include JavaScript, they can also **perform powerful calculations and interpret the results** of preflight steps.

Using process plans along with variable input and JavaScript to perform calculations can **implement all or part of the business logic** of a solution within pdfToolbox. This approach can significantly speed up development and enhance performance compared to making multiple calls to the callas libraries.



Integration capabilities

Supported platforms:

Integrating callas technology as an OEM depends heavily on the availability of platforms and integration methods. From a platform perspective, there are **virtually no restrictions on how the callas technology is made available**; it can be used on macOS, Windows, and any Linux distribution, supporting both Intel and ARM architectures natively. Additionally, it is **available on actual hardware or in virtualized environments**.

On all of these platforms, callas provides **various ways to integrate and interface with its PDF technology**; these options are described in this chapter.

While the callas technology can be integrated using a **hot-folder setup**, where specific folders are monitored, and incoming PDF files are automatically picked up and processed, this is **typically not how OEM partners want to integrate the technology**. As such, this method isn't discussed further, but is of course available if you wish to explore it.

Command-line Interface (CLI)

The core pdfToolbox technology is available through a CLI (command-line interface). The interface used is extensive and highly detailed, and easily integrated into larger solutions.

Often, testing or even production-level integrations are quickest and easiest using this flexible command-line interface.

The CLI is **available on all supported platforms**, and depending on licensing can be initiated multiple times on the same machine to increase processing speed. Documentation for the CLI is available on the **callas documentation site**, and is also **integrated directly into the CLI application** for quick reference of command-line parameters and usage.

Development Kit (SDK)

The pdfEngine SDK offers the functionality available in the pdfToolbox and pdfaPilot products in a single software development kit. The SDK supports integrations in **C/C++, C#, .NET, and Java environments**; it comes with full documentation and a sample application to enable rapid development.

Using the SDK offers almost the same capabilities as integrating with the CLI.

Still, there are a few use cases where the SDK provides more capabilities. Especially in environments where the PDF file can be kept open while different actions are executed on it, and in environments where there is a **mixed use of the Adobe PDF Library and the callas pdfEngine library**, the **SDK has advantages over the CLI**.

Docker

In some environments, there is an advantage to run the callas technology dockerized. callas provides support for this by **hosting a preconfigured Docker image on Docker Hub**, simplifying deployment and ensuring consistency across environments.

The Docker image has a preinstalled version of pdfToolbox CLI – ready for use.

In such an environment, **licensing** requires special attention and can be done through the callas License Server or a special OEM license.

REST API

Different callas solutions allow integration using (REST) APIs. More specifically:

- **pdfToolbox in the Cloud** is a complete SaaS implementation of the pdfToolbox engine. It allows performing pdfToolbox-related tasks without installing anything on the target machine. Anything that is possible using a process plan in pdfToolbox, can be automated through this SaaS solution.
- pdfToolbox Portal has an **extensive REST API** that allows integrating the solution with other workflow components such as MIS or ERP systems, Web2Print systems, or output devices.

Wide market-vertical support

The callas technology is both deep and wide when considering market verticals.

This means that callas technology offers solutions across a broad range of market verticals, with comprehensive support for the most common use cases in each vertical.

This chapter lists the main market segments or verticals in which callas technology is used and the primary use cases it addresses within those segments.

- **Commercial print and cut-sheet digital print**
- **Sign & display**
- **Packaging and label**
- **Textile**

Note that these are **simply the most common use cases** and applications. The technology is developed based on what OEM partners need, and less common applications are often supported just as well, or can be supported based on input from a partner.

The technology is developed in a way that **maximizes flexibility, which often enables quick adoption to new needs**.

Commercial print and cut-sheet digital print

For the commercial print market segment, **all major quality standards from ISO and the Ghent Workgroup are supported**. The engine is **optimized for large documents** (with many pages), so it can rapidly extract essential PDF information and search for and correct issues quickly. Common problems regarding overprint, transparency, registration color, rich black, image resolution and more, can be detected and fixed.

