PRO.FILE

Document Management in complex Technical Structures

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Introduction

The highly complex environments found in technical companies regularly push conventional document management systems to their limits. In these companies, technical product structures come up against a myriad of technical documents such as drawings, product documentations, and specifications.

The information they contain is tightly embedded into a structural context that cannot be represented by the simple storage of individual documents. The information they convey, for example change requests, is tied to technical parts and with them to other information contained in other documents such as product documentations that cannot be managed in conventional document management systems (DMS).

For this field of application that manages documents while also putting them into context with technical product structures, a very specific discipline of DMS coined "DMS^{tec}" has made a name for itself and some vendors have been filling this niche with their industry-specific solutions.

Technical companies should therefore differentiate between DMS vendors and carefully examine and review the industry-specific capabilities of these DMS systems. Will it allow them to tie in their product-specific documents with the existing structures of their products, devices, plants, or even projects? This dependency knowledge gained from the affected documents serves as the foundation from which information-based workflows can be digitalized.

Challenges for technical companies

Today, technical products and services need to be developed against ever tighter deadlines. In many cases, this results in development, production and sales departments working on the same product without basing their efforts on the same information.

More than ever before, collaboration across departments is essential and this can only be achieved by having everyone work with the same information.

Figure 1: Examples of technical companies

Focusing on product creation and product management

Product creation and product management are among the most critical areas when it comes to improving and accelerating information-based processes in technical companies. This, however, is not just about the innovative generation of new products – product creation and product

management go far beyond just that. Adapting and enhancing their existing and proven basic components to meet the specific requirements of their customers is the bread and butter of many of these companies. The key here is to leverage all those templates that were previously created elsewhere. The improvement of product development processes requires, among other things, streamlined coordination between the different disciplines of mechanics, electrical engineering, electronics, and software development. This in turn means that technical companies need end-to-end visibility into the dependencies that are represented by the wealth of information surrounding their products and the adjacent administrative areas. To achieve this, they need to be able to control the flow of their documents at every step within the workflow, based on the technical structure (plant, machine, and infrastructure) at hand. This will, almost automatically, also result in streamlined project design and project documentation and is a first step towards "digital product engineering".

The lifecycle of a product starts with its creation – regardless of whether you are dealing with pumps, motors, components of a special-purpose machine, or a large technical facility in its entirety. Ongoing service delivery is increasingly becoming a part of the product itself. The more customized the product, the more important it is for the manufacturer to have instant access to the information and documents that relate to it. To describe this, the terms digital product management and digital information twin have been coined. DMS^{tec} solutions consolidate this information, structure it, and represent it based on technical structures such as the structure of a plant and the assemblies and parts installed therein. If, for example, multiple instances of the same motor have been installed in one or multiple plants, the service specifications linked to that motor will also be linked to the motors installed throughout the plants.

The Product Data Backbone

The many documents that are created alongside the workflows of technical companies are usually managed separately. The CAD/CAE data generated during product development is stored in PDM systems. The ERP/SCM solutions that support a company's manufacturing and logistics processes have their own data management, as do CRM applications that facilitate communication with the customer. On top of that, conventional DMS solutions are often used to control certain elements of the document flow. This lack of a seamless experience is a sure-fire recipe for conflicts and disruptions. The most sensible way to address this would be to create a common context for all product-related information/documents. But how would one go about organizing this? The best approach is to establish a single Product Data Backbone.

Much like a human backbone, it constantly and seamlessly provides a company's different departments and locations with information generated from across the product lifecycle. The important part here is to digitally establish relationships that connect the information relevant to product creation and product management and to reflect their dependencies as this is the only way to digitally initiate workflows. Two examples would be to inform designers of a failed test of an assembly they created or to have technical editors modify the documentation to reflect changes to a part.

The people involved in the workflow no longer have to piece together their documents from various sources but are automatically provided with complete and valid information through the relationship information provided by the Product Data Backbone.

Why tagging alone is not enough

But why would you need such a Product Data Backbone in the first place? Wouldn't it be easier to just simplify the way we search and find documents? After all, we live in a Google world. Isn't it enough to just enter a few keywords using a built-in search feature to instantly retrieve the information we are looking for? What is being touted as the latest and greatest in minimalism is simply not enough for complex technical product environments. It is just not possible to reflect the technical structures of projects and products and the corresponding document controls using keyword indexing and search terms. More often than not, conventional DMS or portal solutions simply cannot provide insights into the relationships across the product lifecycle.

