TAMPERE UNIVERSITY OF TECHNOLOGY

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# CREATING TECHNICAL MANUAL FOR CONFIGURABLE PRODUCT IN PLM SYSTEM

Master of Science Thesis

Examiner: Professor Asko Riitahuhta
Examiner and topic approved in the Council Meeting of the Faculty of Automation, Mechanical and Materials Engineering on December 9, 2009

# ABSTRACT

TAMPERE UNIVERSITY OF TECHNOLOGY
Master's Degree Programme in Production Engineering
**ASIKAINEN, TUOMAS**: Creating Technical Manual for Configurable Product in PLM System
Master of Science Thesis, 82 pages, 2 Appendix pages
May 2010
Major: Production Engineering, Product development
Examiner: Professor Asko Riitahuhta
Keywords: content management, technical manual, product documentation

In recent years companies have put more effort to developing their product documentation processes. One reason is shortened time-to-market cycles and increase of the more complex products on markets. Companies are turning more and more to systems which offer more efficiency and cost-effective processes for their document creation. Companies and their document authors have been bombarded for several years now about single sourcing methodology and content management systems (CMS), which has been told to fulfill the needs that companies and authors nowadays has, when speaking of documentation.

This study focuses on Siemens PLM Software solution for creating documentation in PLM environment. Solution is called Teamcenter Content Management (Teamcenter CMS) which enables producing documents in XML language and publishing them in different delivery formats for instance in paper, PDF or HTML format . The main point in this study is to find out how Teamcenter CMS can answer the requirements that demanding, international machinery industry enterprise set for their user documentation and documentation process. Study is divided into two sections, to the literary part and to case study part. The first part explores the content management system and the structured documentation in overall. In the part the document and documentation process requirements are researched from the literary. In this thesis the case study part shows as an example of the one type of configurable product manual and its documentation process in Konecranes Oyj. Example demonstrates the documentation and its creation process in demanding machinery industry. Konecranes is one of the world largest producers of lifting equipments.

In the results section all requirements are gathered together and Teamcenter functionalities and capabilities is assimilated to them. In conclusion Teamcenter CMS is a create tool for producing the configurable, standard documentation with multi languages. Teamcenter offers also easy environment for authoring and integration with Teamcenter PLM enables authors to use the benefits that PLM environment brings for the system. However some further development should be done to make the Teamcenter CMS to work seamlessly with Teamcenter PLM system and to connect documentation process fully as part of the product development process.

# TIIVISTELMÄ

TAMPEREEN TEKNILLINEN YLIOPISTO
Tuotantotekniikan koulutusohjelma
**ASIKAINEN, TUOMAS**: Teknisen dokumentaation luonti konfiguroitavalle tuotteelle PLM -järjestelmässä
Diplomityö, 82 sivua, 2 liitesivua
Toukokuu 2010
Pääaine: Tuotantotekniikka, Tuotekehitys
Tarkastaja: professori Asko Riitahuhta
Avainsanat: sisällönhallinta, tekninen dokumentti, dokumentaatio

Viime vuosina yritykset ovat panostaneet yhä enemmän tuotedokumentaation luontiprosesseihinsa tehdäkseen niistä tehokkaampia sekä prosessina että kustannusmielessä. Suurin syy tähän on lisääntynyt kilpailu, joka nostaa yritysten paineita saada tuotteet nopeasti markkinoille. Kilpailu asiakkaista saa yritykset myös useasti tarjoamaan asiakkaille tuotteita, jotka vastaavat täysin määriteltyihin asiakastarpeisiin, saaden tuotteet monimutkaistumaan. Monimutkaiset tuotteet nostavat myös teknisten dokumenttien monimutkaisuutta.

Jo vuosia yrityksiä ja yritysten dokumentoijia on pommitettu single sourcing -metodologialla ja sisällönhallintajärjestelmillä, joiden on kerrottu ratkaisevan kovan kilpailun tuomat dokumentointihaasteet. Single sourcing -metodologiassa dokumentin sisältö luodaan modulaariseksi ja rakenteelliseksi siten, että dokumentin sisältö rakennetaan modulaarisista informaatioelementeistä, joita on mahdollista käyttää uudelleen eri dokumenteissa. Sisällönhallintajärjestelmä on taas joukko työkaluja joilla luodaan, muokataan ja hallitaan näitä modulaarisia informaatioelementtejä. Yleensä informaatio on luotu esimerkiksi erilaisilla merkintäkielillä, kuten muun muassa XML:llä (eXtensive Markup Language).

Tämä työ keskittyy Siemens PLM Softwaren sisällönhallintajärjestelmään, jolla voidaan tuottaa, hallita ja julkaista dokumentaatiota tuotteen elinkaaren hallintajärjestelmässä (PLM). Ratkaisua kutsutaan nimellä Teamcenter Content Management (Teamcenter CMS), joka mahdollistaa rakenteellisten dokumenttien luonnin XML -merkintäkielellä sekä niiden julkaisun eri formaateissa, kuten esimerkiksi paperi-, PDF- tai HTML- muodossa. Teamcenter CMS on integroitu Teamcenter PLM -järjestelmään, joka toimii esimerkiksi tuotesuunnittelu- ja tiedonhallintaympäristönä monissa yrityksissä. Työ on teetetty Ideal Product Data Oy:lle, joka toimii Suomessa sekä Venäjällä Siemens PLM Softwaren tuotteiden jakelijana. Tutkimuksen tarkoituksena on selvittää kuinka Teamcenter CMS pystyy vastaamaan vaativan konepajateollisuuden asettamiin haasteisiin teknillisille dokumenteille sekä dokumentoinnin luontiprosessille. Tutkimus on jaettu kahteen osaan, jossa ensimmäinen osa koostuu kirjallisuustutkimuksesta ja toinen osa Konecranes Oyj:n tapaustutkimuksesta.

Dokumentti voidaan ymmärtää monella tavoin. Kuitenkin tässä työssä dokumentti terminä käsittää vain teknisen dokumentin. Tekniseksi dokumentiksi kutsutaan

tuotteeseen liittyvää dokumenttia, joka välittää tuotteeseen liittyville sidosryhmille informaatiota esimerkiksi tuotteen käytöstä, hoidosta tai huollosta. Se mitä informaatiota dokumentti sisältää, riippuu täysin siitä onko kohderyhmänä esimerkiksi loppukäyttäjä vai huoltomies. Yleisesti teknisestä dokumentista käytetään nimeä manuaali. Kuitenkin dokumentoinnista puhuttaessa on huomattava, että dokumentointi ei pelkästään sisällä lopputuloksena saatavaa manuaalia vaan koko dokumentin luontiprosessin.

Teknisen dokumentin luonti yksinkertaiselle massatuotteelle ei välttämättä ole kovinkaan monimutkaista tai työlästä. Kuitenkin kun puhutaan konfiguroitavista tuotteista, joista voi syntyä monta erilaista tuotevariaatiota, myös erilaisten dokumenttien määrä kasvaa. Kun tuotevariaatioiden dokumentteihin lisätään vielä kielituki yli 20 eri kielelle, muutama eri tuotemerkki, jolla tuotetta myydään ja dokumentin eri formaatit, kuten esimerkiksi paperi, WEB-dokumentti tai PDF, saadaan yhdelle tuotteelle helposti yli 1000 asiakaskohtaista manuaalia. Puhumattakaan siitä, että kyseiset dokumentit on pidettävä ajan tasalla tuotemuutoksista. Edellä mainitut dokumentin ominaisuudet haastavat minkä tahansa dokumentinluontiprosessin.

Sisällönhallinta käsittää sisällön keräämisen, hallinnan ja julkaisemisen mihin tahansa tarpeeseen. Sisältö taas määritellään teoriaosuudessa informaatioksi jota ympäröi sitä kuvaava data, jota kutsutaan myös metadataksi. Informaatio on yleisemmät tallennetun viestinnän muodot, kuten esimerkiksi video, kuvat, teksti. Metadata on taas informaatiota, joka kuvaa informaatiota kuten esimerkiksi kuvan piirtäjän nimi tai piirtovuosi. Sisällönhallintajärjestelmä koostuu yleisesti sisällönluontijärjestelmästä.

Teamcenter Content Management tarjoaa käyttäjälle mahdollisuuden luoda informaatiota XML -muodossa sekä liittää tuotettuun informaatioon tarvittavaa metadataa. XML- kieli on rakenteellinen kuvauskieli, joka auttaa jäsentämään laajoja tietomassoja selkeämmin. Se koostuu erilaisista elementeistä, jotka kuvaavat niiden sisältämää informaatiota. XML-pohjaisen informaation luonti tapahtuu Teamcenter CMS:ssä erillisellä XML editoreilla, johon Teamcenter CMS mahdollistaa integroinnin. Ammattimaiset XML editorit ovat nykyään niin pitkälle kehittyneitä, ettei tekninen kirjoittaminen useinkaan tarvitse XML:n erityisosaamista teknisiltä kirjoittajilta. XML-kieltä hallitaan ennalta määrätyillä säännöillä, kuvauskielillä. Yksi kuvauskieli on esimerkiksi Document Type Definition (DTD). Kuvauskielet määrittelevät usein informaation ja dokumenttien rakenteen, mahdollistaen dokumentoinnin vakioimisen. Teamcenter CMS:ssä XML-elementtien muodostamia kokonaisuuksia kutsutaan topiceiksi.

Teamcenter PLM-järjestelmä tarjoaa dokumentoijien käyttöön monia tuotetiedonhallintajärjestelmän (PDM) ominaisuuksia, joista Teamcenter CMS:ää ajatellen tärkein on työnkiertojen määritteleminen sekä niiden editoiminen. Työnkiertoja käytetään esimerkiksi sisällön elinkaarenhallintaan tai sisällön kääntämiseen toiselle kielelle. Teamcenter CMS on mahdollista yhdistää työnkierron avulla esimerkiksi käännöstoimistoon, jolloin käännettävä topic lähetetään käännettäväksi ja käännetty topic vastaanotetaan takaisin Teamcenter -järjestelmään.

Toisessa osassa esimerkkinä tuotedokumentaatiosta esitellään XN -ketjunostimen omistajamanuaali sekä sen luontiprosessi Konecranes Oyj:ssä. Esimerkki kuvaa dokumentointia ja sen luontiprosessia vaativassa konepajateollisuudessa. Konecranes on yksi maailman johtavista nostinvälineiden valmistajista. Tästä olemassa olevasta prosessista kerättiin vaatimuksia, joita vaativa konepajateollisuus asettaa dokumentoinnille tai sen luonnille. Esimerkki toimii osaksi tukena teoriaosuudessa löydetyille dokumentoinnin haasteille.

Tutkimuksen tulososiossa kirjallisuus- ja tapaustutkimuksessa tulleet vaatimukset on koottu yhteen. Vaatimuksia verrataan Teamcenter CMS:n toiminnallisuuksiin ja kykyihin arviointimatriiseilla. Näissä kahdessa arviointimatriisissa käsitellään esille tulleita dokumentin ja sen luontiprosessin vaatimuksia, joita verrataan Teamcenterin kykenevyyteen tuottaa asiakaskonfiguroitu dokumentti. Tuloksena saadaan, että Teamcenter CMS on toimiva ja hyvä työkalu konfiguroitavien ja standardoitujen dokumenttien luontiin eri kielillä. Teamcenter tarjoaa myös helpon ympäristön sisällönluontiin ja integraatio Teamcenter PLM -järjestelmän kanssa tuo kaikki PLM-järjestelmän tuomat hyödyt dokumentoijien käyttöön. Teamcenter CMS -integraatio Teamcenter PLM järjestelmän kanssa ei kuitenkaan ole vielä täysin toimiva. Integraatiota voisi esimerkiksi kehittää suuntaan jossa luotava sisältö saadaan täysin liitettyä valmistettaviin tuotteisiin, mikä mahdollistaisi esimerkiksi asiakaskohtaisen manuaalin julkaisemisen suoraan fyysisestä tuoterakenteesta. Teamcenter CMS ei myöskään tarjoa vielä 8.1 -versiossa DITA-tukea, josta monet yritykset ovat kiinnostuneita. DITA on arkkitehtuurinen kuvauskieli, joka tuo dokumentaation rakenteellisuuteen lisää syvyyttä. Pienistä ominaisuuksien puutteesta huolimatta Teamcenter CMS tuo dokumentoinnin lähemmäs muuta tuotekehitystä ja parhaimmillaan pystyy tehokkaasti tuottamaan asiakaskohtaisia tuotemanuaaleja.

# FOREWORD

The idea of this thesis was brought up in spring 2009 when Siemens PLM Software (SPLMS) released the Teamcenter 8 version. SPLMS announced that Teamcenter 8 would include also integrated tool called Teamcenter Content Management to create and manage the XML based information in engineering environment and publish it in different output formats. This all sounded really interesting to me and to some of Ideal Product Data Oy customers. Thesis was decided to produce in co-operation with Konecranes Oyj which was interested in of the Content Management tool.

I want to thank Professor Asko Riitahuhta who examined this thesis. Greatest thanks for my co-workers in Tampere and Vantaa, who made this thesis possible and special thanks for the supervisor of this work Teppo Salmia who guided me trough the writing process and who also acted as proofreader of this thesis. Thanks belongs also to Konecranes, and especially to Sami Kentta and Matti Lehto, who gave me the idea to this thesis and let me use their Konecranes specific material.

I want to thank also my dear friend Ville who spend exhaustive days with me in the group working class and my girlfriend Ella who let me spend too much time with my thesis.

Tampere, 18.5.2010

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# ABBREVIATIONS

| | |
|---|---|
| **ASCII** | American Standard Code for Information Interchange |
| **CM** | Content Management |
| **CMS** | Content Management System |
| **CPD** | Collaborative Product Design tools |
| **DAM** | Digital Asset Management |
| **DITA** | Darwin Information Typing Architecture |
| **DM** | Document Management |
| **DTD** | Document Type Definition |
| **ECM** | Enterprise Content Management |
| **EDS** | Electronic Data System |
| **ERP** | Enterprise Resource Planning |
| **IETM** | Interactive Electronic Technical Manual |
| **IPD** | Ideal Product Data Oy |
| **JPEG** | Image format |
| **KM** | Knowledge Management |
| **MSWord** | Microsoft Word |
| **NX** | 3-D CAD program |
| **PDF** | Portable Document Format |
| **PLM** | Product Lifecycle Management |
| **PNG** | Portable Network Graphics image format |
| **R&D** | Research and Development |
| **S1000D** | DTD standard |
| **SDRC** | Structural Dynamics Research |
| **SGML** | Standard Generalized Markup Language |
| **SPLMS** | Siemens PLM Software |
| **Teamcenter CMS** | Teamcenter Content Management |
| **WCM** | Web Content Management |
| **XML** | eXtensible Markup Language |
| **XN** | Konecranes chain hoist model |
| **XPP** | XYEnterprise XML Professional Publisher |
| **ZIP** | Packaging format |

# 1 INTRODUCTION

When speaking of buying a new product or delivering product orders, the actual, physical product seems to be the main thing. Often it is hard to think that almost every product comes also with some kind of documentation, regardless whether it is medicine bought from pharmacy, a toy which turns up from Easter egg or some more complicated electrical device, such as MP3 player. Product documents are delivered with product despite the level of complexity or the size of the product.

