

MODERN SYSTEMS IN TECHNICAL DOCUMENTATION WORKFLOW DESIGN SOLUTION

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Abstract: Technical documentation describes handling, functionality and architecture of a technical product or a product under development or use. In technical documentation are included: technical specifications, drawings, bill of materials, engineering documents etc. Nowadays is very challenging to handle all of this data for complex products. In purpose of handling technical documentation data the specialized software systems are developed. In this paper comparative analysis between Autodesk Vault and SolidWorks PDM is shown. The advantages and weakness of both systems are presented on a practice example

Key words: Documentation vault, product data management, technical documentation, workflow

1. INTRODUCTION

In mechanical engineering, technical documentation is related to set which includes handling description, functionality description, materials lists, technical drawings, product architecture engineering calculations of a product under development or use. In technical documentation, most often are included: technical specifications, drawings, bill of materials, engineering documents etc. As products becomes more complex like nowadays it is very challenging to handle all of this data. In purpose of handling technical documentation data the specialized software systems are developed. The most complex software that are used to run big companies are called Enterprise

Resource Planning, shorten ERP. The most used ones are: NetSuite, SAP and Microsoft Dynamics AX. The part of these systems are related to technical documentation. As the technical documentation comes from CAD software, CAD companies needed to develop a solution, which can be easily integrated into described big systems. The most widely accepted Autodesk and Dassault Systems developed ones. The software for handling the technical documentation developed by Autodesk is named Autodesk Vault, while the one of the solution developed by Dassault Systems is named SolidWorks PDM. These software packages and its workflow architecture, during the last decade, becomes a very attractive topic as for practice implementation as well as research topic in order to make documentation workflow easier and user friendly for all users.

Product data management is a tool that helps engineers and others manage both data and the product development process [1]. The very beginning in usage of product data management tools is related to the Universities for teaching students of teamwork and preparing them for practice. One of the first implementation of these systems is described in paper [2]. This example of product data management usage becomes widely accepted as at Universities as well in practice. One of SolidWorks

implementation example is show in paper [3]. Barbero et. al. were used these tools in order to gain communication between interactive 3D CAD objects and network users [4]. Application of the PDM software packages are lastly appeared in neighbor counties, such as Bulgaria [5]. The PDM tools can also be used in communicating between CAD software [6,7]. This is more common for Autodesk solution. The Stojkić and Bošnjak used Solidworks PDM for supporting the Learning Factory and University of Mostar [8]. The application of the PDM tools is not a option any more, it is a need for the future engineers.

This paper presents a comparative analysis between Autodesk Vault and SolidWorks PDM. The advantages and weakness of both systems are presented by comparing the main characteristics from the users aspect.

2. AUTODESK VAULT CHARACTERISTICS

One of the most important aspect in understanding PDM tool working is certainly its software architecture. Autodesk Vault has three components, which are marked as primary ones: a webserver, a database and a file store. The Autodesk Vault architecture is shown in Figure 1. The main service that it is used in Autodesk Data Management – Autodesk Vault is Windows Internet Information Server (IIS). This service needs to be installed and enabled at all as client computers as well as at Servers computer. The Autodesk Vault server is a Web application that uses services to manage the communication between the clients and the server with Web services. The interaction between the clients and the server is working similar as the way a web browser communicates with a site on the Internet [9].

The server with database is tracking all of the relationships between data. Database server is acting like a catalogue library, and it contains all indexes and pointers where is information that client requires. Autodesk Vault is using a Microsoft SQL server by default. Initially is install with Express version, but if the

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amount data requires it can be upgraded to higher versions. Commutation port via Web server is set to 80 by default after the installation. The data file store and data webserver corresponds to each other and work together. All indexing information about file locations are provided by database. The file store is the most secured place in this architecture and it protects all of the data which is on the storage.

