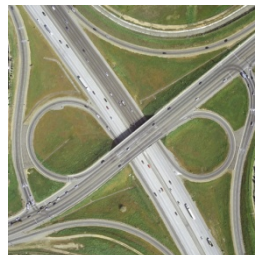
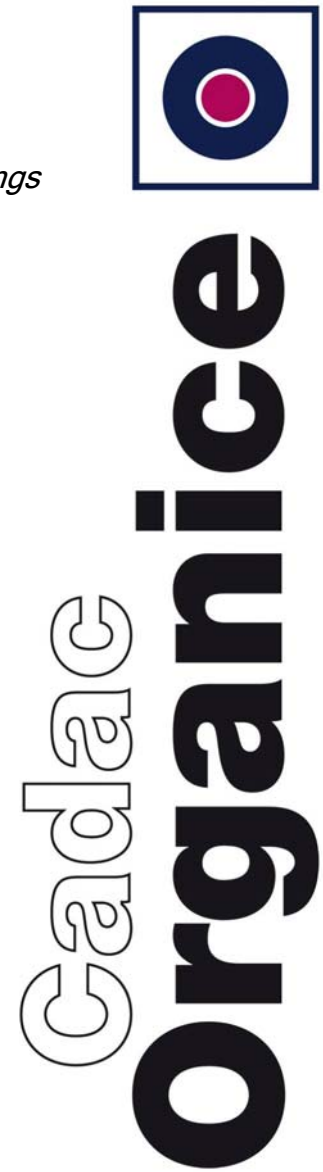


## SharePoint for Engineering Document Management & Control

*Managing and controlling engineering documents and drawings with SharePoint*

A white paper by Cadac Organice BV

Date: 01-03-2012



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## 0 Summary



SharePoint is a powerful platform for document management and project collaboration. Many project-driven engineering companies that intensively share and exchange documents with internal and external project partners are looking into SharePoint as a solution for their engineering document management needs. But to provide a comprehensive solution, SharePoint needs to be able to store and manage CAD files and needs to provide typical engineering document management functionality.

SharePoint out-of-the-box does not provide integration with CAD applications and lacks typical engineering document management functionality, like a viewer to view, mark-up and redline CAD files without the native CAD application, functionality for document distribution and tracking (transmittal management), functionality for extranet collaboration, and functionality to support and automate typical engineering business processes.

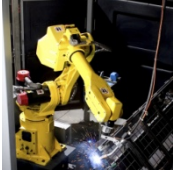
For some CAD applications integration with SharePoint is available, while for others the related PDM solution integrates with SharePoint. But there is not one single solution that provides the integration of CAD applications from different vendors with SharePoint. As a result, project organizations that work with multiple or complex CAD systems are facing a serious challenge where they need to collaborate and share documents with SharePoint.

The best way to benefit from SharePoint as an engineering document management solution is to focus on the best way to manage CAD files. If integration between their CAD application and SharePoint is available, SharePoint can be used to manage both the work in progress as well as the released CAD files for sharing and collaboration. If integration is not available, SharePoint can be used to manage the released CAD files for sharing and collaboration. In this case CAD files are best managed within their CAD application or related PDM system and published to SharePoint when released.

Furthermore it is important that proper functionality is provided to efficiently manage and control engineering documents in SharePoint, like a viewer, transmittal management, extranet collaboration and engineering workflow management. Efficient engineering document management functionality is crucial for the different users in your (project) organization to work efficiently with documents, supporting them in their daily work and responsibilities.

Cadac Organice enriches SharePoint with CAD and PDM integration as well as typical functionality for engineering document management and control, making SharePoint work for project-driven engineering industries.

# 1 Introduction



Microsoft SharePoint is a platform for Enterprise Content Management and Collaboration that can be used to share and exchange information across boundaries. SharePoint allows you to centrally store, manage and access documents across the enterprise and to make them available and accessible to external partners like vendors, suppliers, customers, etc.

But to provide a comprehensive solution for document management in an engineering environment, SharePoint needs to be able to manage all kinds of documents, including engineering documents like CAD drawings. CAD drawings are often created with tools that do not offer out-of-the-box integration with SharePoint, which is needed to manage these documents properly.

There are many different CAD applications that are being used by engineering companies, like CAD applications for 2D drawing and 3D modelling and CAD applications for specific design purposes, like architectural, mechanical or electrical designing. All these applications have their own proprietary file formats, which makes managing these files and integrating with these applications a complex issue.

In addition, CAD drawings are created by CAD Engineers, but are being used by other internal and external users. To work efficiently with these CAD drawings, these users are in need for typical engineering document management functionality.