When talking of product's manual or other documentation, it is wrong to assume that the manual or other documentation is always the same in every product. Sometimes creating the documentation needs as much effort as creating the actual product. Often manual has actually more variations than the physical product has; languages, cultural issues, target audience, purpose of the documentation, product brand and so on, are things that affects critically for the structure of the product documentation. When product manufacturer takes account into these factors, one product manual can be soon a variation of manuals even speak is of the same product.

To produce variety of manuals is a challenge for the enterprises; for instance small cultural differences in the warning labels on document can be huge effort for document creation process. To complete product documentation on schedule, reach the needed quality and make product documentation unique for the specific product, enterprises have to succeed on their documentation processes.

To help this, a number of different computer system providers have made special tools for documentation producers. These systems are called Content Management Systems (CMS) and they are tools which comprise the system for managing and creating the documentation and its elements. To work efficiently CMS needs for the background a powerful methodology to be executed, which is called single sourcing methodology? Siemens PLM Software is offering solution for managing content and executing single-source methodology. The big question is: has this Teamcenter Content Management system capability to answer the challenges what heavy machinery industry faces on their technical documentation.

## 1.1 Problem description

When enterprises are producing configurable products and they want to produce product specific, configured manuals, the amount of different manual variants grow to hundreds. When these hundreds of manuals are produced in over 20 different languages, several different brands and with couple different industry standards, the amount of different variations grow even for hundreds of thousands. How enterprises can handle this? How

to create the documents easily, cost effectively and on schedule? How to make sure that documents are always up-to-date? These are only the few of the questions that can be asked.

## 1.2 Purpose of the study

The main purpose of this master thesis is to study how Siemens PLM Software´s Teamcenter 8 solution, Teamcenter Content Management can answer the needs of contemporary machinery industry documentation production. Study aims also to give the reader an understanding of content management systems, structured authoring and single sourcing methodology behind it. As the contribution of the study, thesis contains a case study which introduces the documentation environment in Konecranes Finland Oy which is on big heavy machinery company in Finland. Study benchmarks Teamcenter CMS functionality for the heavy machinery industry documentation demands that are lead from the cases study and from the theoretical part of the study.

## 1.3 Terminology and scope

Documentation can be understood in many ways but in this thesis we are concentrating to technical documentation despite that results of the study could be valid in context of other kinds of documentation also. Study associates the term technical documentation with the documents and information that are passed on to the public by the manufacturer for instance user instructions, operating instructions or servicing instructions. In the case study as an example is used owner's manual of the chain hoist which includes instructions to use, operate and maintain the product. In this thesis by document is meant technical documents.

Nevertheless technical documentation is not only just the document itself, but also the process how we make the document. As Haramundanis states (Haramundanis 1998, p.1); "Technical documentation is both the work you do when you prepare technical documents and the result of your work". This study focuses the documentation process which is made with Content Management Systems, using single sourcing methodology. Study does not compare the system for any other documentation systems.

From the meta-languages this thesis concentrates only on XML even when some other possibilities exist. Reason for using XML is that it is maybe the most used meta-language and easier to adapt. XML works just example of how structured authoring can be made with these languages.

Teamcenter Content Management which this thesis is about includes a pack of customization solutions which either made by SPLMS or some third side. However this thesis does not take account of these customization solutions or any other solutions that is included to the commercial version of Teamcenter CMS.

## 1.4 Structure of the study

The subject of the study is approached from two view points: the theoretical and the case study part. First, the theoretical part surveys the challenges on the technical documentation and its creation process. Part introduces the content management system and the single sourcing methodology behind it for the reader. Part presents also Teamcenter Content Management System and it capabilities and functionalities in Teamcenter PLM environment. Second, the case study is presenting the example of the owner´s manual of the configurable product and its creation process in Konecranes Oyj.

Thesis consists of eight chapters. Introduction is followed by five chapters of theoretical part; Background information (chapter 2) which introduces the company to where this thesis is produced and Teamcenter PLM product. Overview of technical documentation (Chapter 3) where is told what is meant by technical documentation and what challenges industries meets. Key concepts of Content Management (chapter 4) and Content Management System (chapter 5) which introduces the content management as a concept and it’s the constitution. Teamcenter Content Management (Chapter 6) shows the capabilities and solutions which Teamcenter CMS offers and how to operate with them. Theoretical part is followed by second part of the study, the Konecranes case study. Case introduces the owner´s manual creation process for the configurable, a customer specific product and its creation process in Konecranes Oyj. Results and discussion of the study is presented in the chapter Conclusions and discussion (Chapter 8).

# 2 BACKGROUND INFORMATION

In this chapter we take a look at the companies, to which this thesis is produced and the product Teamcenter PLM system where this thesis is related.

## 2.1 Ideal Product Data Oy

Ideal Product Data Oy (IPD) is Siemens PLM software`s (SPLMS) local partner in Finland. SPS is a one of the Siemens Industry Automation Division's business unit. According to Gardner Inc. SPLMS is the leading Product life-cycle management (PLM) software provider in the world. (Halpern & Miklovic 2008) Company's headquarter is situated in Plano, Texas. Siemens PLM Software was born when Siemens acquisition of UGS Corp. (UGS) closed on May, 2007. Soon after that company's name changed to Siemens PLM Software. Co-operation between IPD and SPLMS started already in 1993 but the full-partnership has started in 2001.

The main office of IPD is located in the city of Vantaa with ca. 25 employees and satellite offices are located in the city of Tampere with 6 employees and the city of St. Petersburg, Russia with 5 employees.

Ideal Product Data Oy offers PLM solutions for different business areas from textile industry to machinery and to high tech industry. IPD tries to answer companies PLM needs by analyzing customer business environment, finding right products to answer customer business demands and implementing and supporting the products. IPD co-operates continuously with SPLMS product development and informs them of development and improvement suggestions coming from the customers.

Product families which IPD represents are: NX, CAD/CAM/CAE commercial software suite, Teamcenter, integration of product lifecycle management (PLM) and collaborative development tools (CPD) and Tecnomatix, a manufacturing and factory planning suite. (Ideal Product Data Oy 2010)

## 2.2 Teamcenter

Teamcenter is a worldwide leading product lifecycle management (PLM) system developed by Siemens PLM Software. It works as a gateway to a company´s product information and enables product and manufacturing data management during the whole product lifecycle. With Teamcenter, companies can e.g. manage product configuration, manage requirements, control changes in design, integrate project information with product data, design product manufacturing, manage approval processes and exchange information between downstream applications such as ERP systems. Information and

data stored in Teamcenter system is accessible to everyone on globally, in certain organization, in real time. (Getting started with Teamcenter guide)

Teamcenter's inclusive end-to-end PLM solutions allow the customer to choose the right blend of solutions for his business need for example from the following Teamcenter modules:

- Enterprise Knowledge Foundation
- Bill of Materials Management
- Community Collaboration
- Compliance Management
- Content and Document Management
- Engineering Process Management
- Formula, Package and Brand Management
- Lifecycle Visualization
- Maintenance, Repair and Overhaul
- Manufacturing Process Management
- Mechatronics Process Management
- Platform Extensibility Services
- Portfolio, Program and Project Management
- Report and Analytics
- Simulation and Process Management
- Supplier Relationship Management
- System Engineering and Requirements Management

Teamcenter is a result of merging two different product lines and two different companies. In the 90's UGS developed a product data management (PDM) product called IMAN which, after Electronic Data Systems (EDS) purchased UGS, became known as Teamcenter Engineering. The other company was Structural Dynamics Research Corporation (SDRC) and the product was Metaphase, which later became Teamcenter Enterprise. Latest released version on Teamcenter is version 8.1, released on November, 2009. (Siemens PLM software 2009)

# 3 OVERVIEW OF TECHNICAL DOCUMENTATION

Over the decades people have gathered information from everywhere but to make it accessible has required the creation of documentation. Documentation is defined to include text, graphics, images, rich media such as video, audio and animation. The collected information could be presented also in different format depending on the use for instance in technical information sheet, owner´s manual, reports or presentations.

This chapter takes a look of technical documentation and more closely owner´s and service manuals. Chapter introduces the challenges that enterprises are facing on technical documentation processes: how product variation, global business, schedules, product changes and collaboration of the different product development departments affects the creation of the technical documentation.

## 3.1 Technical documentation

The goal of technical documentation can be different depending on the product it is related with. Some documents include warnings and safety instructions, some documents have product information and some instructions to guide use of the product or maybe documents include all aforementioned. To which audience the technical documentation is targeted, defines mostly what the document has inside. Person in product service needs different things than the person who is using the product and marketing different than manufacturing. In other words: document has always some purpose which depends on the documents audience. Good example is for example the differences between service manual and operator manual, which is also known as user manual or owner´s manual.

Most operator manuals contain instructions for assembly, operation, maintenance, and storage of products. Many of them contain also sections on trouble-shooting, service and repair depending to what purpose the documentation is meant for. Operator manuals give verbal and visual instructions for the use of the product or its variants. Almost every product comes with some kinds of instructions, how to use it or how to take care of the product. “How-to” is maybe a simple, right word to describe the contents of these publications.

Depending on how complex a product is, it might have separate manuals for service and repair. A service manual has much more specialized use and purpose than operator manual. This can be seen in the content of the service manual, in text and instructions which are more specific and exact. One example of differences between operator and service manual’s contents are presented in Figure 1. (Schoff & Robinson 1991, p.1-2; 125)

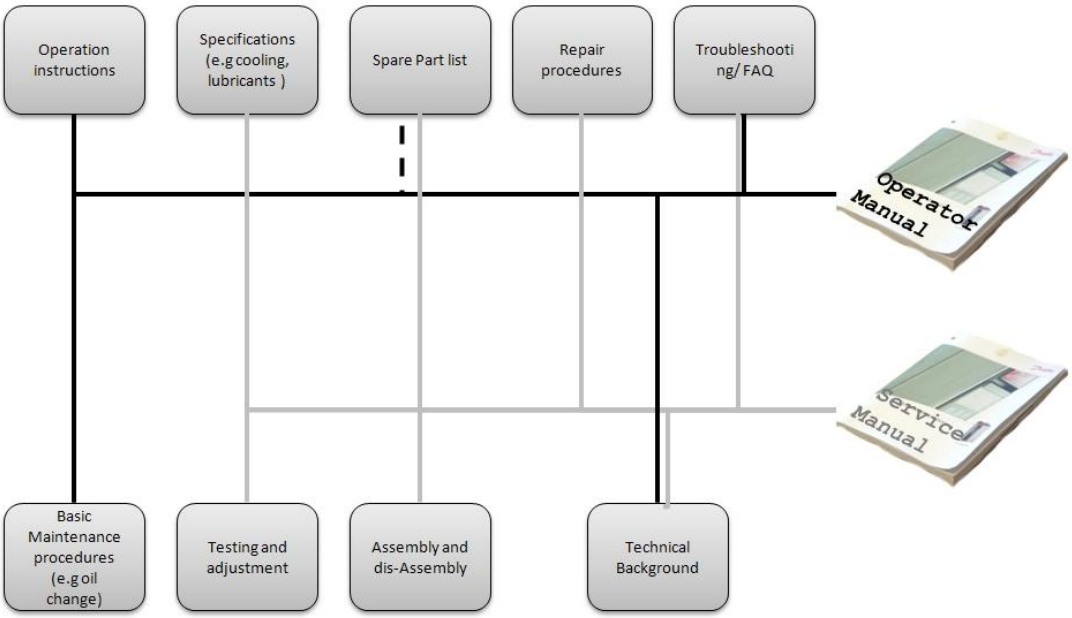



***Figure1*** *Example of differences between operator and service manual (modified Schoff & Robinson 1991)*

Manuals have to include relevant information of use of the product, so that different levels of users can utilize the manual in their needs. Operator and service manuals differ also from each other on this way. Operator manual includes usually just basic operations, advising users to operate product safely, handle product right to keep it on good shape or make some small maintenance operations. A service manual is indented for service personnel, who are coming from manufacturer or some third party to fix complicated problems, failures that product user cannot fix. Service personnel are usually technically oriented, educated professionals and more familiar with the product than basic user. Service personnel do not maybe need so specific knowledge about the product use or keeping product in a good shape. They need to know the components of the products and how to replace them. To do these service personnel needs to know how product is produced to disassemble and assemble it. (Schoff & Robinson 1991, p.126; Pöyhönen & Tiusanen 1991, p.21)

## 3.2 The importance of technical documentation for the end-customer

At first sight, technical documentation seems to include information to use, to repair or take care of the product. However the truth is that technical documents are much more than simply information that they include, sometimes technical documents, such as manuals are determining the quality of the product. When a customer buys a new product, he might be disappointed in a product if it is not as easy to use as he expected.

A customer might open the new product package and play with it without watching a handbook because handbook seems so complicated. A poorly designed, equivocal, or hardly understandable manual may give a customer a sentiment of poor product quality and ensure a customer does not buy the company's products again. Customer might spread the word of the failures on the product and product instructions to other potential customer and get him to change his decision of buying the product. (Silver 2007)

Although companies invest a lot in customer services to increase customer satisfaction they often underestimate the value of good product documentation. User manuals, instructions, online helps and training manuals are the first message about the product to a customer after the sale and also a good chance to make the message of the product positive. If the company succeeds in sending this positive message by making manuals usable, customers might get greater satisfaction from the product even though a manual does not create more features for a product. Greater satisfaction might increase the customer loyalty and furthermore the company might reduce costs of decreasing customer service or help desk calls. Good quality manual is going to be read, used and saved by the owner – and sometimes coveted and copied by competitors (Schoff & Robinson 1991, p.2-3; Silver 2007).

## 3.3 Technical documentation business challenges

Technical documentation has become a substantial part of a product's development cycle. It should conform to different factors on product development area for example such as product variation and local preferences of global markets. When thinking of creating documents for the different audiences, it might be easy to create documents for simple products for a certain audience. Nevertheless, when companies deal with more complicated products which are often sold globally, have maybe several different variations and brands, documents creation is not simple anymore. Figure 2 illustrates as an example of how many variations of different technical document could exist when talking of configurable product. In the Figure are presented only three options of each variable.