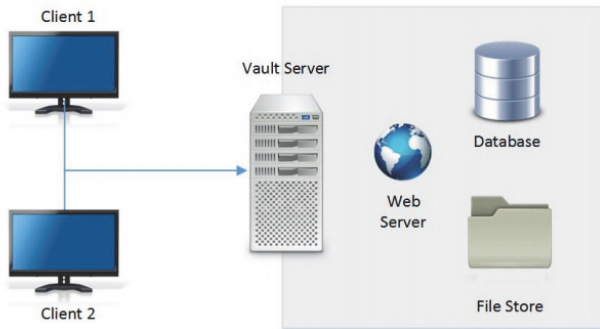


Fig.1. Autodesk Vault Architecture

The part which client see is the Vault Explorer. The Vault explorer is a standalone client application which allows clients to see the database structure, conduct searches, access the stored files, and use the data. The Vault explorer is a client interface insight into database. The client application is organized same like Windows Explorer or Microsoft Outlook to be easier for user experience. The Vault explorer has a folder tree on the left and a list of associated project data files on the right. User credentials access the Vault, which is given to user from the Vault Administrator. The currently used data is secured from unauthorized access and changes, so the unwanted changes are prevented.

The Autodesk Vault is integrated with within Autodesk parent applications: Autodesk Vault for Autodesk Inventor® software package, Autodesk Vault for AutoCAD® software package, Autodesk Vault for Microsoft® Office or Autodesk Vault for Plant3D® etc.

These clients provide two main options:

- Direct access to the vault database via currently used application and
- More data knowledge to the vault when interacting with the vault server.

A vault add-in is a piece of client software that is installed as plug-in into Autodesk existing applications in order to extend its capabilities to support vault operations and workflows. These tight integrations allow user to interact with the vault while working in the context of the applications that are used daily.

Each component of Autodesk Vault PDM tool can be configured to run on its own server. In server configuration, each component is configured according to workflow shown in Figure 1. The default Autodesk Vault workflow is:

1. User send checks out a file command;
2. Check out command sends a request for the file to the Vault server;
3. Vault server sends a query to the database;
4. Vault server copies the files from the file store to the user local machine so the user can do files modification etc.

It is very important to notice the user computer is not in direct communication with another user computer at any time, so the vault server is one and only which can delegate files.

A Vault implementation does not necessary be complicated. It can be simple if all of the Vault components are installed on a single machine. If different components are installed on different machines, especially if the machines are not close to each other (for example on remote locations), the implementation becomes very complex. Before the Autodesk Vault PDM tool is even considered for the implementation the information check list needs to be made. That checklist considers of the following:

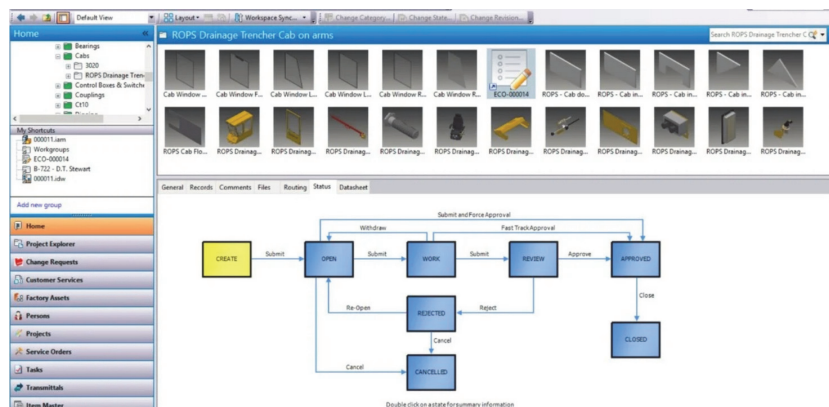


Fig.2. Autodesk Vault default workflow setup

1. Number of users who will be using Autodesk Vault.
2. The number of servers (Fore easier implementation lower number, one if is possible).
3. The hardware specifications for all the servers.
4. The Operating Systems for all servers.
5. All firewalls installed on servers.
6. List of other applications running on all servers.
7. The version of Microsoft® SQL is going to be used.
8. Frequency of users' access information in Autodesk Vault.
9. The latency between all servers, [9].

When all of these checklist items is carefully planned and considered, it will be prevented having an access problems and slow response times. For example, if the more than ten users occurs at the time the newer server versions must be used. For more than 25 users, the usage of SQL enterprise must be considered. When the implementing Vault is for a single user, all of the components can be loaded on a single machine [9].