This whitepaper describes the possibilities and impossibilities for SharePoint to manage the CAD files and to integrate with CAD applications. It provides an answer to the question if and how SharePoint can be used as an Engineering Document Management & Control solution to store, manage and share design information across multi-disciplinary organizations and project teams.

## 2 Engineering document management



Engineering companies are responsible for developing and producing products and for designing and constructing projects. They not only need to manage their office documents but also their design information. Design information is typically created by CAD Engineers, but is used by others. CAD Engineers create the drawings and the detailed designs that are needed to manufacture products and equipment, or to build buildings, infrastructure, plants and installations. When this design information is released, it is used by the people that actually manufacture the products or build the buildings, like planners, production employees and construction workers, or for instance by purchasers responsible for buying the necessary parts and materials.

In project-driven engineering industries such as the Oil & Gas, Mining & Metals, Process & Power, Equipment Manufacturing, and Building & Construction, people collaborate in project teams. These project teams consist of people from different disciplines and with different expertises. They can come from different departments, offices and companies. To collaborate efficiently, project members need to easily share and exchange information, like CAD drawings and other engineering documents.

There are many different CAD applications that are being used by engineering companies, like CAD applications for 2D drawing and 3D modelling and CAD applications for specific design purposes, like architectural, mechanical or electrical designing. In many projects often a combination of different applications is needed, and as a result multiple CAD applications are being used. All these applications have their own proprietary file formats and their own way of integration. This makes managing the different CAD files and integrating different CAD applications in one and the same management system a complex issue.

In practice we see that every CAD application vendor has in fact developed its own Engineering Document Management (EDM) or Product Data Management (PDM) system. In some cases we even see that a vendor of multiple CAD applications has developed separate solutions for each application, without proper integration between them! Because of this there is no EDM or PDM system available in the market today that offers deep integration with different CAD systems from multiple vendors.

As a result, organizations and project teams that work with multiple CAD systems are facing a serious challenge where they need a flexible and user friendly solution for engineering document management.

SharePoint is introduced by Microsoft as a powerful platform for Enterprise Content Management and Collaboration across boundaries. It easily integrates with the IT infrastructure of any company and provides a central and secured environment in which teams can share and exchange documents. This makes SharePoint very interesting for project-driven industries that are in need for such platform. But to provide a solution for engineering document management, SharePoint needs to be able to store and manage design information.

### 3 Managing CAD files



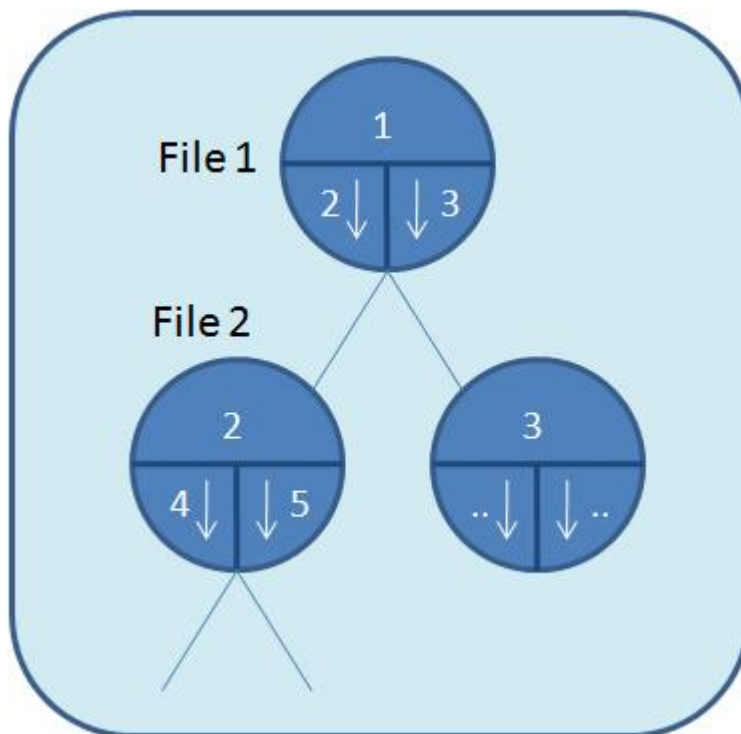
For engineering document management, SharePoint needs to store and manage CAD files and to integrate with different CAD applications. Today, SharePoint already provides the possibility to store different kinds of files and to launch the related application. But this is not sufficient for managing CAD files properly.

#### 3.1 CAD files

##### 3.1.1 Reference files

CAD files are compound files with references to other files, blocks, images, etc. It is important that not only the CAD file, but also these references are properly managed. Often multiple people are working simultaneously on the same CAD file and its references, and when files are updated, also the references need to be updated.