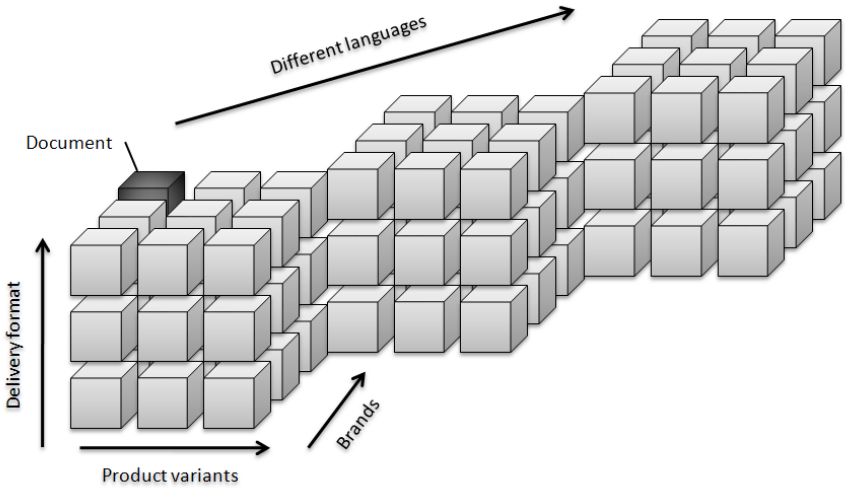



***Figure 2*** *Example of how many document variants born, when speak is of four variables and their three options.*

KGU (KGU Consulting GbmH 2007) sees a several challenges on creating product documentation and adds that winning all these challenges can be kept in many industries as premise for competitiveness. To understand these challenges better it is important to open them a little bit.

**Product configuration and product variants**

Customers want a product that answers fully to their need for an individual product. Individual product is created in sale-delivery process when a customer specific configuration is made. The product structure is designed to be modular so that individual product or its variation can be build driven-by-order and individually from pre-produced components. (Soronen 1999, p.9)

Nevertheless, creating a unique product is very expensive and cannot satisfy a large group of customer. To achieve fast, flexible, high quality and customer oriented production, companies has focused to mass customization where configuration is playing a big role. (Soronen 1999, p.2) Sääksvuori and Immonen (2002 p.24) define a product configuration or a configuration process as customizing a product according to customer wishes, meaning of producing some variation of the physical properties of the product, from where a customer can choose combination of features he wants for his individual product. Product variants are formed when product includes a group of different, mutually exclusive physical properties or subsections of the product. This group, containing all the possible variants forms a generic structure of the product, which is created during the product development process. A generic product structure exists because it consists all possible product structures that product has and where the customer specific product is easy to configure. It is not maybe wise to present separately the all possible product structures of the product. (Saaksvuori & Immonen 2002, p.24) Figure 3 presents a simple example of the generic product model. In the figure two

different product variant have been generated from the generic model in module level. Generic product model of course can be reach also to part level of the product structure.

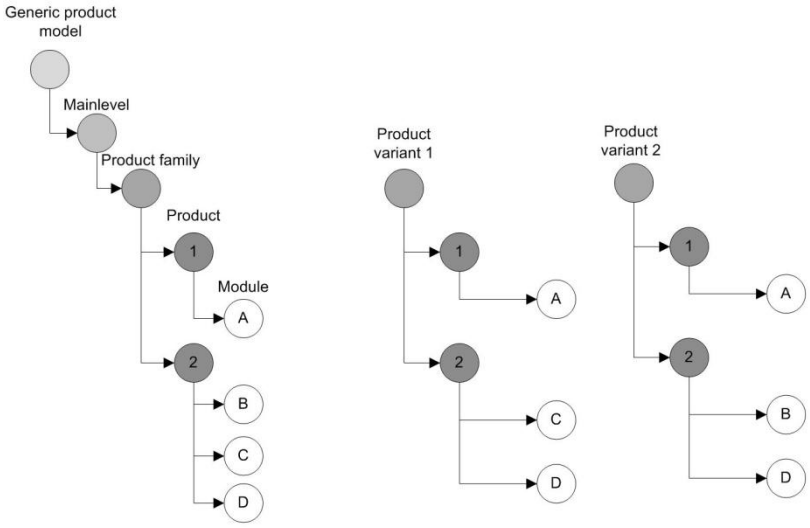



***Figure 3*** *On the left is a simple example of the generic product structure and on the right its two configured variants.*

Each variant is configured to meet customer demands by choosing right combination of modules by a specific requirement list of that particular product family.

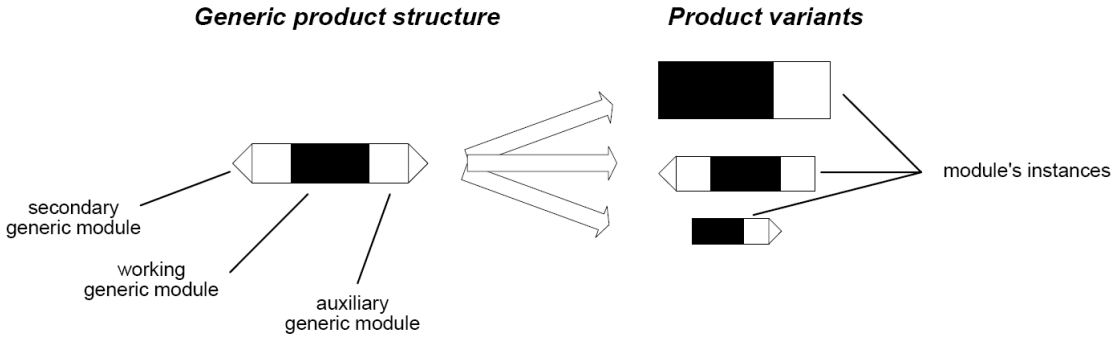



***Figure 4*** *Three different module types in generic product structure (Riitahuhta et al. 2001)*

Riitahuhta et al. (2001) defines that generic product structure consists of three different module types: working, secondary and auxiliary modules. Example of these modules is presented in the Figure 4. Working modules exist in each product variant in a particular product family. Auxiliary modules constitute of product variants listed by the customer´s requirements. Secondary modules exist only if working modules or auxiliary generic modules need some supplement module to reach customer´s requirements.

As companies are trying to meet customer needs better via product configuration, make production more efficient and lift up productivity; and at the same time to reduce

cost and lead times, they have to pay attention also for technical documentation. In the cases where company wants to produce documentation which coincides with configuration of the variant the supporting documentation for each variant has essentially the same information except for a few differences. The organization must find a way to manage these different documentation sets for each variant. Changes to common information must be reflected in documentation for all variants, while changes for one or a few variants must be made to the pertaining documentation only. (Siemens kalvo)

**Localization**

Globalization has been a trend decades now. Companies are more international and the economic links between nations have increased. If companies want to sell their products globally, their services and marketing also have to reach global level. (Schoff & Robinson 1991, p.145) This is meaning that product manuals has to reach the global level also which forces organizations to provide technical documentations, either paper or online for local marketplaces. Creating and producing technical documents for local use might cause many problems for the technical writes or documentation manager. (Davoid et al. 1995)

Despite that the world is shrinking, most people still only speak their own language and user documentation of the products has to be available in most cases also in user's native language. There are over 5000 languages and dialects spoken and in some cases product manual should be produced in over 20 different languages. To make a manual in English gives a huge advance because it is inherited from Romance and Germanic languages, from languages that are used in western countries. Often languages such as French, German, Spanish, Italian and German are sufficient to be used in European markets to meet user's native languages. Manual that is used in exotic country include also an exotic language, like Russian, Arabic, Japanese and Chinese. Problems with these languages are mostly in their different alphabets, characters and format. In Arabic manual must be formatted to be read from back page to front and text lines from right to left instead of from left to right. In Japanese some text are formatted like in western countries horizontally but some text is read vertically. Different measurement can be also problematic; measurements are changing from U.S imperial system to European metric system. (Schoff & Robinson 1991, p.145-148)

In some counties manufacturers produce documentation locally in different languages. For instance in Canada manuals have to be written in English and French and in Finland in Finnish and Swedish. Labor force in some places could as well be mainly from other countries. In this case manual or instructions, at least labels and warnings should be in labor force's own language to avoid futile accidents. (Schoff & Robinson 1991, p.148-149)

Line between localization and translation is a little bit unclear according to some experts who have research localization. (Hietaniemi 2006, p.11-12) Nevertheless, in

this thesis it not relevant to study what is the relationship between translation and localization but focus how international markets impact for document creating process.

**Delivery times**

Once a product is developed, effectively product launch becomes the critical step to its success. The product information must be published when the product goes to market or product launch is unsuccessful. Causing a missed product launch because of incomplete product documentation is the nightmare of every documentation department and often it shows as increased product costs. It might cause also a missed competition benefits compared to competitors by giving competitor to launch first. In many cases product launch cycles become faster because of increased competition. Documentation departments have to try keep up in same speed with other product development and try to get documentation ready for the product launch. Same time document authors try to increase customer satisfaction with high quality documentation which brings authors more pressure at their work.

**Keeping documentation up with product changes**

Increasingly complex product needs also more effective change management. PDM and PLM systems are taking care of the version and revision controlling when speaking of product changes. Nevertheless, the product documentation has to change alongside of product. What could be worst for documentation than be attached with product which does not match the information the documentation includes. In worst case scenario, product is futile to use with incomplete instructions. Incomplete product documentation decreases also dramatically the document quality which effects of course straightly for quality of the physical product.

More challenging is to keep documentation up-to-date when documentation is created by subcontractors. Product documentation is seen as a part of the product development even enterprises are does not consider it as part of product manufacturing processes. This causes that documentation is often outsourced to subcontractors which likely are working outside of the actual development process. To get product changes reach to documentation, when they are different processes, in different enterprise cultures, needs and effective information exchange between enterprises. (Heemels & Grosser 2008)

**Bringing documentation as part of the product developing process**

Organizations have often two different systems to manage the product development one for engineering and one for technical publishing. These two groups are working often in different environments creating the problems on delivering information between each other. Technical publishing system does not often know in what stage the engineering system is and vice versa and critical product information which is made by engineers is delivered often too late to technical publish side stretching product developing process time. In Figure 5 is example of this process.

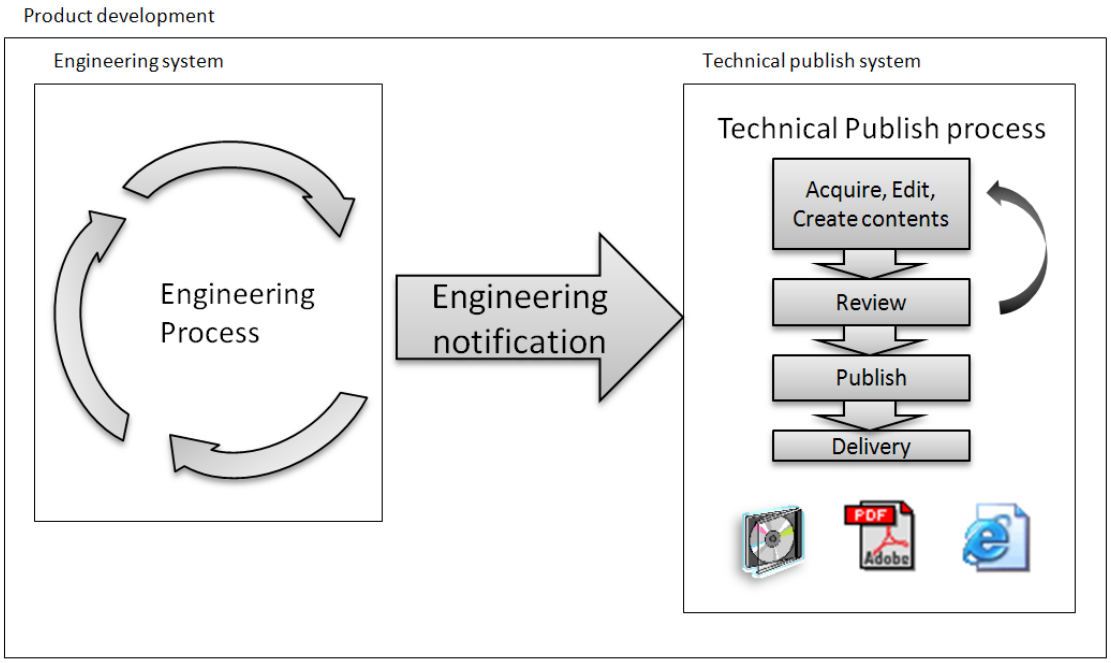



***Figure 5*** *Example of how Engineering systems and technical publish systems works together (modified from Siemens PLM presentation 2009)*

Figure represents an example of how some Engineering systems and Technical publish systems work together in Product development. When a product design is ready engineering systems sends notification to technical publish that creation of product documentation can be started. After this notification, documentation creators such as illustrators, authors and editors start doing the product documentation for a new product. They begin to gather and create information, review the results and in the end publish and deliver the final documentation as a part of the product.

Process shows that technical publishing starts working when engineers give a signal, meaning that work can begin only when product is ready for delivering. To find right information from engineering system and publishing it in right format takes time and risk staying on schedule. These two systems should be integrated to work as one and bridge the gaps in information flow. (Siemens PLM presentation 2009)

## 3.4 Summary

Technical documentation is often understood as instructive or informative document which is somehow related for the physical product. The purpose of this information leads the content of the documentation in the right direction, offering right information for right audience. Technical documents in industry are often for example different kinds of manuals for example to service, maintain or use the product. Sometimes manuals are including sections for all the previous mentioned purposes and sometimes manual is only for one purpose. For instance service personnel are a professional who

needs to check some information of the installation guide and therefore he does not need instructions to use the product to increase the number pages on the manual.

However, technical documentation is much more than information to guide the users or other persons. Technical documents are parts of the product and related to the overall quality impression that customer will gain from the product. If product manual that customer get with the product is full of typos, lousy structured and useless, it does not give the good impression of the product either. When customer is not satisfied of the product, he often let it next time on shelter when he visit the shop and pick some other product. To satisfy customer and to create informative technical documentation needs a well controlled documentation process. However, the documentation in overall is not that simple. When speaking of international companies and complex products, enterprises face new dimensions in documentation. When these dimensions are attached with the enterprise desire to serve customer, spring up the customer individual manuals. Dimensions that enterprises are facing can be understood as challenges for product documentation. Siemens PLM Software (SPLMS) (KGU Consulting GmbH 2007) challenges for product documentation are:

- Product configuration and product variants
- Localization
- Delivery times
- Keeping documentation up with the product changes
- Bringing documentation as part of the product developing process

These are variables in technical documentation, which makes every technical document to be own kind. Generic product structures, languages, hurry in schedules, product changes and the co-operation with other manufacturing process brings their own pressures for the documentation authors. SPLMS states that to win these challenges can be kept in many industries as premise for competitiveness.

# 4 KEY CONCEPTS OF CONTENT MANAGEMENT

There are several different definitions for content management (CM) found from many sources. People see it often as a way to create Web sites but Bob Boiko sees that "CM is a much broader process of collecting, managing, and publishing information to whatever medium you need" (Boiko 2005, p.XV). Content management is used anywhere information is collected or created from multiple sources and authors; and then published for multiple delivery formats. Information is somehow structured and it is requires coordinated co-operation between subject matter experts. Typically the output from the CM is large documents, which answers the enterprise compliance, document localization and customer or product specific configuration.