- Conversions between different color standards can be done using either **ICC Profiles or DeviceLink profiles**, and ink saving using dedicated ink reduction profiles is also possible. Ink coverage problems can be detected, and if the correct ICC profiles are available, corrected as well.
- The **imposition engine** supports step-and-repeat or fill-page operations and the creation of optimized folded-job impositions, even if creep is required. The engine supports the **detection and creation of bleed** around page edges, the addition of **trim and fold marks, scaling, rotation, and re-ordering of pages**.
- On top of the functionality supported for the commercial print market, **specific small-format digital print standards are also supported**.
- The callas technology is **fast enough to satisfy** even the most **demanding digital print workflows**.
- Where necessary, **accurate detection of black-and-white and full-color pages** allows optimizing for click-charged print paths. The callas engine can also **identify documents suitable for Enhanced Print Mode (EPM)** workflows.

Packaging and label

Quality control in the packaging and label market **covers all everyday use cases and extends to more advanced detection and correction**. A wide array of problems with cut contours (or die lines as they are often referred to in packaging workflows) can be detected, from disconnected paths, to contours that are filled rather than stroked objects, wrong naming conventions, to having critical content such as text too close to the cut contour.

- **Full support for spot color manipulation** and the Processing Steps ISO standard allow correcting issues with technical content (or colors) or the normalization of brand colors.
- **Missing bleed can be detected** around cut contours and corrected by using pixel repetition bleed creation.
- The dedicated “shapes” technology can **create cut contours on the fly**, either from vector objects already present in the PDF or using edge detection of page content.
- This can also be used to **dynamically add additional separations**, such as under color white, varnish, or foils. Choking or spreading is fully supported while creating such additional separation content.
- The imposition technology can be used for dedicated label **step-and-repeat imposition or to perform true-shape nesting** for labels or packaging. Creating proof layouts to be used in approval workflows or adding registration and cutting marks is easy as well, as is adding different types of identification or cutting barcodes.

Sign & display

In some ways, quality control for sign & display workflows is much more complicated than in other market segments, primarily due to the tendency to create PDF files that are scaled down (at half size, 1/10th size, or sometimes even more exotic choices like 1/42nd of the final print size), and because of the vastly different viewing distances for various products in this segment. Luckily, with the **support of variables in the preflight and correction engine**, callas technology can handle this without any problem.

- **Finishing PDF files to meet production requirements** with added cut and fold lines, construction marks, mirrored bleed, and additional white space at certain edges of the product, as well as eyelet marks, are all quite straightforward.
- **Ganging and nesting** are of course useful again for these kinds of job, but for larger jobs tiling now plays an important role as well. The **creation of tiles and associated job construction sheets** is built into the callas-supported imposition technology.

Furthermore, these processes can be **fully automated using process plans** and, if necessary, **additional logic implemented** through **variables and JavaScript.**

Textile

In some ways, textile is **very similar to the previously mentioned market segments**. This means that quality control, tiling, imposition with nesting, creating bleed, adding marks, cut contours, and additional separations are essential in this market segment. Additionally, **process plans and JavaScript support** are also crucial for managing the vast array of different products in this segment.

callas software as a strategic partner

During a build or buy decision, the available technology is extremely important, and this has been the focus of most of this paper so far. However, the role of callas software as a strategic, long-term partner for OEM customers should not be underestimated.

Nearly all OEM partners who have chosen callas technology for integration into their solutions over the years remain engaged partners. Currently, there are **over 75 active OEM partners** of various sizes collaborating closely with the callas software team.

The core OEM team at callas software has also worked with these OEMs for many years, gaining experience in handling the production requirements of their end-users in the best way possible.

Close cooperation

While callas software distributes end-user software through a distribution channel, all OEM relationships are directly between the OEM partner and the callas OEM team. This has several advantages:

- The OEM partner gets **direct access to OEM support** and, if necessary, the development team. This allows problems to be identified and resolved quickly. But it also enables callas to advise on the best way to handle integrations and obtain the result the OEM partner seeks.
- As the principal OEM people at callas have many years of experience at callas, and at industry organizations involved with standardization, they can **advise the OEM partner on trends in the market**, and **opportunities they can take advantage of**.
- Because of the typical long-term relationships, the callas OEM team is well-aware of the direction OEM partners want to go into, and can **direct product development to match that strategic direction**.