The relationship between a CAD file and its references is stored within the CAD file (e.g. AutoCAD, MicroStation) and sometimes additional references are stored in an external file (e.g. project file) or database (e.g. ADT, Civil 3D, Inventor). This means that an Engineering Document Management system can only manage CAD files properly if it is able to “read” the reference information and if it is integrated deeply with the CAD application used to create and edit the CAD files.



*Fig.: reference file information is stored in the CAD file (e.g. AutoCAD, MicroStation)*

Furthermore an Engineering Document Management system needs to be able to “read” reference information from a project file or database.

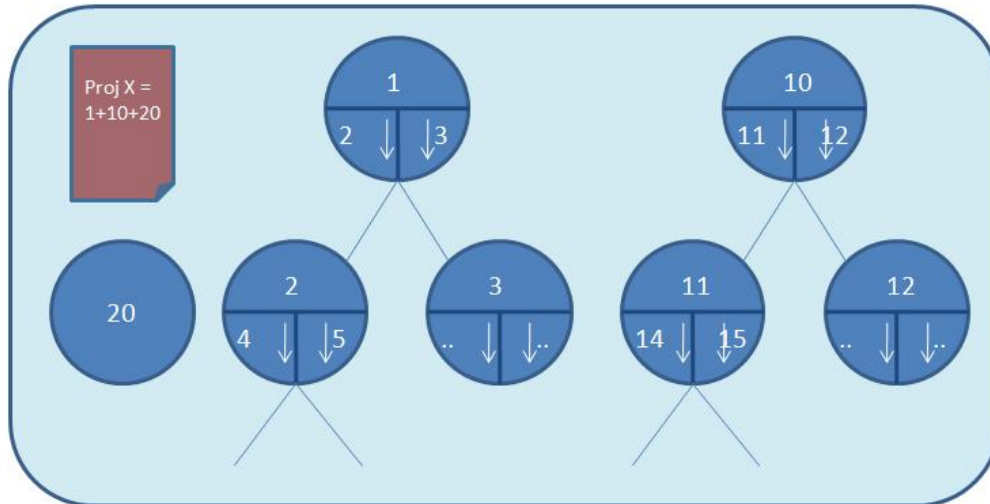


Fig.: reference file information is stored in a project file (e.g. ADT, Civil 3D, Inventor)

### 3.1.2 Layouts

CAD designs can be very large, especially when the object has extreme dimensions, like bridges, sky scrapers, roads, railways, etc. As a result, it is not always possible to fit the design in one (paper size) document. This is especially true when the design is created in a certain scale, and this scale needs to be kept in the document. In these cases, often multiple drawings are created from one and the same design.

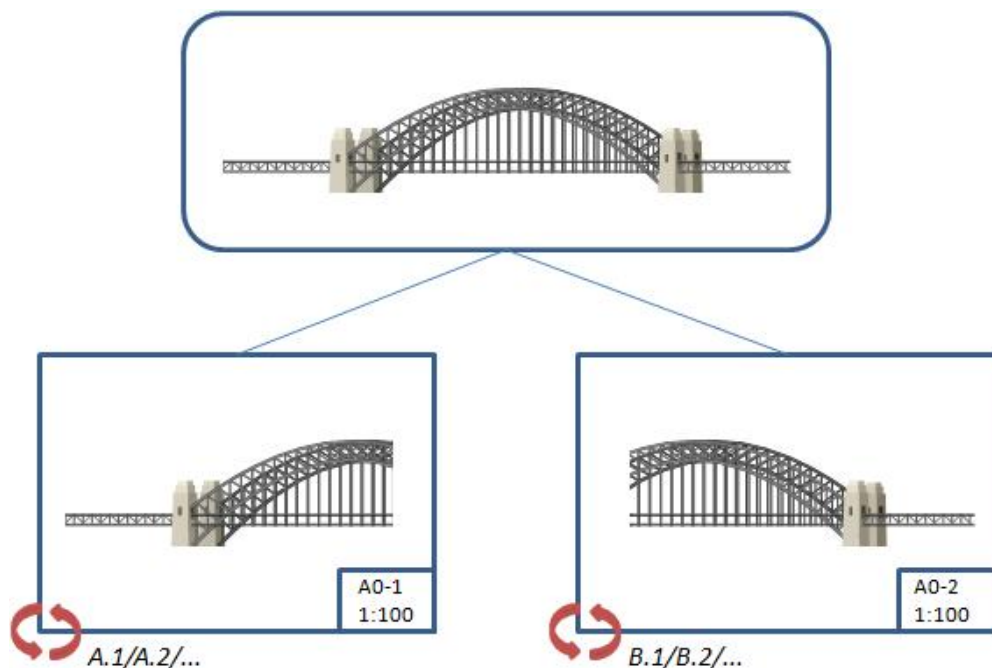
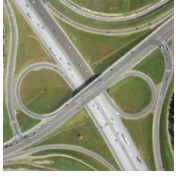


Fig.: multiple drawings are created from one design



Views of a design are mostly used to “translate” the design to a drawing on physical paper with its own versioning logic. This means that one design could contain multiple drawings, each with a different version. An Engineering Document Management system should be able to manage the relationship between the design and the different versions of the drawings derived from the design.