The key concepts of the content management are introduced in this chapter. First is presented some definitions about content, what is it and how it is structured. After these definitions the study explains the structured documentation and single sourcing publishing methodology; and the features where it is based on.

## 4.1 Content is information and data

Content is easy to mix with data which is a word used from the computer processed information. Data is information which is separated from the human meaning and context, often is just binary code, a set of zeros and ones which computer is turning to information. (Boiko 2005, p.4) Content therefore can be imagined as the result what human sees after computer has processed the data. For instance when thinking of simple Webpage, a programmer put some videos, pictures and other data files to it, and thinks every time that he is handling data. The consumer, however, who is reading the page, sees only information, the content of the webpage. Boiko states that "content is information plus data" and adds that "Content is information that you organize around a specific purpose for a specific use" (Boiko 2005, p.7-11).

Boiko writes that the world information has many different meanings but in the case of CM it can be understood as "all the common forms of recorded communication" (Boiko 2005, p.6). Steve William (Contentmanager.eu.com) is on the same line with Boiko but he adds the word "digital" to information, he describes content as "any type or "unit" of digital information. It can be text, images, graphics, video, sound, documents, records etc. anything that is likely to be managed in an electronic format".

Boiko clarifies that not any of recorded information which is moving around the world is content. Information just comes as content when it is used in somewhere. As a simple example could be a photo that someone has took on holiday. It is just a data when it is in the camera among the other pictures but when the photo is set up on album

it becomes content on the album. In this thesis by information is meant all knowledge that is transmitted to audience trough books, news, sound, music, pictures, images, multimedia, and presentations and so on. In this thesis by content therefore is meant the chunks of information and its metadata where the publication is compiled of.

## 4.2 Single sourcing publishing methodology

To manage documentation creation process effectively and to be sure that content management supports the needs for documentation process, needs also huge endeavor from enterprise. Enterprises often misunderstand CM. They assume that CM is technology that makes their documentation process work just by that. Even though tools and technology are both playing great role in CMS it does not depend only on these two. CMS needs also an efficient methodology behind to be executed efficiently. For example to re-use content, to create document structure or to control documentation creation does not happen with technology, technology just gives an opportunity to carry out them. (Hackos 2002, p.8-9)

### 4.2.1 The idea of the single sourcing publishing

The purpose of the single sourcing according to JoAnn T. Hackos (2002, p.295) is "to write once and use the modules of information many times, revise once to update everywhere, and translate once". In the other words the idea is to create modular content in document or repository, assemble it to publication and publish it in different formats, purposes and audiences without that content is changed during the process. Ament lists three main characteristics for single sourcing (Ament 2003, p.3);

*Modular writing*: Modularity is one of the key words when talking single sourcing method. In linear documentation content components are more strictly tied together as for example in a book where contents are organized so that they compose a narrative story. The intention is to read whole story from the beginning until the end. This cause that contents cannot be maybe separated from the context without losing the meaning of the information what content is consisting. In modular documentation however, contents are tied weakly to each other even components can comprise the complete documentation. Content components are designed to be individuals and not tied in any particular document. Contents are developed in element level, in other words contents are modular which enables contents to be arranged in different order. Ament highlights the meaning of modularity and keeps it one of the main points in single sourcing method. (Boiko 2005 p.131-132)

*Re-usable content*: Re-using of the contents happens all the time when contents is cut and paste from for example Word document to other. Existing content is copied to new document. It is better to re-use information than recreate the same information which already exists, but it is still not single sourcing. Single sourcing manages the

content components and maximizes its re-use. The important requirements to re-use content is to get access for reuse information and effective search functions which enables finding right content components from the repository. (Rockley 2001)

*Assembled documents*: Single sourcing enables assembling the different documents from the same content components regardless of end delivery format which is not possible in format-tied documentation. Different tools are used to turn contents in different formats, for example to PDF (Portable Document Format) or to HTML (Hypertext Markup Language).

### 4.2.2 Structured authoring

Behind the modularity, re-usable contents and assembled documents is the accurate build document structure. Sarah O'Keefe (2009) defines structured authoring as "publishing workflow that lets authors define and enforce consistent organization of information in documents, whether printed or online". In other words it is an authoring way where information is created regardless the presenting format. It helps designing the document in a way that authors can easily add or change information and it´s format in any part of the document. Structuring however is not a piece of cake, it needs a good information model and structuring rules behind it to be executed.

**Information model**

Hackos (2002, p.124) states that "Information model is an organizational framework that is used to categorized the information resources". The framework is the base of the enterprise publishing architecture. It specifies what kind of types of information is used and how the information is structured in the enterprise's documentation process. Information model can be any size; sometimes it is just needed to model specific and limited scope information. Sometimes information model can reach across the whole organization including all documentation that enterprise has. When enterprises are planning for structured documentation, the first thing is to decide what to exclude from the model. Hackos presents information model as in the three-tiered structure Figure 6.

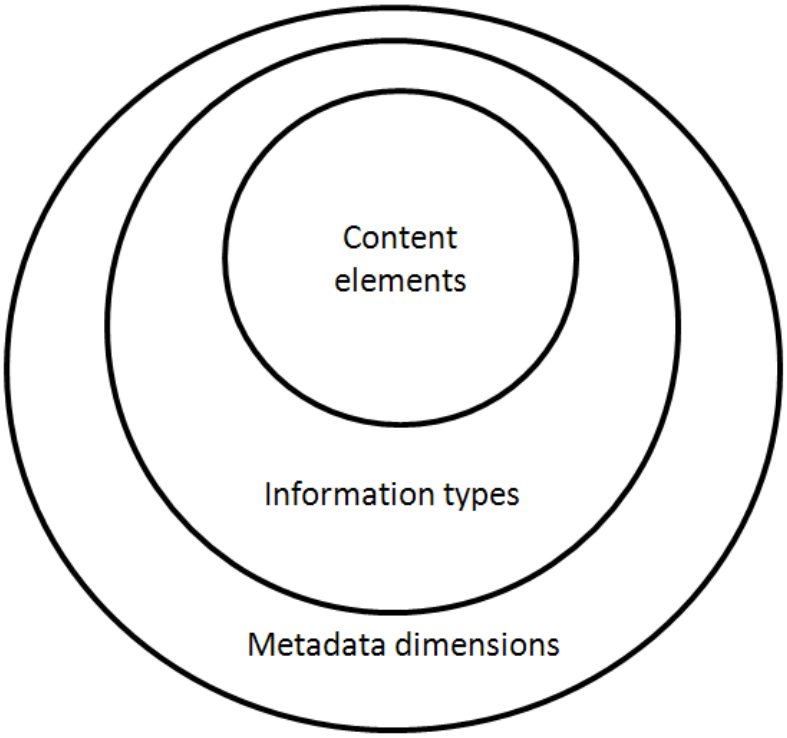



***Figure 6*** *The three-tied structure of an information model (Hackos 2002, p.126)*

Three-tied structure consists on the uttermost ring metadata dimensions which identify how your information is categorized. These metadata dimensions are also known as metadata attributes. In the middle ring are information types where information is classified for specific types. Information types are the basis for creating the well-structured modular contents that has particular purpose in the documentation. In the innermost are the content elements which structure the information type and describes the content elements which are used to build the information types.

**Information types**

Boiko point out that to turn information to content, it needs purpose. Purpose is driving information to more categorized form, information types. Hackos (2002, p.161) defines information type as "subject-matter-related categories of information that authors use to create a consistent, well-structured topic. It consists of a set of required and optional content units (elements)". Topics are standalone information chucks that do not require another topic to be understood. Topics can be any size, from the whole publication even to standalone information tag. Creating topics according to some rules and giving information type to them, helps authors to keep their contents well-structured and reusable in different context.

Information types come more universal when looking at technical information. Standard information types such as procedures, concepts, warnings and other are often used to categorize technical information. For example in the operation manual information model could include types such as warnings, procedure, information,

adjustment and so on. Each information type must be defined so that authors know in what circumstances and what purpose it is used. Authoring teams' job is to guide each other how to use them and choose the other authors to choose the right type in right situation. (Hackos 2002, p.161-163)

**Metadata dimensions**

Metadata dimensions are often used to identify the information type. To manage information more efficiency it needs something to help recognize the information so it can be used in the right context. Information type itself has not enough information to be somehow individualized. To give information more essence we need some data to store to it and this data is called metadata. Boiko defines metadata as small chunks of information or data which is attached to content, so that it is easier to catalog, store and retrieve it. (Boiko 2005, p.491) Therefore content actually is not only pure information it is combination of information and metadata as shown also in Hackos three-tied structure. Metadata is information which helps describing of the actual information and to make context and meaning of information clear enough for computer so it can organize and systematize its collection, management and publishing of contents. (Boiko 2005, p.11) Metadata is also known as attributes, which is name-value pair that is associated with a particular content element. In the Table 1 is a short example of metadata dimensions or content attributes that content could contain:

| Content Information | |
|---|---|
| Author | Name of the content author |
| Title | Title of the content |
| Description | A description of the content |
| Langugage | Language of the content |
| Creation date | Creation date of the content |
| Audience | Audience to whom content is pointed |

***Table 1*** *Example of content attributes*

Boiko notes (2005, p.491) that when talking about importance of the contents and information in it, it is wise to remember that without metadata contents and information are formless and insignificant. Metadata enables the controlling of the content describing it in the way that it can be easily retrieved from the system and use in the right context.

**Content elements**

Structured authoring is based on different sizes of information units, content elements. Element is unit of content and it can include text or other elements. These content elements are smallest chunks of information which comprise the information type. They specify each content category which can be found from the particular information type

and guide the author in writing of this information type. Elements are organized inside of the information type hierarchically and often so that a particular information type has a specific structure for its elements. Information types or content types are built from content elements; this does not mean however that individual element can be only in one information type. In good information model content elements are designed so that they can be used in creation of other elements also. (Boiko 2005, p.21-23)

**Structuring rules**

As told before, information type is consisting of hierarchical structure of individual content elements. Each information type consist a specific structure inside, which set the elements in right order. Structure is managed with specific templates which order the structure of the information types. When author wants to create a particular information type, template provides right elements for authors use. Templates can be just a standard template created with some tagged languages such as eXtensible Markup language (XML). More detailed explanation about templates in the section 4.2.3. (Hackos 2002, p.68-69)

### 4.2.3 XML

XML is great tool for content element creation and for creating templates and guidelines that ensure that structural elements within modules are reusable and variable. XML is markup-language which was designed to structure, transport and store information. It is a simplified and restricted version of SGML but to read and understand it does not need system that supports SGML. XML is great tool for many industries that create technical documents because it is a standard way to identify structures in a document and to add markups to documents. XML provides also possibility to store metadata attributes inside of the elements tags. Tags in XML are not predefined; actually with XML it is possible to define desired tags and structural relationships between them. Example of XML and tags is seen in Figure 7. (O'Reilly xml.com)

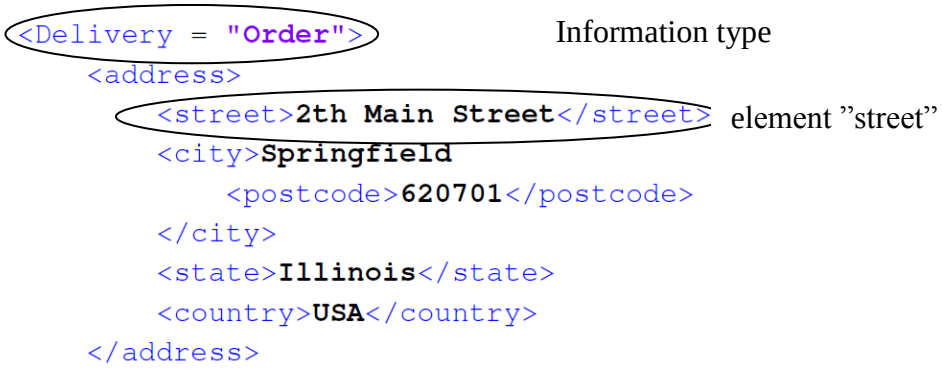



***Figure 7*** *Example of the XML markup language*

The intention of using XML in structured authoring is to use tagging language to identify elements of the document based on their content, not their appearance. The tagging language is the set of descriptive tags which are surrounding the elements. XML does not provide a set of predefined tags, instead of this; authors can define their own tags and the relationship between them. Boiko defines markup language as: "the most simply it is a set of codes or tags that surrounds content and tells a person or program what that content is".

For those companies with more demanding documentation requirements, structured authoring via these meta-languages provides a standardize way to create contents; and an effective way to re-use and manage contents in CMS environment. XML and SGML provide the possibility to use such a format in creating contents that is not tied in any particular end format. (Hackos 2002, p.68)

As in the Figure 7 is shown, it is possible to create XML documents by adding descriptive tags inside of the content module. For instance in the figure inside of the circles are street tags and between tags the actual information, in this case 2th Main Street.

These tags plus information are called XML elements, which are the main building blocks in XML documents. Elements can contain text, other elements or be empty (w3schools). XML elements builds together the XML components and components the whole XML documentation. Example of the XML structure is shown in Figure 8.

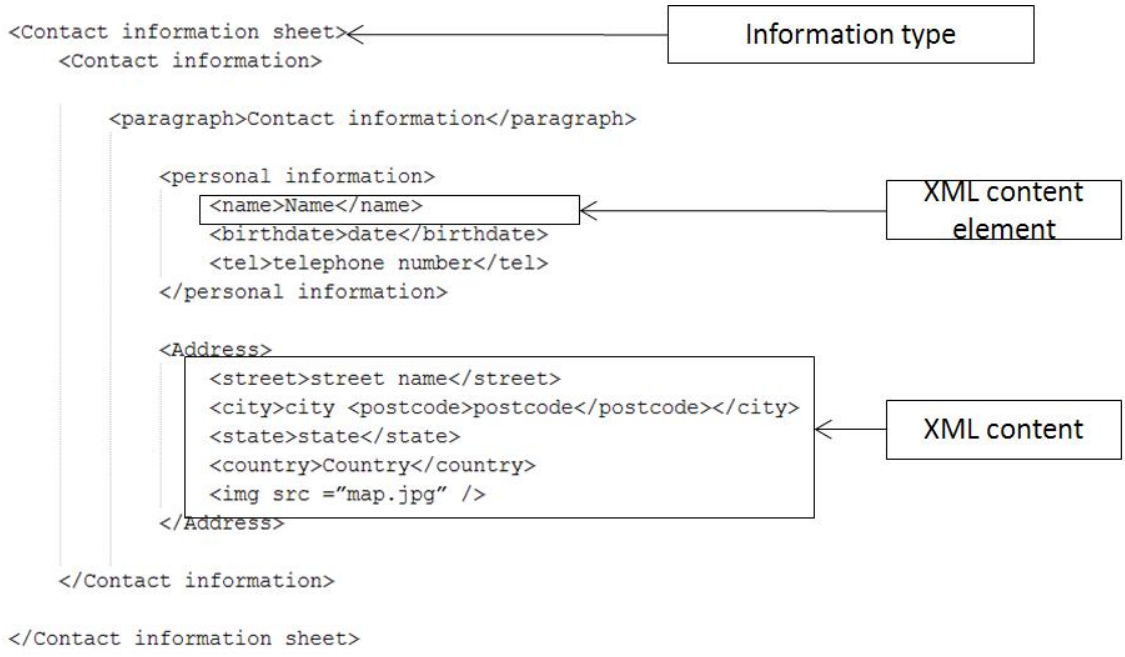



***Figure 8*** *Example of the XML document and its structure.*

As mentioned, XML is not tied in any particular object architecture such as HTML or Java. XML in CMS is tied to end format via style sheet, helping authors to concentrate just creating the information not the presentation. XML is great way to create content structure with descriptive tags. Nevertheless, if author can create any tag

he wants; how to control XML? How to ensure that tags are right tags in the right place? How to standardize tags usage? (Boiko 2005, p.827)

**DTD and Schemas**

Hackos states (2002, p.68) that structured authoring is the most efficient when the XML content and the composition of the document is managed by a set of structure rules. She adds that to make the structure tighter and content requirements for the specific document, standard set of rules are needed. These rules are called Document Type Definitions (DTD) or schemas and its job is to standardize the creation of the modules and documentation components.