Support and training

- OEM partners have **access to the callas support team** during their evaluation of the callas software and after successfully integrating the software.
- OEM partners are also invited to join **pdfCamp events**, where they can interact with the callas team and others in the industry in a hackathon-style environment.
- Additionally, OEM partners can **receive training on callas technology and PDF technology in general** from OEM team experts.

End-user channel and customers

As mentioned before, the **relationship** between an OEM partner and the callas software team is **always a direct one** and doesn't go through the end-user distribution channel. However, the existence of this distribution channel, and its many integrators and resellers around the globe who possess deep knowledge of callas technology, provides **opportunities for training and support of the OEM's customers if desired**. Additionally, it creates **a large pool of end-users who are already aware of and familiar with callas technology**, which can shorten the learning curve when this technology is integrated into an OEM's product offering.

OEM agreements designed to grow your business

End-user pricing for the callas products either works through fully-activated licenses (bound to the - virtual or real - machine they are running on) or through the callas License Server. Pricing for OEM partners is typically much more personalized.

callas **strives to tailor OEM pricing so that it makes sense for both parties** and that a long-term win-win relationship can be built and maintained.

This makes **pricing highly personal and often unique to a given OEM partnership**. These are the core principles upon which OEM pricing is (often) built.

Ultimately, every relationship between an OEM partner and callas software is unique. In all cases, **callas will strive to have a well-balanced OEM contract** that serves the long-term goals of both partners.

Host product pricing

callas OEM technology is **usually built into a host product**. The sales price and model of that host product are significant factors in structuring OEM pricing. callas can work with **one-off sales models** at different price points and with **subscription-based pricing**.

Added value

A contributing factor to the cost of integrating callas technology is usually **the proportion of the host product's value derived directly from the integrated technology**. A host product that utilizes callas technology solely to extract basic PDF information, as opposed to one that applies preflight and correction technology, can significantly influence the cost level.

Support and maintenance

Establishing a direct relationship with callas, which **includes direct communication** with product managers, support staff, and development staff when appropriate, holds significant value. As described in the previous chapter, callas prefers not to be a passive partner in OEM relationships but to **actively engage in ensuring the OEM relationship's success**.

Because of this, all callas OEM relationships include an **ongoing support cost**.

Usually, this is structured as a **minimum yearly fee** (in such a way that the support cost is not charged if the value of the OEM partnership exceeds the yearly minimum fee).

Professional services

In some cases, there are requirements that extend far beyond the support included in an OEM contract. In those instances, callas can either suggest **a partner to perform those services or provide them directly**. Such additional services are **typically charged on a daily-cost basis**, depending on complexity, time needed, and sometimes location.

Return on investment

It is certainly appropriate to ask what the return on investment is of using callas technology for PDF processing, rather than building PDF processing technology from scratch. It is impossible to come up with exact numbers, given the broad scope of the phrase "PDF processing technology." Some guidelines, however, are relatively easy to estimate.

Low-level PDF support

When developing any technology related to PDF documents, low-level PDF format technology is essential. Several low-level PDF libraries are available, **including both open-source and commercial options**. Robust feature support and timely updates are typically found only with the commercial options, which leads to licensing costs. Alternatively, it is possible to **develop low-level format support independently**, necessitating an initial investment of between one and two developer man-years.

Implementing PDF quality control

Once low-level PDF format support is ensured, the **next step is to implement PDF quality control**. In this scenario, the PDF file does not need modification, simplifying implementation requirements. A conservative estimate for implementing ISO PDF/X verification, supporting the most commonly used PDF/X versions, is approximately one man-year.

Supporting market-segment-specific verification, such as the Ghent Workgroup standards, would easily add another two man-years, especially because some of the checks require the ability to render PDF pages and analyze the rendered images accurately. Implementing false-positive avoidance, as allowed by the GWG 2022 specifications, will significantly increase the time required.

ISO PDF/X verification
~1 developer man-year

Market-specific verification, such as the Ghent Workgroup standards
~ 3 developer man-years

False-positive avoidance (GWG 2022)
significantly more time

PDF modification capabilities

While all of this adds up to a significant amount of developer time, the **most time-consuming implementations are for the PDF modification capabilities**, so prominently available within the callas technology stack.