### **3.1.3 Title block linking**

A CAD drawing includes a title block area with information about the drawing, like drawing number, project number, description, revision number, etc. The title block information is often used as metadata, and needs to be kept up-to-date. The metadata of the drawing can change and as a result it should automatically be synchronized with the title block information. An Engineering Document Management system should be able to derive title block information from a drawing and map it with the metadata.

### **3.1.4 Viewing CAD files**

CAD engineers are responsible for creating the drawings and designs, while others are using these drawings in their work. To open and view CAD drawings and designs, these users would need to have access to the CAD applications. However, CAD applications are not easy to use and are too expensive to provide access to everyone. Therefore often integrated viewing applications are used to open and view CAD files, without the need for the original CAD application. An Engineering Document Management system should therefore include a viewer to allow users without the CAD application to open and view CAD files.

### **3.1.5 Mark-up and redlining**

CAD drawings and designs are controlled documents that need to be approved before they are release for general usage. Approval processes are often parallel and multi-level processes where multiple engineers, managers and sometimes external users need to approve documents. In these processes it is not only crucial that users are able to view the content of CAD drawings and designs without the native application, but they should also be able to provide feedback through mark-up and redlining. Mark-up and redlining information from multiple users needs to be consolidated to one Engineering Change Note or Order (ECN/ECO), which the CAD Engineer can use to update the drawing or design. An Engineering Document Management system should include a viewer and support mark-up and redlining.

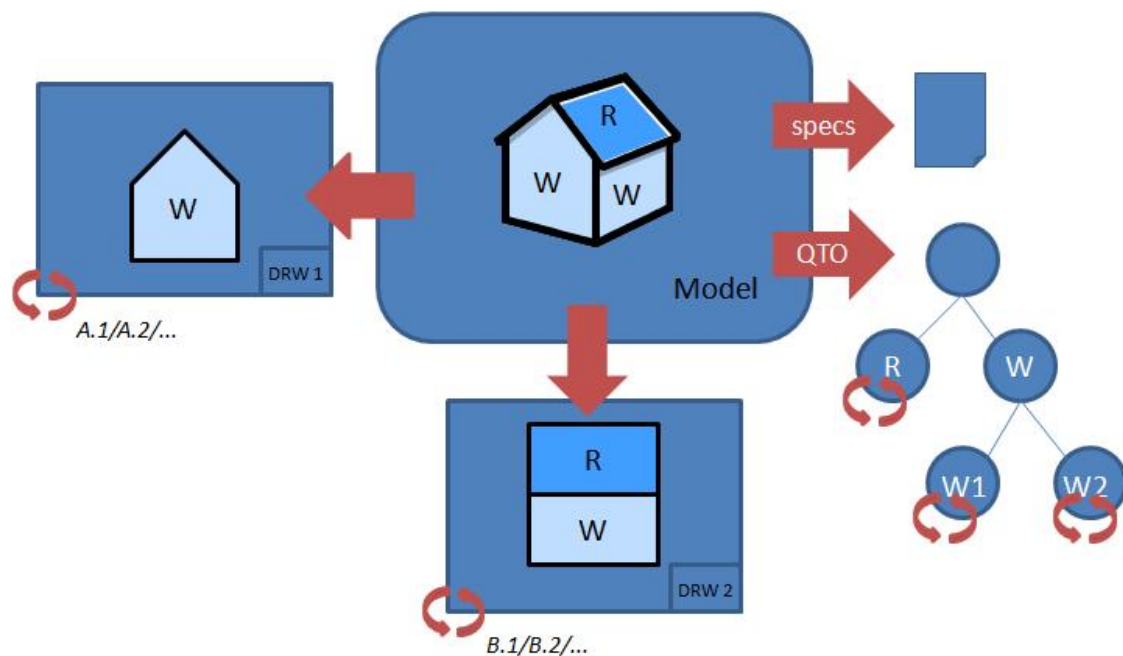
### **3.1.6 BIM**

Nowadays new projects often start in 3D CAD applications by creating a 3D model of a product or project. Building Information Modelling (BIM) is a process in which AEC



companies collaborate in a 3D model. An example of a popular 3D CAD application for BIM is Autodesk Revit.