The differences between XML Schemas and DTDs are only in their capabilities. Schemas are newer and alternative way to define the structure of the XML publication. Schemas give more control to use XML to exchange data. Nevertheless the meaning is the same: to define the rules that determine what XML element and attributes are allowed to use in your system. Boiko (2005, p.827) has described how DTDs and Schemas list the rules:

*Element names* are the unique names for the element types, tags that can occur in the document. Names are for example body, paragraph, chapter, and so on.

*Allowed child elements* defines how many and what kind of child elements of each element can consist. In what order they can occur and what elements are required.

*Attributes* defines specify attributes for each elements and in addition a attribute type for example a unique id, reference to unique id and so on. Defines also whether the attribute is optional or required.

DTDs and schemas do not just set the types of information types; they also specify to how the structure can be constructed and what elements a specific information type consists. For example DTD on user manual should first set structure of the manual, for instance such information types as front page, introduction and the other chapters. Then DTD defines for example what tags these information types can include for example warning, title, body and date. Each of these tags is listed in DTD. It is also defining what attributes the information types include.

With DTDs it is also possible to assign tags in specific order, for instance that authors name comes before title; and to determine tags as required or optional. When XML is used, it is even possible to tag information not only format for assembly and delivery but also with its semantic content. Semantic content points to the information that tags has inside. For example metadata attributes can be linked straight to the information which is inside of the content. For example in the case of author tag; <author>Author name</author> which includes the name of the author of the document can mapped from the metadata attributes inside of the content. This enables searching

all the document or contents by a specific author. DTDs and Schemas bring standardization for constructing the document. Enterprises of course do not need to build their DTDs from the beginning. Existing DTD and schema standards are for example DocBook, S1000D and Darwin Information Typing Architecture (DITA). (Hackos 2002, p.68-69)

### 4.2.4 Single sourcing benefits

In overall what benefits single sourcing brings for authoring. Ament (2002, p.8) mentions three reasons to carry out single sourcing method:

**Saving time and money**

Properly used single sourcing saves authors' time and company's money. This happens because contents are created at once and it is possibly to re-use them later in different ways. In other words contents are not need not to be created multiple times for different deliverables. For example if author creates a printed manual and online help it is likely that those two end documents include almost same information but in different format. If those two are created separately, an author has to do the same work twice. Single sourcing gives the possibility to make all work at once halving the workload.

Single Sourcing also gives author more flexibility. Documentation creation process can be started in early stage without fearing that author is making futile work. Meaning that sometimes document requirements can change during the project for instance from Online help to a printed document. Single sourcing enables to convert content to other format easily.

**Improving document usability**

Method is forcing authors to create information which is usable in any situation. In Aments words: "usability is a prerequisite for single sourcing". Same content has to be usable despite of what is the end format, Webpage, Paper or Online Help (Amend). As mentioned before, using XML and SGML give possibility to use contents despite of end format. Already created documents or contents of the documents are multifunctional and therefore also easily to import in other systems.

**Increasing team synergy**

Individual documents are theoretically owned by an individual writer even if it is created as teamwork between product developers, template developers and content developers such as authors and editors. In format-based documentation authors has to work sometimes in the areas that they are not so familiar with, accumulating the responsibility for the individual writer. Separating the content from format in documentation creation, single sourcing method clarifies the team work, individual writers know that they are just part of the team and documentation is created as a team. Team members are allowed to concentrate on documentation creation what they do best and dividing the pressures to whole team. Either individual writer have anymore to

make the decisions alone but make the decisions as a team dividing the pressures of bad decision to whole team.

**Improving quality**

When contents are authored in modules or in element level it gives the possibility to the author to do what they do best. Authors can be assigned to use their knowledge for creating specific information chunks rather than to whole books. For example if thinking of some large complex system, it is not worth assigning an author to write about hydraulic component if he has no knowledge to do it. Single sourcing increase the quality of information from which the documentation is comprised.

Single sourcing gives also opportunity to use the same contents in different end-delivery, without that the information inside of the content changes. Interaction between different audiences and content helps to improve the quality of the information that content has. For instance in a case where the same content is used in training manual and technical documentation information meets two different audiences who are maybe seeing information in different ways. Information that content has, has to fulfill needs of both interest groups which increases the quality of the information.

Creating documentation in small pieces also helps with text typos. Information can be created and reviewed in small chunks, which makes reviewing easier. Typos and other mistakes in content can be easily corrected without reading the whole documentation. Contents are updated straight way to where ever they are used. (Hackos & Hedlund 2001)

## 4.3 Summary

Content Management (CM) is according to Boiko a process of collecting, managing and publishing information to whatever need. In CM process the information is collected from the different sourced and published to different delivery formats, for example such as PDF, CD/DVD and WEB delivery. CM is seen as process for producing large documents which answers the enterprises needs, localization and product configuration.

Boiko defines content as information and metadata which is describing the information where it is related and to be more precisely it is information which is organized for a specific use. In this thesis the information means all knowledge which is transmitted for a specific audience trough books, news, sound, music, pictures, and images, multimedia and so on. Content therefore is a chunks of information with metadata.

Content management is the technology to execute the documentation but this technology needs an effective methodology behind it. Methodology is called single sourcing and the idea of this methodology is according to Hackos is to write the non-format-tied, modular information chunks, reuse the information and deliver the information changes straight to way for existing publications. When talking of modular

content and modularity itself, content components has to made small, focused and stand-alone to maximize reusability.

The key for reuse and modular documentation is structured authoring. In structuring authoring the documents are divided in content elements which consists information and metadata and which can be used in any document structure. Behind the structure is well defined information model which defines the information types and metadata attributes that is used in the document authoring. Information types are consisting of hierarchical structure of individual content elements. Hierarchical structures are controlled with a set of rules, templates which can be created for example XML markup language. These templates are also known as Document Type Definitions (DTD) and schemas. Structuring authoring is method to structure content elements in much more effective and powerful way than format-base authoring can ever be. (Hackos 2002, p.68)

Single sourcing methodology saves author's time and enterprises money because the information can be often reused so the information has not to write again. Information is neither tied to any particular end delivery format so paper and WEB delivery can be handled with same contents which improves the usability of the contents. Single sourcing also increase the team synergy, the author has not take a responsibility for the whole documentation. In addition the quality of the documentation will improve because authors can focus to write the modules where they are specialized. Also when content is created in small chunks, the amount of typos will decrease.

# 5 CONTENT MANAGEMENT SYSTEM

Content Management as System "is a tool that enables a variety of (centralized) technical and (de-centralized) non technical staff to create, edit, manage and finally publish (in a number of formats) a variety of content (such as text, graphics, video, documents etc), whilst being constrained by a centralized set of rules, process and workflows that ensure coherent, validated electronic content". (Contentmanager.eu.com) At widest Content Management System is used for Collection, management and publishing of chunks of information which can be called content elements. (Boiko 2005, p.86)
This chapter introduces what types of CMSs exists and after that focus on one specific type of CMS. Chapter presents also the elements of this type in CMS.

## 5.1 Types of CMS

It is sure that not every enterprise or document department needs the widest CMS on market. For enterprise is important to define to which use they need the CMS and choose the right level for the system. Suzanne Mescan (2004) defines six different varieties CM Systems which are document management (DM), web content management (WCM), digital asset management (DAM), customer relations management (CRM), knowledge Management (KM) and Enterprise Content Management (ECM). These six types are presented in Figure 9, which shows also the capabilities of these types.

| | Types | | | | | |
|---|---|---|---|---|---|---|
| Capabilities | ECM | DM | WCM | DAM | CRM | KM |
| Possibility to catalogue and search word processing files on the system with key words | ✓ | ✓ | | | | |
| Same content is feed for multiple web delivery and is frequently updated | ✓ | | ✓ | | | |
| Graphics and multimedia files is possible to catagolue and search from the system with key words | ✓ | | | ✓ | | |
| Customer contact information, history, notes, activities, and sales opportunities that need to be gathered for an organization | ✓ | | | | ✓ | |
| Internal business processes, technological tools, organizational routines, and intellectual assets that need to be gathered into database for access by employees. | ✓ | | | | | ✓ |
| Multiple document with overlpping contents, including marketing material, product packaging, product specification, technical documentation, users' manuals | ✓ | | | | | |
| Multiple document with the same contents produced in different delivery formats (for example CD, PDF, WEB) | ✓ | ✓ | | | | |

***Figure 9*** *The six types of CMS and their capabilities (Mescan 2004)*

As shown from the table, any of CM system does not reach so high in the capabilities than Enterprise Content Management system. This does not of course mean that it is the best one, it is just the widest. Every enterprise has to choose the system which answers to their needs on CMS. In this thesis we are focusing only to enterprise wide system.

## 5.2 Enterprise wide CMS

To get a further inside to enterprise wide CMS, it is good idea to explore it in parts. Several CMS specialists have divided CMS already for different systems, processes, requirements or components. James Robertson (2002) divides CMS as requirement list for full life-cycle of CMS from the creating of content to end-format delivery. Whole life-cycle requirements are divided in five categories to make it clearer. These five categories for requirements are Content creation, Content Management, Publishing, Presentation and; contract and business. At same time JoAnn Hackos (2002, p.60) separates CMS for four different components: Authoring, repository, assembly and linking; and publishing. As seen, the partition of these specialists is quite similar. Nevertheless, this thesis uses the third specialist's, Bob Boiko's (2005, p.86) three system model which is presented in Figure 10. In this model CMS is divided in three different systems: Collection system, Management system and publication system.

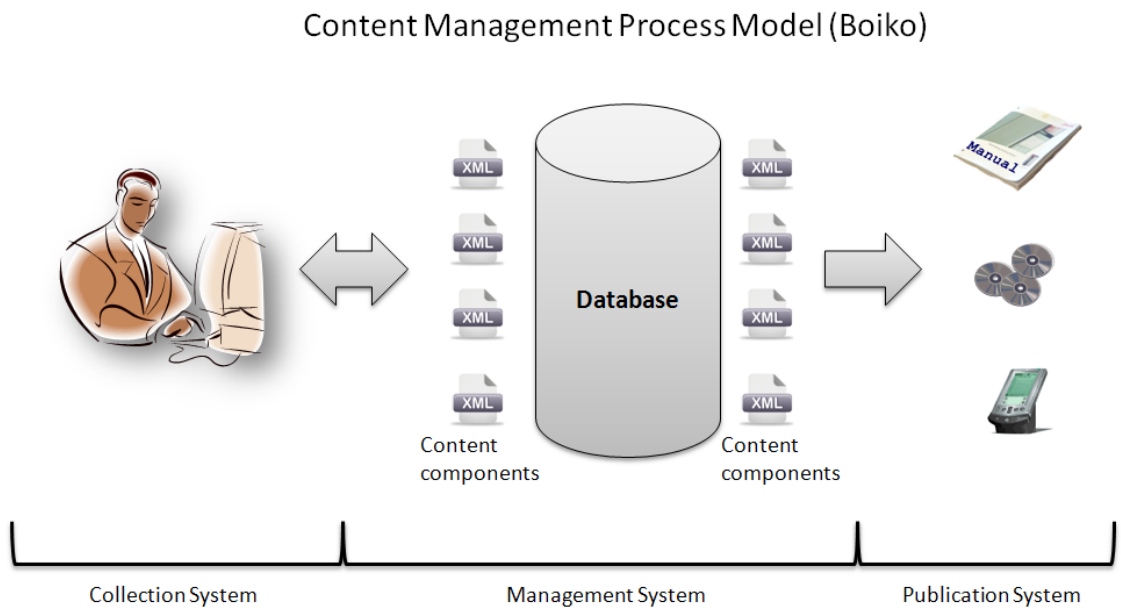



***Figure 10*** *Content Management and its three systems according to the Boiko (modified Boiko 2005, p. 86)*

As noticed these three different ways to divide CMS has the same twist. All three have more or less own processes, or systems as Boiko uses, for content creation, content management and publishing the contents. To get the whole picture of CMS it is important to look inside of these three systems.

### 5.2.1 Collection system

Collection system is responsible of processes that happen before content component is ready for publication (Boiko 2005, p.87). Authors either create or acquire information to or from the existing source- Sometimes existing information needs to be converted to master format such as XML. In the end, when information is ready, it has to be divided into components and attach to the right metadata (Boiko 2005, p.72). Without effective authoring process CMS will fail soon after implementation. Following is a listing of several key requirements of collection system, which can be held as universal. (Robertson 2002)

*Integrated authoring environment*: The CMS must provide an effective structured authoring environment for authors which include needed tools for content creation. Environment can include external content writing tools, to with author can create the content and keep it outside of the CMS until the content is ready and import it later to the system. Author can also send early drafts of the content to CMS and use the management capabilities of the system such as version control, workflows, status etc.

*Multiuser authoring*: The CMS must allow authors to work same time with simultaneously documentation preventing coincident changes. Documentation needs to a lot of authors to get documentation ready on time because it is structured numerous of content elements.

*Non-technical authoring*: Authors must be able to create contents and documentation without any special technical knowledge. Even when single-sourcing methodology and meta-languages such as XML or SGML is used. Authors can protect themselves from the technical orientation by selecting authoring tools which allow them to create content in the way they understand, for example most XML editors need almost no knowledge of XML to create XML format information.

*Separation of content from end-format*: Cross-media publishing, meaning publishing source information in multiple end-formats, needs that content is separated strictly from the format. This is for example possible in the case of XML or SGML meta-languages, contents are untied for a specific format and outcome is managed with style sheets (Hietala, 2004).