3. SOLIDWORKS PDM CHARACTERISTICS

SolidWorks product data management (PDM) tool is used to manage and synchronize the design data across your

entire company with a single server solution, which is tightly integrated with all SolidWorks applications. This tool is very easy deployable. By leveraging a secure vault, 3D design environment and associated files can be used by all participants from engineering to manufacturing. This way of configuration enables everyone involved in the company projects to share information and collaborate on designs, while automatically protecting the company intellectual property with the automated version and revision control systems [10-11]. The architecture of SolidWorks PDM system is shown in Figure 3.

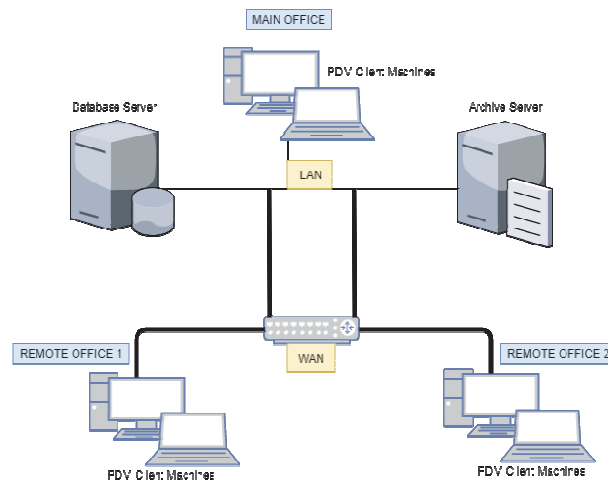


Fig.3. Solidworks PDM architecture

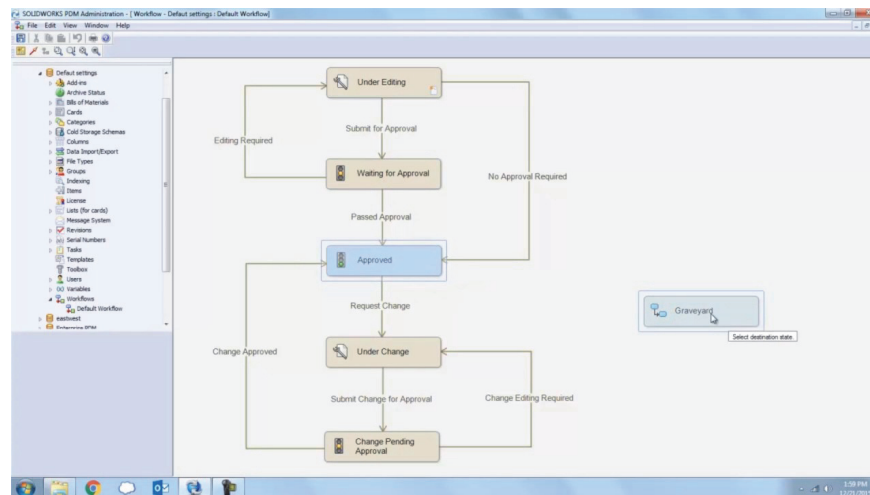


Fig.4. SolidWorks PDM workflow

SolidWorks PDM tool is used to centralize all of the products engineering data and brings the users many benefits, such as:

- product data repository has a very fast response, a faster than Autodesk Vault;
- the file version controller does for both minor and major changes, and it writes and save them on data storage, which is very useful in preventing a data losses;
- workflows are integrated in the way to automate the design and approval process in order to gain a much more efficient release of the new products;
- product data management reacts very fast to the search queries which reduces search and check out time significantly, no matter of file type which is searched.

SolidWorks PDM tool is powered as well as it is Autodesk Vault with Microsoft SQL Server. In dependence of number of users SolidWorks PDM tool uses different versions of Microsoft SQL Server, standard package for small amount of users, Enterprise for big companies. The SolidWorks PDM tool has a very good characteristic in user experience:

- product data can be searched in a multiple ways with usage of characteristics such as: document or file name, data content, or by using a custom properties like part numbers, part description, or momentary workflow state;
- it gives to the users a very fast response and access to the parts, assemblies, material specifications, engineering calculations etc. For all actions the file replication is used in order to prevent data losses;

- it has a wide range of ways to access the vault files such as smartphones, tablets or other devices;
- the file management is very simple to use, so the file access control can be easily operated;
- users can easily reproduce a bills of materials for each product or assembly and customize them for usage in different departments;
- it support a very large number of file extensions can be used such as: CAD formats, MS office files, pictures, animations and so on;
- it automatically creates neutral files like PDF files, eDrawings or STEP files;
- it has advantage that it is integrating in many popular CAD software packages and so on.