In a BIM project, a 3D model is created that eventually delivers the necessary data and input to all project members to perform their tasks. The ultimate goal of BIM is that every project member is able to work from the 3D model. However, this is not always possible. To perform certain tasks, often 2D views or sections with more details are needed. Furthermore a dynamic 3D model does not always provide the legal foundation on which contracts and agreements can be based. As a result, snapshots of the 3D model are 'frozen' into documents, like 2D drawings, specifications and the Quantity Takeoffs (QTO). These documents are extracted from the 3D model, on which contractual agreements are based and which can be used by the project members to perform their tasks.



*Fig.: contractual agreements are still based on 'frozen' documents*

Since the 3D model changes in time, every time snapshots of the model are taken. This leads to new versions of drawings and documents and all project participants should be notified about these versions. An Engineering Document Management system should therefore be able to properly manage the relationship between the 3D model and the derived 2D drawings and documents.

### 3.2 CAD integration

To manage CAD files, SharePoint needs to integrate with the CAD applications. However, SharePoint out-of-the-box does not provide CAD integration.

### 3.2.1 CAD integration modules



To integrate SharePoint with CAD applications, integration modules are needed for the different CAD applications. Microsoft does not provide CAD integration modules for SharePoint, and they do not have the intention to do so, since they lack the necessary knowledge and expertise. Therefore CAD integration modules have to be developed by others.

There are many CAD applications, like applications for 2D drawing and 3D modelling and applications or add-ons for specific designing, like architectural, mechanical or electrical CAD. These CAD applications are all very different and they all have their own proprietary file format. Understanding all these file formats and understanding how to integrate with all these CAD applications, requires a huge effort. And not only to develop the integration, but also to keep it up-to-date with new versions of the CAD applications and file formats. For that reason, it is impossible for a single solution to integrate SharePoint with all possible CAD applications.

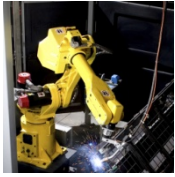
For a number of CAD applications solutions have been introduced that integrate these applications with SharePoint. But the majority of these solutions only focus on one CAD application, or functionality is limited to the technical boundaries set by SharePoint. This makes them not suitable for engineering companies or engineering project teams that use multiple or complex CAD applications. In addition, these modules often provide a solution for CAD Engineers to manage their CAD files in SharePoint, but they lack the proper engineering document management functionality for users to work with these files efficiently.

### 3.2.2 PDM integration

To manage CAD files properly, most CAD vendors have developed their own Data Management solution (PDM). They know best the structure and content of their CAD files and they are best equipped to develop a system to manage these files. Other (independent) suppliers are in most cases not able to develop a similar high level of integration, because they lack this expertise.

An increasing number of PDM vendors have noticed the benefits of SharePoint, especially in the area of collaboration and sharing design information with other internal and external users,. They are integrating their solutions with SharePoint and are able to publish CAD and design files to SharePoint, while the original files and their relationships are still managed in the PDM system. Other users are then able to find and retrieve these files from SharePoint without having to use the PDM system. But also in this case users still need typical engineering document management functionality in SharePoint to work efficiently with these CAD files.