*Single Sourcing Methodology*: Same content components can be often used in different publications. Using of single sourcing methodology allow using the same component in various publications regardless of publication format and audience.

*Metadata creation*: Metadata is needed to describe the content components. Metadata information is needed for instance when searching components from the system repository. Metadata attributes could be for example Name, Content ID or Author, which can be used as keywords on search. Metadata helps filtering and arranging the content components.

*Ease of use and efficiency*: CMS works successfully when it offers easy environment to create, edit and manage of the contents and publish them for usable documentation without trashing or change the meaning of the information along the process (Boiko 2005, p.11).

*Linking*: It is important that CMS allows author to link content components together. It has to provide also possibility to track document components where they are used and allow restructuring of the contents without breaking the links.

### 5.2.2 Management System

The management system in CMS responds the storage of the content elements and the other data. It is system to manipulate and manage the content components (Robertson). The system contains (Boiko 2005, p.100):

*Repository*: The main piece of the CMS system where components are storage. It is also the place to storage all other data which is belonging to the CMS such as configuration files, metadata, templates and so on. Example of the repository and what it can include is presented in Figure 11. In the figure repository is divided in two different components, Content files and Control and configuration files. Figure is just to clear the image of the repository.

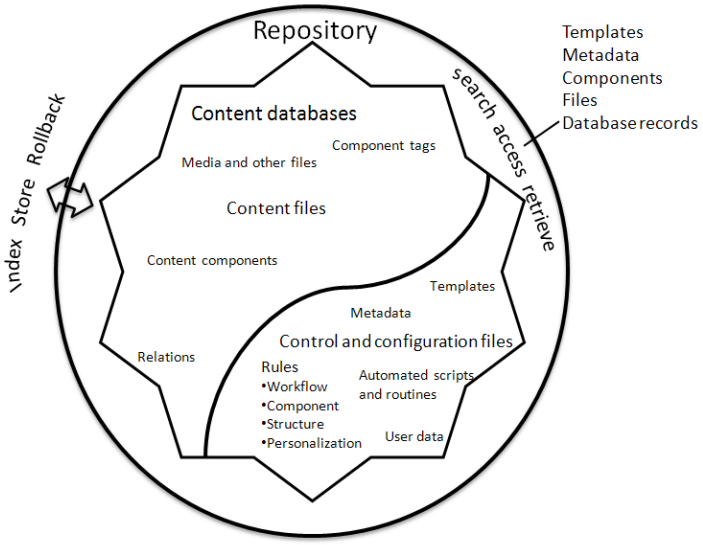



***Figure 11*** *Example of the repository and the components it is including (modified Boiko 2005, p.101)*

*Administration*: The configurations for the CMS system are made in administration system. It could include setting the user role and accessibility, configuring for metadata attributes fields, maintaining workflows or documentation structure, setting stylesheets or different tools for publishing and creating new content types.

*Connections*: CMS is often needed to connect to other systems also such as XML Editors, Enterprise Resource Planning (ERP) Systems or PLM systems. Connection between CMS and other systems are managed with connection system. It is possible to configure for instance CMS to use a specific repository or to retrieve needed metadata from the company's ERP system. Typically CMS is also connected to some editor where it is possible to create and edit the information.

*Workflows*: The workflows are to manage steps to get contents published. In the other words they enable to coordinate the whole process flow from the content creation to end publication. Therefore workflows are present in the whole CMS system, in Content creation, management and publishing. The content creation workflow process might include for instance content creation, review and approval tasks. After these tasks content is valid and ready to move into the repository.

In the management system, workflows could be used to help controlling of the change management procedures or to manage connection between other non-CMS systems from where data is retrieved to CMS system or data is moved such as ERP.

Publication System could use workflows to preview and approve the publication which is ready, to ensure that publication is as best it could be. Workflows could be used also in the translation process, where contents or publications are sent to translation office. On the Figure 12 is the example of the content creation workflow (Boiko, p.).

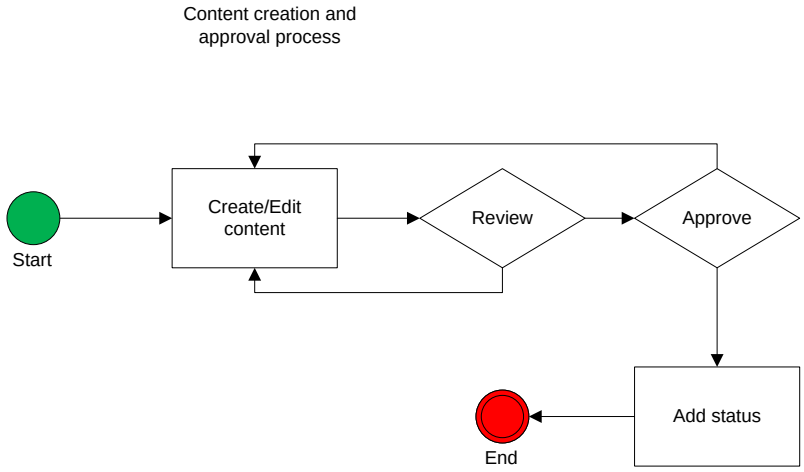



***Figure 12*** *Example of the simple workflow process*

### 5.2.3 Publication system

The publication system retrieves the needed content components from the repository to the publication and publishes it in the needed format such as webpage, printed document, PDF or online help. Publication is not the end document yet, it is just content components arranged in the specific order with standard information. The publishing system includes for example following components (Boiko 2005, p.106-111):

*Publishing templates*: Are files which control the output, the final appear of the sheets or publications. Templates give the visual look for the publication, for instance fonts, colours, paragraphs et cetera. CMS does not use the common word-processing templates for instance what Microsoft Word is using. Templates are normally made to CMS with some programming language for instance with XSL language which enables turning XML to other XML, HTML or text format. These kinds of templates are known as stylesheets. Stylesheet helps author on the writing process, author can create content without thinking how it is going to look like in the final document.

*Publishing services*: A set of tools which define what is published and how it is published. Services retrieve the needed components and metadata from the repository; and runs for instance publishing rules and content conversion to publish the publication in right format. Publisher choose for example the format, language and audience from

the publishing tool and after that services retrieves the needed information and convert it to the right format for the publishing process.

*Publications*: CMS can be used to publish different kind of publications, for example printed manuals, web publication or electronic publications. Different formats can be published with same style sheet for example. Services are just using different conversion to the different publishing formats.

## 5.3 Content management authoring styles

One of the things that define CMS is how contents are managed. Boiko (Boiko 2005, p.131-146) appoints three different ways to manage contents, management can be linear, modular or a little bit of both depending how contents are created and managed. It is not obvious for the company which one of these three systems is the best. Company has to define first their needs of their documentation and then choose the right way to produce right structured contents. In the following is the short presentation of all three.

### 5.3.1 Linear

In linear system or a composition system, document is divided into components and these content components are ordered in particular order. Documentation is like in the book, the idea is to read the whole document form the beginning till the end so that some kind of narration runs trough almost the whole publication. Components are tied together and when single component is taken off from the documentation, it might lose its meaning and significance. Authoring happens mostly by people who knows the purpose of the whole documentation and how content components related to each other. In system a fewer kinds of content types exists, and they reflect the structure and interrelationships of the content.

### 5.3.2 Modular

In modular or a component management content elements are complete modular. Content element might be designed separate from the other elements in the same documentation which enables for example reusing of content in different documentations or bringing re-existing elements easily from the other sources and systems. Relation between each content element is much looser that in composition system. But the major difference in collection between the two systems is that in a component system the document templates defines only the structure of the contents, when in composition system author has to think how content fits with other contents in the documentation. Authors in modular system can also focus on the content and not the document structure.

Publishing of modular elements happen consist of choosing and assembling the right content components for the publication. Component system includes more content types

than composition system and they are all created based on what sort of information is in them.

### 5.3.3 Schema-driven

Third one, which is between these two systems, Boiko calls a Schema-driven system. Schema system has a little bit of both of previous two systems. It enables the flexibility of multiple content types as component system does, and it provides high level of integration as composition system does. Behind the whole system are XML or database schemas that define the content and document structure. Schema-driven system, which is also known as component system, offers a cross-publishing so it can produce wide range of different publications. In other systems, content types unite content thematically, regardless how it is published. And publications are produced by combining elements of various components at the time you want to publish them.

## 5.4 Summary

Content Management system (CMS) is a pack of tools which enables creating editing and managing the content elements such as text, graphics, video, documents for instance. At the widest CMS is used for collection, management and the publishing of the content elements. Suzanne Mescan defines six different varieties of CMSs. These six types are document management (DM), web content management (WCM), digital asset management (DAM), customer relations management (CRM), knowledge Management (KM) and Enterprise Content Management (ECM). Widest of these six is the enterprise content management where this thesis is focusing.

Enterprise wide CMS can be divided according to the Boiko in three parts; Collection system, Management system and publications system. Figure 13 shows what these three systems include.

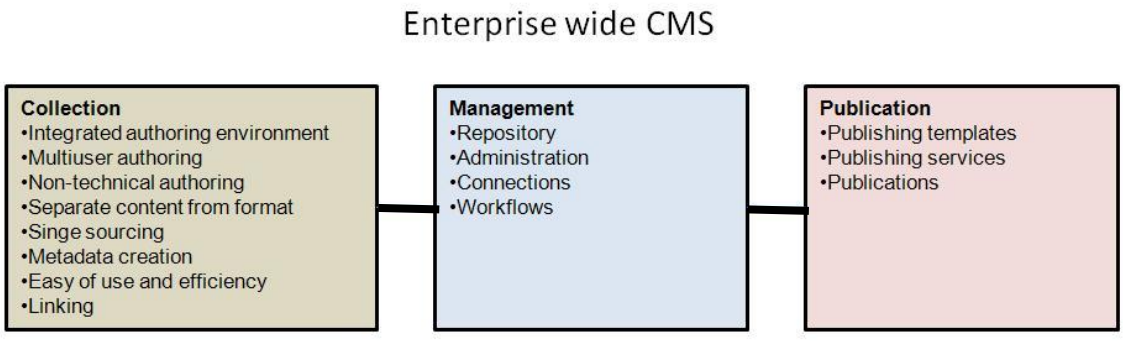



***Figure 13*** *Enterprise wide Content Management System features*

Basically these three systems contrast the whole CMS process. First, in the collection system the authoring and document compiling is made. The management system controls the whole CMS, there is managed the life-cycle workflows such as translation

workflow and publishing workflow for instance, the database of system and connections with other systems. It is also the system which administrates the authoring environment. The last system is publication system where the compiled publication is published with right features.

In CMS Bob Boiko defines three different ways to manage the contents. These systems are linear, modular and schema driven. In linear system the document is gathered like a book, the information is places in the particular order. Document is designed to be read from the beginning till the end and if some information is removed from the book the whole content can suffer. Another system is modular, the composition style where the document is structured from modular content elements. Relation between content elements is much looser than in linear system. Modular element can be removed from the document without that the information which document includes suffers. In modular system a specific templates are used to place the modules in right places when authors has not to think the structure of the document, but they can concentrate to create the information. Third system is schema-driven which is a little bit of both of first two. Behind the system is a DTDs or schemas which define the structure of the document and content elements. Documents are created without caring the delivery format or outfit of the end delivery.

# 6 TEAMCENTER SOLUTION FOR THE DOCUMENTATION

Siemens PLM Software offers add-on module to Teamcenter PLM system which enables creating the product documentation in same environment with other product development. Module is called Teamcenter Content Management (Teamcenter CMS). It provides solution for enterprises to generate and publish product information inside of the Teamcenter PLM system with single sourcing methodology. This chapter introduces this enterprise wide CMS solution and finds out its capabilities on documentation creation.

## 6.1 Introduction to Teamcenter CMS

Teamcenter CMS is originally developed by KGU-Consulting GmbH, which is a small German IT service provider. KGU implemented in late 1990's a SGML solution on Metaphase (following Teamcenter Enterprise) for Danish company Danfoss Drives.

In 2004 KGU started co-operation with Siemens PLM Software (former UGS) to provide CM for Teamcenter. Later on Siemens PLM Software purchased the rights for CM software from KGU which is still operating as partner of Siemens PLM Software on the continuing CM development process (KGU Consulting).

Teamcenter CMS makes product documentation process a tighter part of the product developing process and brings it to the same working environment, giving all capabilities from PLM system for document authors' use. Via Teamcenter authors can work together globally and together with engineers. CMS module in Teamcenter manages the text and graphic components that comprise the publication and uses XML and SGML meta-languages for storage of the contents. Content can be therefore easily exchanged and further edited with other systems such as XML editors. Teamcenter CMS also supports cross-media publishing where documents (publications) can be generated from the application for different types of media like books, CD-ROM, webpage or even Interactive Electronic Technical Manual (IETM). TC CMS supports also multiple language versions and management of topics though release cycles. (Trish Laedtke 2009)

## 6.2 Teamcenter CMS concepts

Teamcenter CMS can be divided in three different systems which can actually be mirrored to Bob Boiko's CMS system partition. In Boiko's system CMS consists of

collection, managing and publishing system collection system. Collection system in Teamcenter CMS is consisting of Teamcenter CMS clients and authoring tools. Managing system consists of Teamcenter and its functions; and publishing system the Teamcenter CMS server and publishing tools. Teamcenter CMS systems are presented in Figure 14.

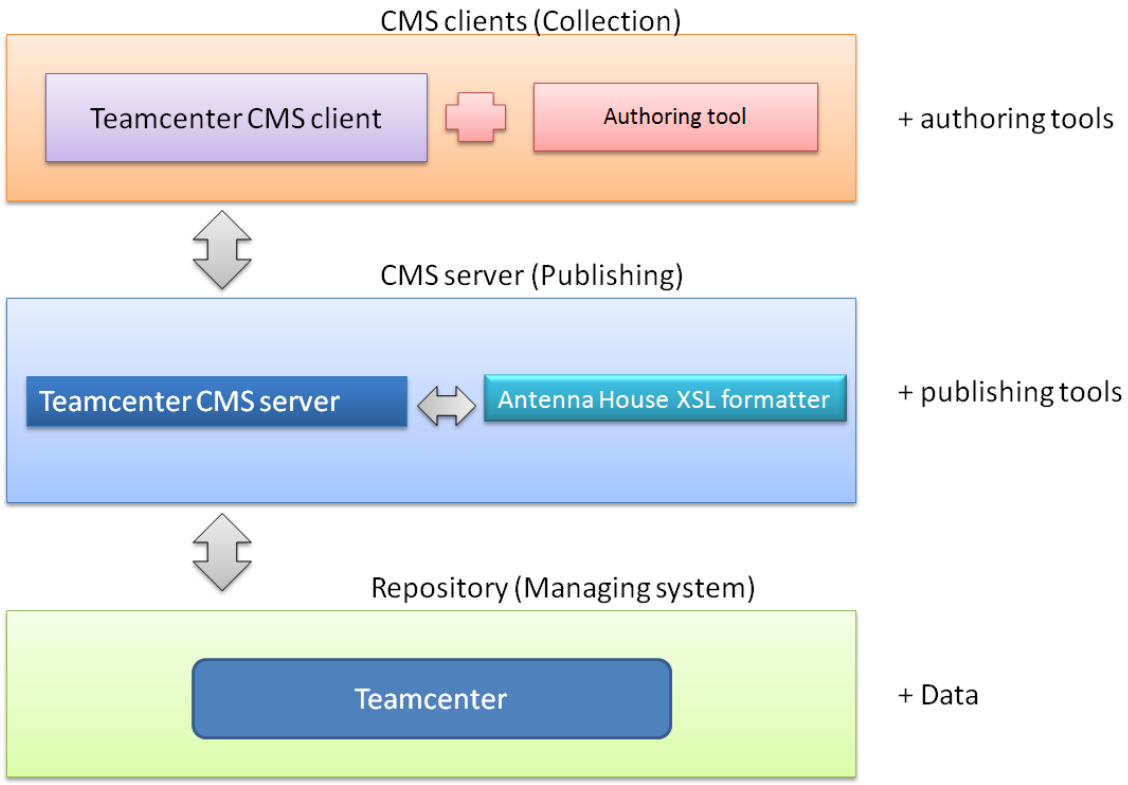



***Figure 14*** *Teamcenter CM system architecture*

Teamcenter is the PLM environment which connects CMS to enterprise's other processes. Sign-in to CMS application happens via Teamcenter with individual username and password. After system login, author has access all features that PLM system offers.