SolidWorks PDM tool by installation has a workflow like it is shown in Figure 4. This type of workflow prevents the confusions in user side about product current status. It is also very easy to do products, assemblies and parts submittals and approvals. Users can easily customize the show workflow and management needs.

SolidWorks PDM tool is very user friendly and it has an intuitive graphical user interface. This interface is designed to help the users to map workflows and do a minimal amount of administrative work, while automated tracking of approvals and sign-offs maintains accuracy and accountability. The advantages of the described user interface are:

- utilization of a multiple workflows to handle different document types and approval processes;
- a multiple required approvers can be conducted with Parallel transitions command;
- usage of serial number generators is good to automatically create and assign properties like part numbers, project numbers, and document identification numbers;
- automation of project folder creating structures and standard documents is very useful to help ensuring consistency and completeness of the product data.

4. CONCLUSION

Both of the presented software packages have a numerous advantages. The advantages of both Autodesk Vault and SolidWorks PDM are:

- the information about any product component of document can be found very quickly;
- those tools improves productivity very much;
- PDM software packages reduces the errors and product developing costs;
- these software packages makes teams collaboration between users much easier etc.

However, there are some disadvantages in using PDM software packages such as:

- PDM system not used effectively due to users faults;
- possibility of duplication of data and effort;
- PDM system can too slow if there is no proper planning for the network bandwidth, server configurations, system configuration, etc.

All of those listed problems in PDM software packages usage can be overcome by proper configuration of

software and hardware and with proper users training. The advantage of SolidWorks PDM related to Autodesk Vault is that SolidWorks PDM is easier for configuration and it has less hardware requirements. The Autodesk Vault advantage is that it is much easier to handle standard product components and integration with rich content center databases. The disadvantage of Autodesk Vault is that it is much harder for configuration, and it requires stronger hardware support.

The future work in this field will be related to implementation of PDM software packages to the course Technical Documentation at Master Academic Studies. The future conclusions and testing of these tools will be made during to student practice projects conducting.

ACKNOWLEDGEMENT

Ministry of Education, Science and Technological Development of Republic of Serbia, Grants TR 35033, 35021 and TR 33015, supported research presented in this paper.

REFERENCES

- [1] Baxter, D. H. (2001). Examining the benefits of a self-taught solid modeling course. *age*, 6, 1.
- [2] Philpotts, M. (1996). An introduction to the concepts, benefits and terminology of product data management. *Industrial Management & Data Systems*.
- [3] Buchal, R. O. (2006). The Use of Product Data Management (PDM) Software to Support Student Design Projects. *Proceedings of the Canadian Engineering Education Association (CEEAA)*.
- [4] Barbero, B. R., Pedrosa, C. M., & Maté, E. G. (2012). Assessment of 3D viewers for the display of interactive documents in the learning of graphic engineering. *Journal of Educational Technology & Society*, 15(4), 167-180.
- [5] Dimitrova, N. (2015). Application of modern approaches for training of students. *International Scientific Online Journal-ISSN*, 2367-5721.
- [6] Antonov, A. (2018). Application of Autodesk Software Product For Training Of Students In General Engineering. *Association Scientific and Applied Research*, 13, 31.
- [7] Brasiel, M., & Faria, D. (2013). Practical Strategy and Workflow for Large Projects: A Realistic Solution.
- [8] Stojkić, Ž., & Bošnjak, I. (2019). Development of Learning Factory at FSRE, University of Mostar. *Procedia Manufacturing*, 31, 180-186.
- [9] Waguespack, C. (2013). Mastering Autodesk Inventor 2014 and Autodesk Inventor LT 2014: Autodesk Official Press. John Wiley & Sons.
- [10] Tickoo, S. (2019). *Learning SOLIDWORKS 2019: A Project Based Approach*. CAD/CIM Technologies.
- [11] Dogra, S. (2020). *SOLIDWORKS Simulation 2020: A Power Guide for Beginners and Intermediate Users*. CADArtifex.