### 3.3 SharePoint for engineering document management

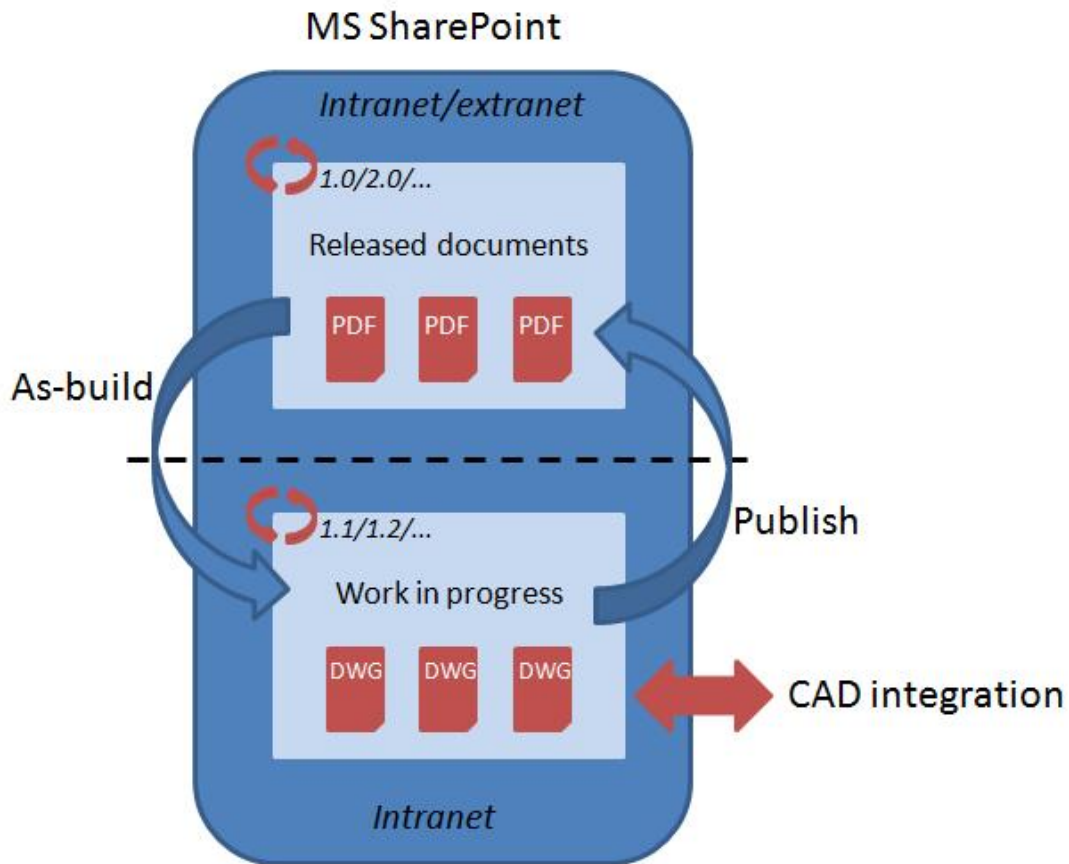


SharePoint provides a powerful platform for information sharing and collaboration across boundaries, and is seen by many project-driven engineering companies as the right platform to manage, share and exchange project documentation with the extended enterprise. But to manage all engineering project documentation including CAD files, SharePoint out-of-the-box is missing the integration with CAD applications for CAD Engineers and typical engineering document management functionality for the users of CAD files.

So if you are considering managing your engineering documents in SharePoint, you should first find out if SharePoint is capable of integrating with the CAD applications you are using. Depending on your situation, SharePoint can either manage your work in progress and your released documents, or only your released documents.

#### 3.3.1 Managing work in progress and released documents in SharePoint

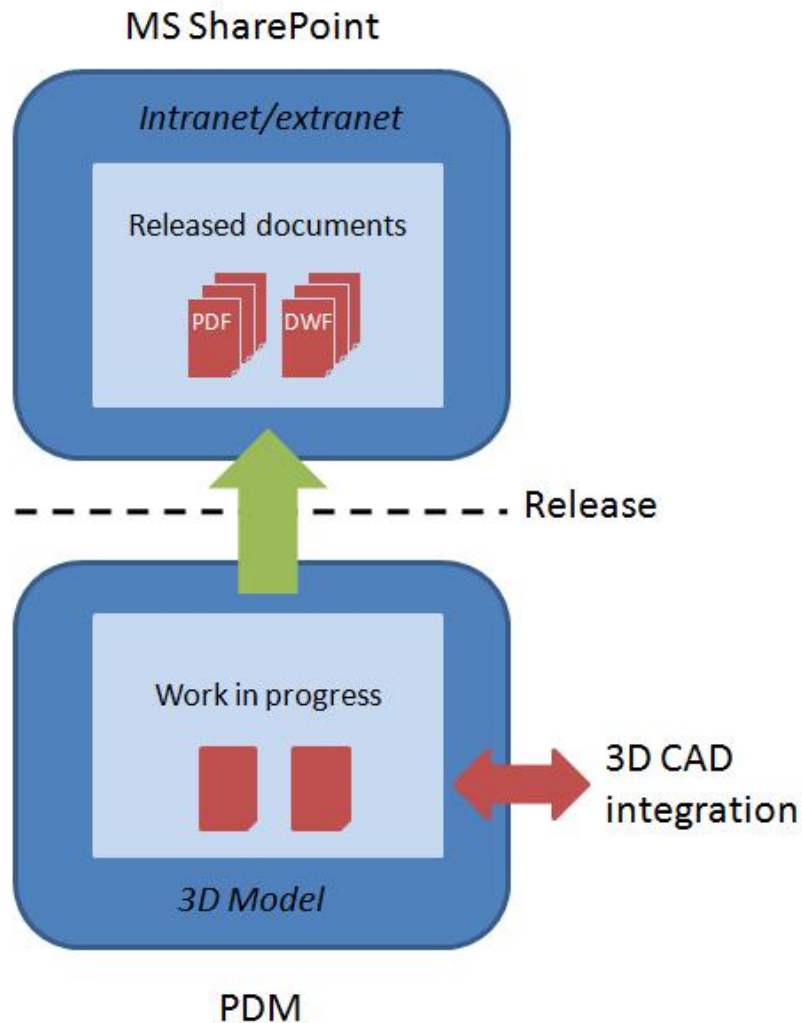
When you are using CAD applications for which integration with SharePoint is available, you can decide to store and manage your CAD files in SharePoint. As long as the CAD engineers are working on the CAD files (work in progress), SharePoint can be configured such that only restricted users have access to these files. When the CAD files are released, they are also accessible to others.