## 6.3 Collection system in Teamcenter CMS

Collection system consists of Teamcenter CMS client and authoring tool. Collection system allows authors to create and edit, re-use and relate easily XML based information. Document components can be saved to and retrieved from the Teamcenter CMS repository through CMS user interface. Teamcenter CMS is divided into two different interfaces, to CMS and to CMS Administration.

CMS interface is the window where technical authors can operate actions that they need to manage the topics and compile the publications. A publication is the document structure from where the actual documents are published. Publications are composed from single components which are called topics. Topic is, as mentioned before is

information chunk that is autonomous from other information chunks and therefore it can be used as individual information. Teamcenter CMS bases on the management and maintain of these topics during the document creation process by the author or other process participants.

### 6.3.1 Multisite authoring

Teamcenter CMS enables multi-user authoring which connects the authors over the world. Different sites across the entire enterprise bring enterprise authors working in the same environment and with same publications. Figure 15 shows an example of what is the idea of multisite authoring. Content element updates reach the whole author network in minutes.

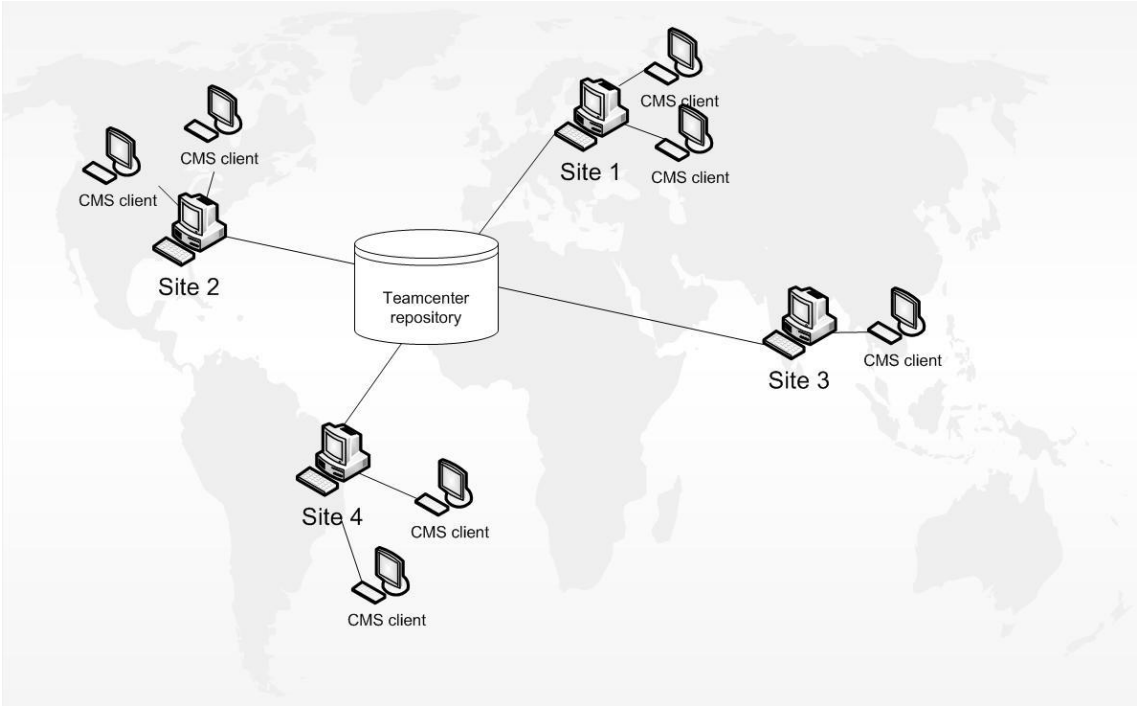



***Figure 15*** *Illustration of multisite authoring*

Every site might have their own repositories where the files are stored. Different sites are attached together and information can be retrieved from the all sites which maintain a record of each object in the entire network.

### 6.3.2 Authoring environment

Teamcenter CMS interface offers several perspectives to help author in work. Figure 16 shows the perspectives that authors can use:

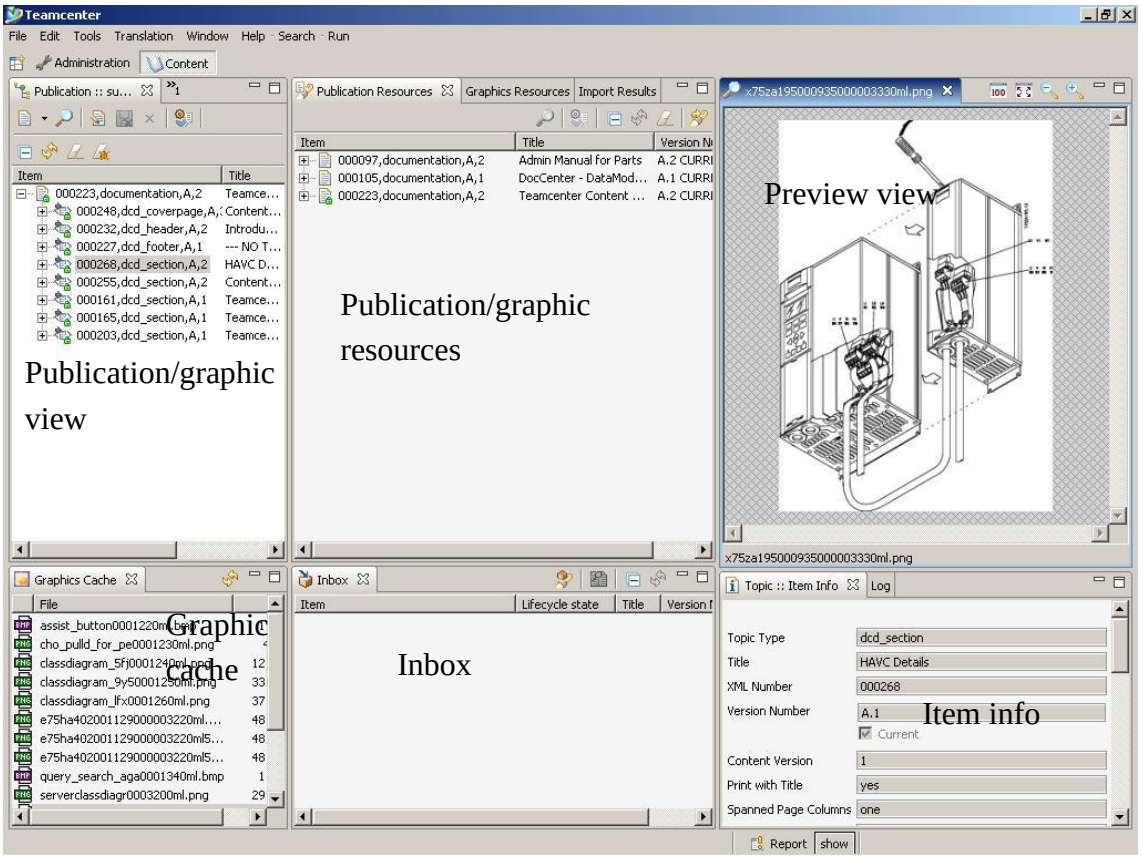



***Figure 16*** *Teamcenter CMS interface perspectives*

Perspectives that are found from the Teamcenter CMS are:

*Publication/graphic view* is the main work area where author create, update, delete and relate items to other items.

*Publication Resources/graphic Resources view* is the search area where authors can search topics and graphics from the Teamcenter CMS repository and move them to work area.

*Preview view* is the window which displays the preview of the content. Basically it shows how the content look likes when it is attached to the documentation.

*Graphics Cache* displays the graphics stored in the cache.

*Inbox* shows the items on your inbox which has been send for example from the translation office.

*Item info view* shows the metadata attributes that topics are including.

System offers also a Teamcenter CMS administration application which offers interface for system administrator to administrate the system. More about administration in managements system section on thesis. (Content Management Guide 2009)

### 6.3.3 Creating the publication

Like other CMSs, behind Teamcenter CMS is also accurate information model which defines what publication types and topic types can be used in the system. Topics are called in Teamcenter CMS all information (content) levels that publication includes. Topics are individual content elements which can be attach and detach from the other topics without the meaning of the content changes. Topics are often composition of other topics. The lowest topic type is XML component elements which are the building block for other topic types. Figure 17 shows a content topic tree in Teamcenter CMS.

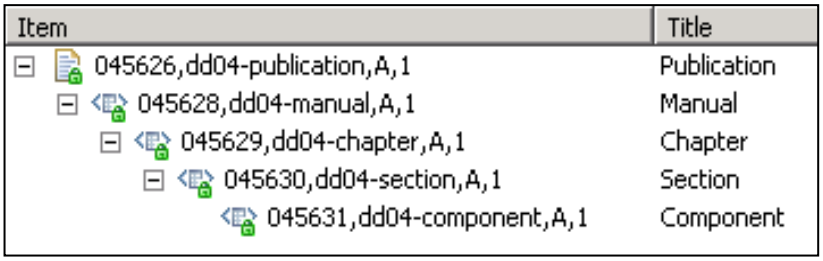



***Figure 17*** *Content topic three in Teamcenter CMS*

Authoring in Teamcenter CMS starts the creation of a right type of publication. Publication types are redefined in the system and such a publication which is not predefined in the system cannot be created. Publication types can for example be service manual or user manual. Authors choose also in what master language publication is created, and classifies the publication for example to introductory text, procedure, legal statement and so on.

When author has filled in the publication base attributes the DTD or schema defines how the publication has to be structured. They define what topic objects structure consists of and the order how they are set on the publication, for example chapters and sections. DTDs and schemas also define what XML element types the topic objects can consists of, element types are equal with XML tags. As in Figure 18, the publication structure consists of the publication type: manual and objects from where it is compiled; chapter, section and component type of topics. Component topic includes the actual content chunks, XML elements such as text, table or graphics contents.

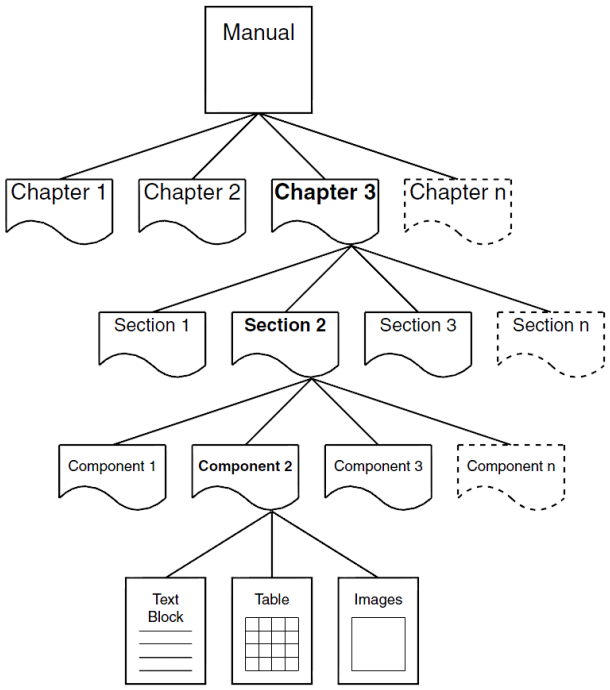



***Figure 18*** *The example of publication structure*

Publications might have some standard elements when it is created, such as front page, header, footer and so on, they might be created automatically when the wanted publication type is chosen. Creating the new empty publication is not the only choice. Author can create new publication also from existing ones, using existing publications as templates for the new publication. This enables that author can choose what existing topics he wants to bring from the existing publication to the one author is creating.

Authors can also manually configure the needed publication from the generic publication with configuration action. In this case the publication just consist the all possible topics, where author manually choose what to include in the new publication.

Publication is compiled in publication view in Teamcenter CMS interface. When the publication is saved in the Teamcenter repository, Teamcenter generates the whole structure also as Teamcenter items. The structure can be viewed also via Teamcenter 8 interface as in the Figure 19 is presented. Figure shows how the same document structure is shown in different views.