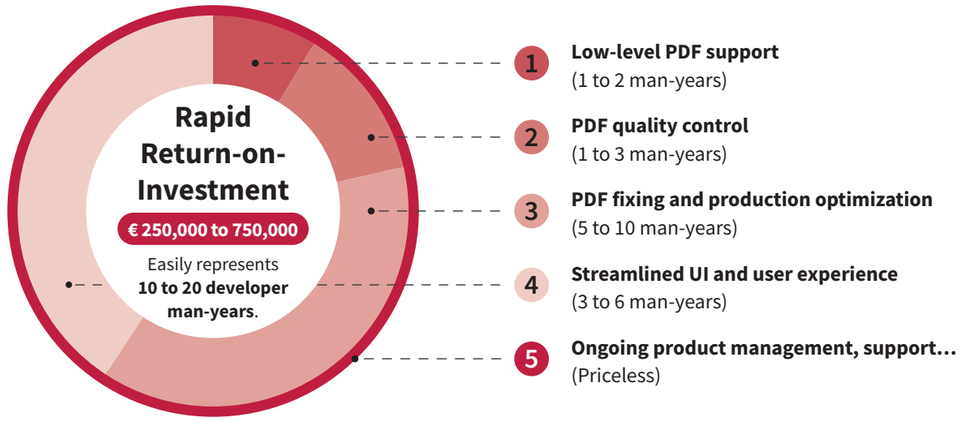
Mature technologies such as process plans, JavaScript variables, barcode reading and writing, PDF file decorating, color transformations, transparency flattening, and support for multiple input and output file formats can easily push the implementation time to five to ten developer man-years.

Including modification capabilities
~ 5 to 10 developer man-years

Hidden & ongoing costs

To these costs, one should not forget to **include the product management investment**, necessary to understand exactly how all of these functionalities should behave with a wide range of both correct and questionable PDF files. And the support cost to correct problems and ensure the viability of the technology with new versions of the PDF file format and updates to the supported standards.

Given all of this, estimating robust PDF file support at a total cost of approximately 10 to 20 developer man-years, or a **monetary cost of €250,000 to €750,000, is not out of the question** and may be overly conservative. In addition to this initial investment, ongoing maintenance costs must also be considered.



For all but the most specialized or niche requirements, this is **unlikely to be justifiable and is far higher than licensing a robust PDF engine, such as the one from callas**. Especially given the continuous improvements and additional complex functionality added by callas in each subsequent release.

Conclusion and next steps

While it is theoretically possible to develop your own PDF quality control, fixing, or processing technology, this white paper clearly highlights how complex and costly such an endeavor truly is.

Over the years, callas software has developed an **impressively broad PDF-related feature set** that is both sufficiently low-level to allow for flexible integration and customization, and sufficiently high-level to reduce implementation costs and minimize time-to-market significantly.

The callas technology can be utilized as **either a PDF processing or creation engine** by employing the pdfToolbox, pdfaPilot, or pdfChip products, or it can be integrated with a pre-made user interface and business logic using the pdfToolbox Portal.

Due to its wide platform support and personalized cost, it is **both technically and commercially viable for integration into all types of products**.

Learn more about the technology

The **documentation site** contains extensive technical documentation about the product.

The **callas YouTube channel** features numerous videos for beginners and experts to introduce you to the different functionalities included in the technology.

Subscribe to the callas YouTube channel to explore more.

callas software also has t**wo websites you can explore**: the main end-user website and the OEM partner site.

OEM partner site
oem.callassoftware.com

callas website
www.callassoftware.com

YouTube
youtube.com/callassoftware

Online documentation
help.callassoftware.com

Start a conversation

The best way to get started working with us is to have a conversation with one of our team members. **Contact Jeremy Spencer**, our OEM director, **or another member of the callas OEM team to begin**. On the OEM site, you can also find a list of events we will be attending if you prefer a real-time meeting to get going. The most important part is to **reach out and connect with us**. We're ready to have a conversation about your business goals, restrictions, and desires. Most long-term partnerships start with an initial meeting.

Try it out for free

If instead you prefer to do your own technical evaluation first, the full technology, including an interactive desktop application that demonstrates all capabilities, is available – for free – for you to test with. **Fill out the form on the OEM web site to get started**.

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