*Fig.: Managing work in progress and released documents in SharePoint*

### 3.3.2 Managing released documents in SharePoint

If you are using CAD applications for which integration with SharePoint is *not* available, you can implement SharePoint as a project sharing and distribution environment for released documents. To manage CAD files during work in progress, it is recommended you use the related PDM system(s) for your CAD application(s). When CAD files are released, you publish them from the PDM system to SharePoint, where they are easily accessible to others.



*Fig.: example of managing a 3D model in a PDM system and managing the released documents in SharePoint*

In this situation, SharePoint provides a complementary document management and collaboration environment, where CAD engineers can publish their released CAD files and easily share and exchange them with others.

### 3.3.3 Engineering document management functionality

As mentioned before, CAD drawings are created by CAD Engineers, but are being used by others. These users need to have the right functionality to work efficiently with CAD files and to properly share, exchange and use these files in their work.

Since CAD drawings contain graphical information, it is important that users can easily view the content of these drawings. Because users often do not have access to the CAD application, viewing applications are available to view the content of documents without the need for the native application. In addition, viewers often provide the



possibility to mark-up and redline documents, for example when documents need to be revised. This helps users to easily review drawings and provide feedback in approval processes or request changes in an as-built situation.

Since CAD applications are not always available and not everyone is working with the same applications (especially not in case of external parties), documents cannot always be exchanged in a native file format. In such situation it is useful to be able to convert files into an independent file format like PDF or DWF that can easily be used by everyone. This is also very useful when documents need to be shared that are not allowed to be changed, for instance in case of legal liability.

In project teams, people from different organizations collaborate, each with their own role and task. Project members are steered with documents and it is very important that there is accurate insight in what information was sent to whom and why, and what the recipient is expected to do. Furthermore it is important that this process is tracked, especially in case of revision processes and with respect to legal liability.

Where different parties collaborate, we often see that there are big differences in the level of IT infrastructure and skills. Where one party is able to work fully digital, another party may still depend on paper (e.g. legal reasons). As a result different ways of communicating between project partners should be supported.

SharePoint out-of-the-box does not provide functionality for engineering document management and control. So when you want to use SharePoint in your organization and for your engineering projects, you not only need to integrate SharePoint with CAD applications or a PDM system, but you also need to extend SharePoint with typical functionality that supports users in managing and controlling engineering documents efficiently.

## 4 Conclusion



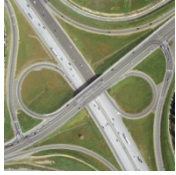
SharePoint is a powerful platform for Enterprise Content Management and Collaboration. Many project-driven engineering companies that intensively share and exchange documents with internal and external project partners, are looking into SharePoint as a solution for engineering document management and control. But to provide a comprehensive solution, SharePoint needs to be able to store and manage CAD files and needs to provide typical engineering document management and control functionality.

For some CAD applications integration with SharePoint is available, while for others the related PDM system integrates with SharePoint. But there is not one solution that provides integration for all CAD applications with SharePoint. As a result, it is not easy for a company to find the right solution that is capable of integrating SharePoint with all the CAD applications and add-ons that are being used. Especially not for project-driven engineering companies that work with multiple and complex CAD applications, or that collaborate with external project partners that all use their own CAD applications.

The best way for engineering companies to benefit from SharePoint as an engineering document management and control solution is to focus on the best way to manage CAD drawings and design documents. If integration between their CAD application and SharePoint is available, SharePoint can be used to manage both the work in progress as well as the released CAD files for sharing and collaboration. If integration is not available, SharePoint can be used to manage released CAD files for sharing and collaboration. In this case CAD files are best managed within the CAD application or related PDM system with SharePoint as a complementary environment. When released, CAD files are converted into an independent file format like PDF or DWF and published to SharePoint, where they can easily be shared and exchanged with internal and external users.

Furthermore it is important that SharePoint includes proper functionality to efficiently manage and control engineering documents. This includes a viewer to view, mark-up and redline CAD drawings, functionality for document distribution and tracking (transmittal management), functionality for external collaboration, and functionality to support and automate typical engineering business processes. All this functionality is crucial for users in project-driven engineering industries to work efficiently with documents, supporting them in their daily work and responsibilities.