A part's structural information is traditionally created by a company's development team and then used by its production and sales departments. CAD, PDM, ERP and CRM systems, however, are seldom run in consistently managed structures. Looking at the storage mechanisms of conventional file systems like Windows Explorer and the large amounts of unstructured and infinitely multiplied information they entail, one thing quickly becomes apparent: They fail to provide the required level of control over versions, release mechanisms, and collaboration efforts.

Conventional Windows Explorer folder structures are not at all suited to provide a single source of structured information. If, for example, a motor has been installed in five different locations throughout a plant, its specifications will be stored in five different locations within the folder structure. If changes are made, they need to be synchronized across these five locations. What's more, this does not even take into account the fact that the specifications used by the development, product and purchasing departments and the product descriptions of the sales teams are most likely stored in completely different folder structures or even systems, even though they are dealing with the same motor.

The storage and indexing features of conventional document management systems do allow companies to establish connections between documents by using the same keywords. It is, however, not possible to clearly establish their relationships based on a document's tag alone, as this can only be achieved based on a plant's structure, as it is not intrinsically tied to any one document.

The suffix that makes all the difference: from DMS to DMS^{tec}

This document management approach is based on product structures and is a particular discipline of conventional document management: DMS^{tec}. DMS solutions from the "tec" category such as PROCAD's DMS^{tec} link documents to technical structures to provide a seamless experience that provides end-to-end visibility into the machine, plant, or infrastructure – eliminating redundancies and covering the entire lifecycle.

DMS^{tec} manages a product or plant structure – regardless of whether you are dealing with a simple assembly or an infrastructure object – in a way that is completely detached from the document itself. These structures can, for example, represent the technical attributes of a product, the installation of modules into a higher-level system, or the place of installation. From the information perspective, the structure is defined by metadata and links.

Links are used to ensure that the same information is made available and editable from a single location. Each document, along with its specific information, is stored in a single location and then incorporated into existing structures that reflect its logical relationships.

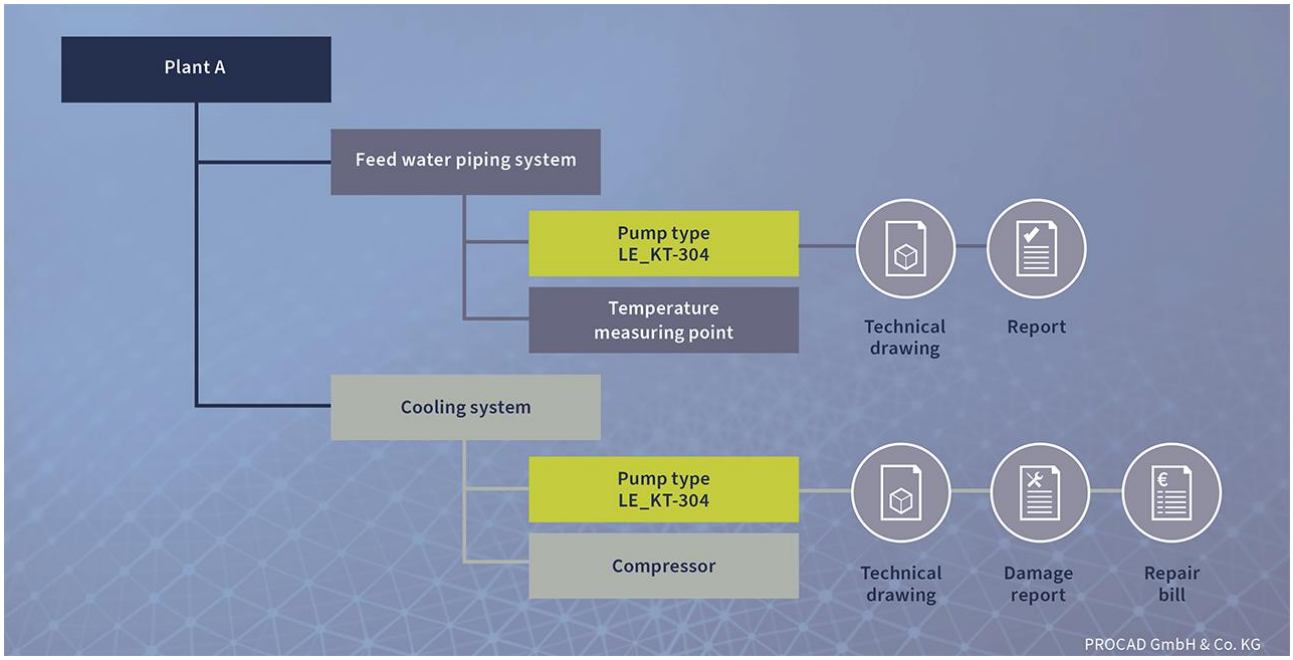

Figure 2: Documents in a plant structure

This approach overcomes the many shortcomings of modeling technical structures using the folder structures of the file system. Instead of distributing information across multiple locations inside the file system and storing identical information under different designations, information is stored only once and dynamically embedded into structures, effectively transforming 1:1 or 1:n relationships into n:m relationships. Another benefit is that this allows companies to create custom views for their different departments and roles. (see figure 2)

DMS^{tec} provides the basis for differentiated views of documents

It is counterproductive to make all information available to everyone. Individual departments and employees need whatever information is relevant to their work. Information needs can differ widely depending on whether you work in development, order processing, technical purchasing, service, or management. With DMS^{tec}, it is possible to give each role in the company their own specific view of relevant information – while making sure that each file is managed only once within the Product Data Backbone.

Different views: development, design, manufacturing, and assembly

Design departments put together their view of native drawings, CAD models, wiring plans or PCB layouts of a component. They spend most of their time working with CAD and CAE tools. The

documents that are part of their daily routines, however, differ widely from those that are used on the production floor or in the assembly process. Here, the focus is on documents like drawings as exploded views in PDF format or as simplified models in JT format, routings, or assembly and production reports. Design and development teams require a completely different view than their colleagues in manufacturing and assembly.

The project manager view

The project managers overseeing the timely delivery of a customer's system certainly also need access to some of the documents created by the development departments, but they don't need to go into every technical detail. They also create their own documents, such a meeting minutes, resource plans and calculations and store the customer correspondence in archives that provide complete audit trails. Project managers need a bird's eye view and put together their view of development documents accordingly.

The sales and procurement view

Sales teams need to be able to access all contracts, correspondence, and complaints related to a product. Most likely they will also require access to more technical documents such as photos of a piece of machinery or 3D models to share with other customers as references. On top of that, sales representatives will also want to look at their company's order processing documents from time to time. All of this defines their own specific view.

The accounting and finance view

Commercial departments also work with very specific documents. The accounting department is the central location where all bids, orders, order confirmations, and invoices pertaining to sold equipment come together along with any documents detailing project design services and purchased parts installed in the plant or machine. Each of these documents is related to the elements found in the product structure. Purchasers don't need to know every single detail about a machine, but they need to have a quick grasp of any spare parts that may need to be ordered to remedy a defect and they must be able to do so choosing the best quality part at a reasonable cost and with the shortest lead time. Consequently, they also require access to technical documents. On top of that, commercial departments need to have an archiving system in place that allows them to maintain complete audit trails.

The service and maintenance view

The lifecycle of a piece of equipment starts once it is installed and put into operation at the customer's site. The key to optimum operation and customer satisfaction, however, lies in preventive maintenance and timely repairs in case something goes wrong. Field technicians need to be provided with a digital representation – also known as the digital information twin – of the machinery they are working on. If, for example, they are performing maintenance work and have to repair or replace a pump, they cannot do so without knowing which particular pump they are dealing with. How much did it cost? Who was the contact person on the supplier side? Is it still under warranty? Where to find the installation guide? Are there any video tutorials I could use? Some of this information is contained in the invoice stored in the ERP or SCM systems and some of it is stored in completely different locations. With DMS^{tec}, it just takes one click to

provide maintenance engineers with consistent and complete information without any redundancies.