## 5 Cadac Organice



As a subsidiary of Cadac Group, Cadac Organice has more than 25 years of experience in implementing CAD applications and PDM systems for project-driven engineering industries in the Oil & Gas, Mining & Metals, Process & Power, Equipment Manufacturing, and Building & Construction. Cadac Organice has strategically chosen to leverage Microsoft SharePoint as platform for Enterprise Content Management and Collaboration and to enrich SharePoint with functionality for Engineering Document Management and Control. It provides all the fundamental functionality on SharePoint that project-driven engineering organizations need in projects and in collaboration with external partners.

### 5.1 Project Document Control

Cadac Organice supports the document control process in project-driven engineering industries. It allows Document Controllers to plan document delivery from internal disciplines and external partners and pre-populate document registers. Document Numbering functionality supports complex schemes and is used to automatically number documents and reserve document numbers and ranges. Tasks can be issued to receive the necessary documents on time, and Document Controllers can monitor the progress. Metadata information can be retrieved from other business systems based on the document number to prevent manual input and the possibility of errors. This ensures metadata integrity.

### 5.2 Engineering Document Management

Cadac Organice offers a document management environment in Microsoft SharePoint, optimized for project-driven engineering industries. Based on more than 25 years of experience, we have developed best practices that reflect the document management needs and working methods of companies and project teams in the Oil & Gas, Mining & Metals, Process & Power, Equipment Manufacturing, and Building & Construction industries. Our solution includes all functionality to create, store, search, retrieve, view, check in, check out, edit and revise engineering drawings and documents. It integrates with Microsoft Office, Outlook and various CAD applications, and includes an internal viewer for viewing, comparing, mark-up and redlining.

### 5.3 CAD Drawing Management

Cadac Organice offers basic integration with SharePoint for various leading CAD applications, including:

- AutoCAD;
- Revit;
- Bricscad;





- MicroStation.

Through a toolbar in the CAD application users can directly interact with drawings in SharePoint. The integration includes reference file management and title block linking.

For users that do not have access to CAD applications, Cadac Organice has an integrated viewer that also includes functionality for mark-up, redlining and to compare drawings and drawing revisions. Also additional viewers like Autodesk Design Review can be used to view specific CAD file formats in the most optimal way.

## 5.4 Publish to SharePoint (PDM integration)

Companies that use multiple or complex CAD applications are advised to manage 2D and 3D CAD drawings and models in the related PDM system. Cadac Organice provides integration tooling to publish released CAD drawings from PDM to SharePoint. In SharePoint these documents can easily be shared with internal and external users for review and approval processes or collaboration. CAD drawings can be published in different file formats and metadata information is mapped between the PDM system and SharePoint.

## 5.5 Transmittal Management

Cadac Organice provides functionality to distribute multiple documents efficiently to multiple recipients at once and offers management information to document controllers who need to track transmittals. A transmittal definition specifies exactly which recipient needs to receive which documents and whether the recipient should receive the documents digitally or on paper. A transmittal tracking list in SharePoint records who received what and when. When documents are modified, the document controller is automatically notified by email of the need to retransmit the package.

## 5.6 Workflow Management

With Cadac Organice you can build productive serial and parallel state workflows in SharePoint to automate business processes. Using the friendly graphical interface, users can simply drag and drop workflow states between the start and end points of the workflow and define routing from one state to another. Actions with activities will route the document or item to a next step in the workflow. Users or groups are assigned to actions, including roles and permissions. Workflows can be executed automatically or manually, and users receive visual feedback on workflow status and history.

## 5.7 Project Collaboration



Cadac Organice allows companies to collaborate efficiently with external partners in a secured SharePoint extranet site. Users are able to share documents and versions with other users based on contractual relationships captured in a communication matrix. They are notified by email with a transmittal coversheet that new documents are shared with them. Only users with whom a document is shared are able to see and access the document. The solution offers a full audit trail and allows project partners to seamlessly share documents, providing a single source of truth.

## 5.8 Document Publishing

Cadac Organice can publish documents that are stored in SharePoint to other libraries or internal and external sites for sharing and collaboration. Documents can be published in a native file format, but they can also be converted into PDF or DWF, so that they can easily be opened, viewed and annotated by others without the native application. Published documents can easily be distributed, accurately printed and securely archived for many years. Document publishing can be initiated at any time through a custom SharePoint workflow, for instance to publish documents to any document library or SharePoint site for distribution, printing, archiving or to an extranet for external access.

*For more information, please visit us at <http://www.organice.com>.*

## List of abbreviations

2D	2 dimensional
3D	3 dimensional
BIM	Building Information Modelling
CAD	Computer Aided Design
DWF	Design Web Format (file format from Autodesk)
DWG	Drawing (file format from AutoCAD)
ECM	Enterprise Content Management
EDM	Engineering Document Management
PDF	Portable Document Format (file format from Adobe)
PDM	Product Data Management
QTO	Quantity Takeoffs
XREF	External Reference File (file format from AutoCAD)