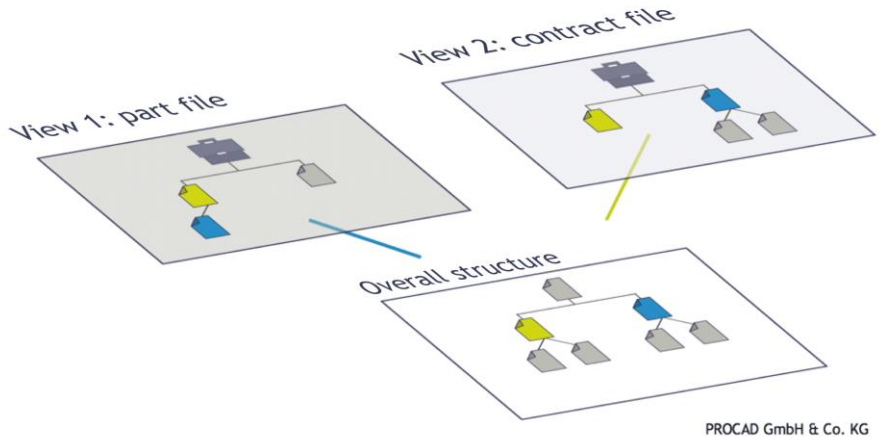

Figure 3: Custom view by department

The overall review remains

This shows that modern DMS[tec] solutions allow for different views to meet the demands and requirements of a company's various departments (see figure 3). But none of this would be technically feasible without the Product Data Backbone. Consequently, the one cannot exist without the other. It is the only way to establish the diverse relationships between product structures, product-related documents, and the information they contain. The following example is to illustrate why this overall view in the context of individual views is so important. Performing on-site services is usually not part of the product creation process. If, however, an inherent defect in the product is discovered during a service call, this information must be reported back into the "development, design and manufacturing" view. The Product Data Backbone, through its connections to the field service management system, informs the relevant process owners that a part or component requires modifications.

DMS[tec] provides the basis for documentation and document control

Complete documentation is a part of every technical product. It is an important legal requirement. Manufacturers must provide insight into every last detail about how their product is built and how the individual components are structurally interconnected. A thorough documentation cannot be simply created after the fact but has to be generated alongside the development and manufacturing process.

In plant and mechanical engineering, documents such as bids, orders, and order confirmations often serve to determine the initial project structures within the ERP system. These often reference a standardized system that then needs to be adapted to the customer's project-specific requirements. Ideally, this structure is transferred to the DMS[tec] solution where it creates an empty file to serve as the order folder. The machine and/or lifecycle file for the system has thus been created. Over the course of the product creation process, it will be populated with data provided by the mechanical design (CAD models, drawings, engineering

BOMs), electrical design (circuit diagrams, PCB layouts, external data sheets), project planning (specifications, contracts, customer drawings, production data sheets, email correspondence), and quality assurance (release reports) teams. Afterwards, documentations are automatically available for product management purposes such as manufacturing, maintenance, service and repair, and customer service (see figure 4). This is how an information twin of a machine or plant is created, the entire lifecycle of which can be seamlessly tracked across all disciplines, departments, and locations.

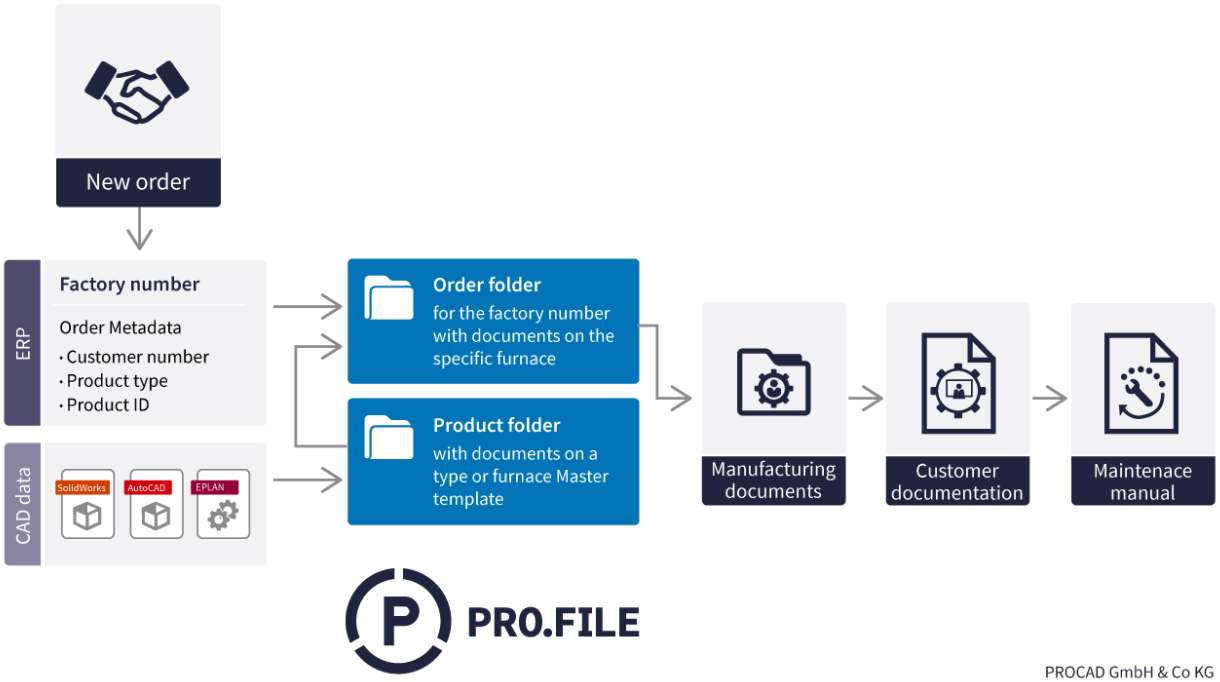

Figure 4: Digital document control in order processing for a make-to-order manufacturer on the example of PRO.FILE

Deep integration with authoring systems increases the data quality of a DMS^{tec} solution

The quality of a well-tuned DMS^{tec} solution is also determined by its suitability for integration with important authoring systems. If, for example, the DMS^{tec} system is capable of recognizing e-mails as "correspondence", it will automatically read out important metadata such as subject line, recipient, and sender. It will immediately identify duplicates – which means that even if an email has been sent to 10 different recipients, it will only store it once in the system.

Bidirectional integrations with authoring systems also ensure the automated transfer of project and item information into relevant documents. As a result, an engineering change request is not just linked to the item in question and visible to everyone involved, the system will also automatically read out the corresponding item number, project number, author, etc., even if this information is maintained in other systems, such as the ERP system. By putting this information into context across system boundaries, companies can create a truly seamless product creation process. The automation cuts time and effort and reduces the error rate.

In a nutshell:
How technical companies benefit from DMS^{tec} solutions

- Provision of all documents in their currently valid version.
- Secure and protected storage and archiving with built-in document access control.
- Creation of specific views for departments, work groups, and management levels.
- Modeling of the technical structures to which the documents can be linked.
- Integration with Office applications such as e-mail, Word, Excel, and PowerPoint.
- Archiving of commercial documents with complete audit trails to ensure compliance with relevant commercial legislation and other regulatory requirements.
- More effective collaboration with customers, suppliers, and government agencies through the maintenance, provision, and transfer of complete, seamless and transparent machine and lifecycle files in digital form.
- Creation of a complete IT-based representation of a product or project – also known as a digital information twin.

In conclusion: Why technical companies need to embrace DMS^{tec}

Conventional document management systems are simply ineffective at modeling the complex structures found in technical companies. DMS^{tec} describes a particular type of document management system that is capable of modeling these technical structures. This lets companies implement a unified Product Data Backbone, which in turn allows them to model their digitalized processes.

Technical companies need to be aware of enterprise-wide coherences when introducing a DMS system, regardless of whether this introduction is driven by the development department, the IT department, commercial departments or any other business department. Otherwise, the introduction of such a system will quickly result in a tangle of interfaces or end up as just another document storage location.

With its PRO.FILE and DMS^{tec} platform, PROCAD has created a solution that specifically caters to the needs of technical companies looking for a Product Data Backbone to support their document management needs. PRO.FILE is a fully configurable platform that can be tailored to the requirements at hand to deliver maximum impact right away.

Your contact

Do you have questions or need more information?
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