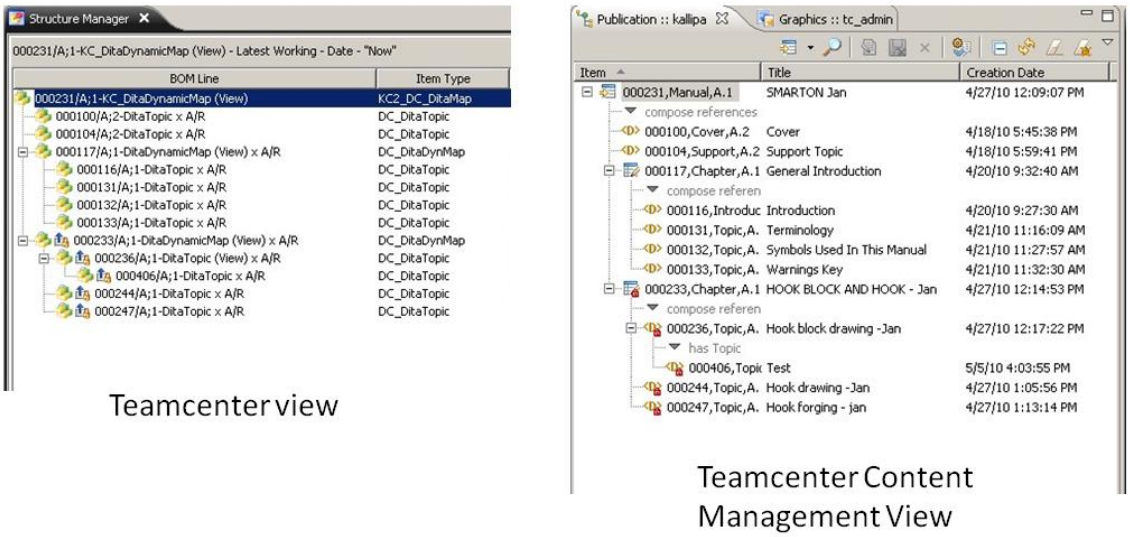



***Figure 19*** *Same document structure in Teamcenter and in Teamcenter CMS*

The whole structure is showing as normal item object. When the item is investigated in more detail it is noticed that it actually has a structure attached to it. This structure looks similar than the actual physical product structures which are created by Engineering department. Document structure can be viewed in Teamcenter Structure Manager Application. (Content Management Guide 2009)

### 6.3.4 Creating and editing the topic elements

Teamcenter CMS does not include own editor for creating and editing XML based information. Nevertheless it includes integration with several different authoring tools which can be chosen among the most used XML editors. XML is a great language because it can be edited even with simplest text editor that Microsoft Windows offers with notepad. However, notepad does not recognize that authoring happens with XML and therefore cannot guide the authoring. When XML is used a lot and text editors are not enough, it would be better to use more professional XML editors. Most of the professional XML editors offer possibility to create XML documents without a specific skill of the XML language and so it is in Teamcenter Content Management also. XML editors that Teamcenter CMS has integration are all professional editors such as XMLSpy and XMetal for example. They are easy to use and help authors to create error-free XML document by validating it with DTD or Schema forcing authors to stick in the valid structure.

Authors can create topics in Teamcenter CMS two different ways. First way is to create a topic element first in the work view and then open it for edit in the separate XML editor to create content to it. Second way is to start creating directly content in XML editor and saving it to the repository when topic elements appears at the appropriate level in the structure. When author creates a new topic or picked one of the existing one for edit, topic opens to XML editor. Author creates the content for the topic

with XML mark-up language, and attaches possible graphic data to content. Author can check in any time how the topic seems by using preview function. Example of the Xmetal XML editor interface is shown in APPENDIX 1.

**Graphics**

XML editors do not give the author a possibility to create graphical data. Graphics has to be created with separate tools. Teamcenter CMS does not offer integration any of this kind of tool directly but graphics can be created and saved to repository for example with Teamcenter Visualization Mockup module. Graphics cannot be retrieved directly from the Teamcenter CMS repository or from the computer disk to the created content. Graphical data has to first import to Teamcenter CMS file cache as Figure 20 shows.

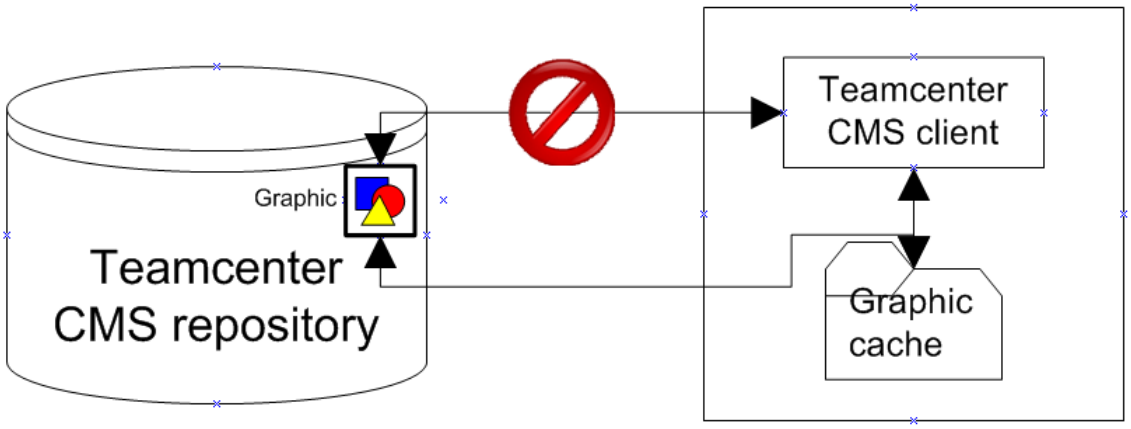



***Figure 20*** *graphic use in Teamcenter CMS*

CMS supports a various formats of graphics for instance JPEG, PNG, GIF and even PDF format. It supports also some video formats which can be attached to WEB publication. Different formats are used for example when author wants to use cross-media publishing. Different delivery formats needs different graphic qualities for example PNG-file format is more suitable for WEB documents than jpeg format.

Authors do not use the actual graphic files in contents but actually they are using graphic item. Graphic item is the main object on the CMS representing the set of different file types of same graphic. It has a number of graphic options associated with it as the Figure 21 presents. In the figure graphic item have two graphic item translations which have two graphic options, one for WEB delivery and the other for PDF delivery. Graphic options are categorized by language and end delivery format. Author's job is to define the rules, in which publication the graphic option is used and the graphic priority. The CMS system fills in the graphic option automatically when content is edited or published. (Content Management Guide 2009)

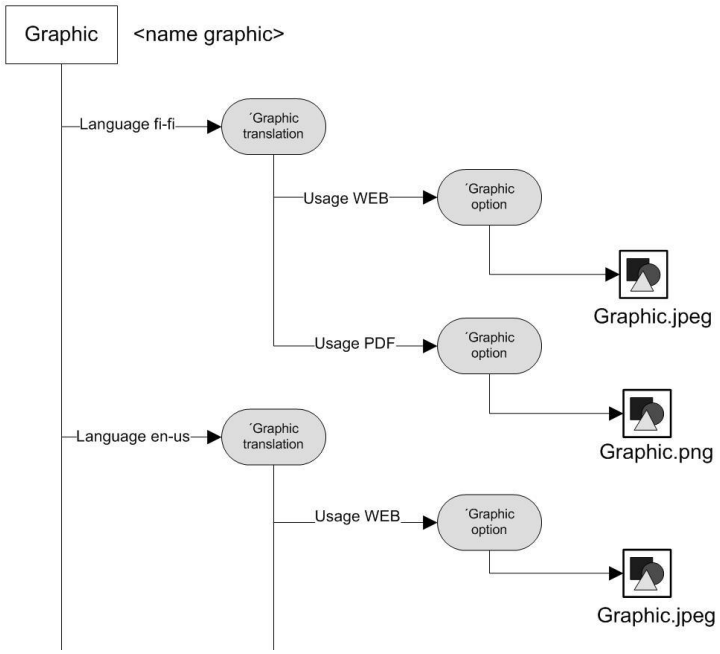



***Figure 21*** *Graphic options tree. Options organized by language and format (modified KGU CMS concepts)*

Teamcenter Content Management allows author to create and manage relationship between graphic options and reference them into XML content. Graphics are also possible to trace in which topics or publications they are used in the user interface.

### 6.3.5 Creating topic metadata

Every topic has some metadata information related. Metadata information is previewed in the topic information view which shows the form of the topic where attributes are situated. Example of the form is presented in Figure 22.

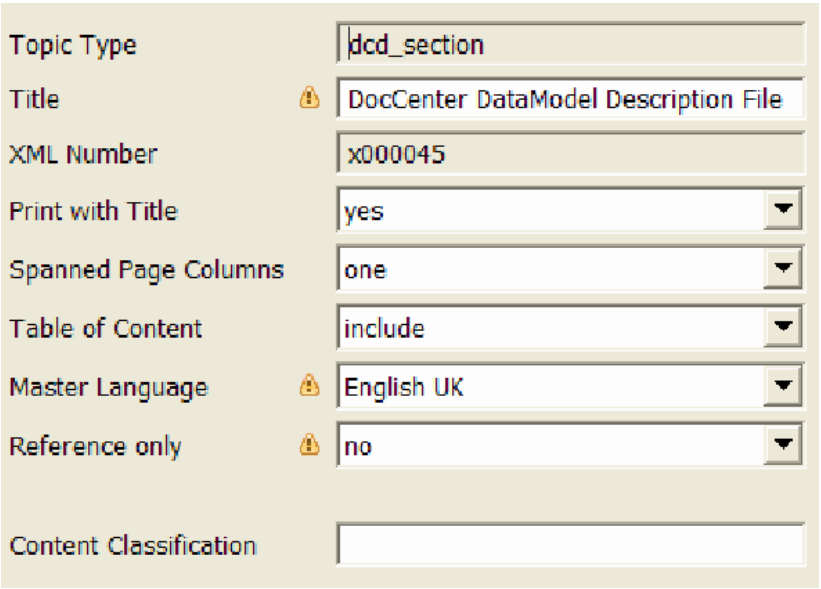



***Figure 22*** *Teamcenter metadata form*

Figure shows attributes that topic type section has for example master language, topic type, title and so on. Metadata information is separated from the topic content's and applies only on topic level. Teamcenter CMS enables using this metadata inside of the content, for example the title of the topic can be mapped inside of the content. New attributes can be created in CMS administrator interface with administrator privileges.

### 6.3.6 Controlling the topics

When multiple authors are working with same documentation, CMS system has to control the contents in a way that prevents authors from editing the same topic at same time. Teamcenter CMS allows authors to lock the topics, which they are editing, to their use. If topic is already locked, author cannot lock the topic again until it is in unlocked mode. Authors can lock also the whole publication so no other authors can edit it. Authors can see from the green lock icon on the topic if topic is locked or unlocked. When editing and saving a topic which is still on the work state, meaning that it is not yet frozen, every save will increase the topic version number by one. In other Teamcenter applications lock and unlock are known as Check-Out and Check-In. This is because Teamcenter CMS is originally developed to work as standalone.

Unlocking the topic makes it available to other authors for editing. However, when topics are ready to publish, meaning that not any changes are allowed on topic anymore, topic has to be locked in some other way. Teamcenter CMS enables authors to freeze topic when topics are ready. Freezing the topic differs from locking so that topic cannot be modified in any way. Only way to modify the topic is to create a new revision of it. (Content Management Guide 2009)

### 6.3.7 Search existing topic elements

The way how authoring is done, offers a great possibility to re-use the already created contents. Nevertheless, finding pre-existing topic or graphics is not very easy without an effective search tools. Teamcenter CMS offers a search tool which possible searching the topics and graphics from the Teamcenter CMS repository or from the graphic cache. Figure 23 shows the example of the topic and graphic query forms.

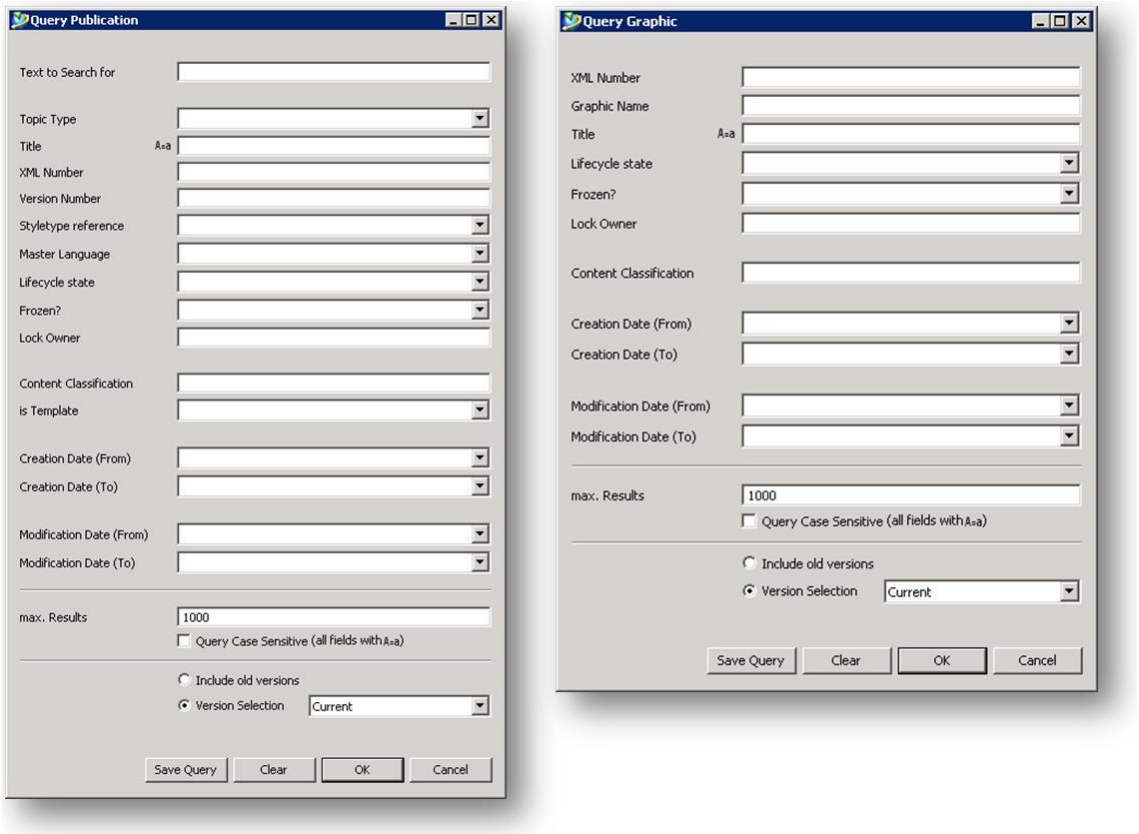



***Figure 23*** *Teamcenter topic and graphic search forms*

Search form open for a separate window, to where author can choose the object type that he searches and fills the search form with search criteria. Search results open in the same view where the search attributes are filled. From the search results author can for example copy the found topic to the publication.

Search can be proceeded also trough the Teamcenter 8 PLM system client interface using its search functions. However, the found topic cannot be open from the Teamcenter 8 to the Teamcenter CMS. To edit and attach the topic to the publication, topic must be opened trough the Teamcenter CMS interface.

Teamcenter CMS offers also tracing the topics. Author can trace for instance where the topic is used, earlier revisions or all translations of topic and so on. However, tracing is not so effective than searching by attributes. (Content Management Guide 2009)

### 6.3.8 Creating translations

When authors are starting to create the topic they choose the master language for it. However, one language is not often enough on documentation. Teamcenter CMS enables sending the topics straight away to the translation office which can be an external company. Before authors can start the translation process, they have to be sure that needed translation language is created to the CMS system. Teamcenter CMS supports over 25 most common languages.

To get the translation, author has to just send the topic to the translation workflow which is defined in Teamcenter. Author does not have to send the whole publication to the translation office but only the topic he wants to be translated. Some of the publication topic might be translated again and it would be waste of time and money to send already translated topic again.

Translation office must be created in the system before it can be used. Object is send to translation office in compressed zip file with a translation order attached via email. Translation order is order sheet where author fills the translation information, for example to which language the translation is needed. Example of the new translation order dialog is presented in Figure 24. (Content Management Guide 2009)

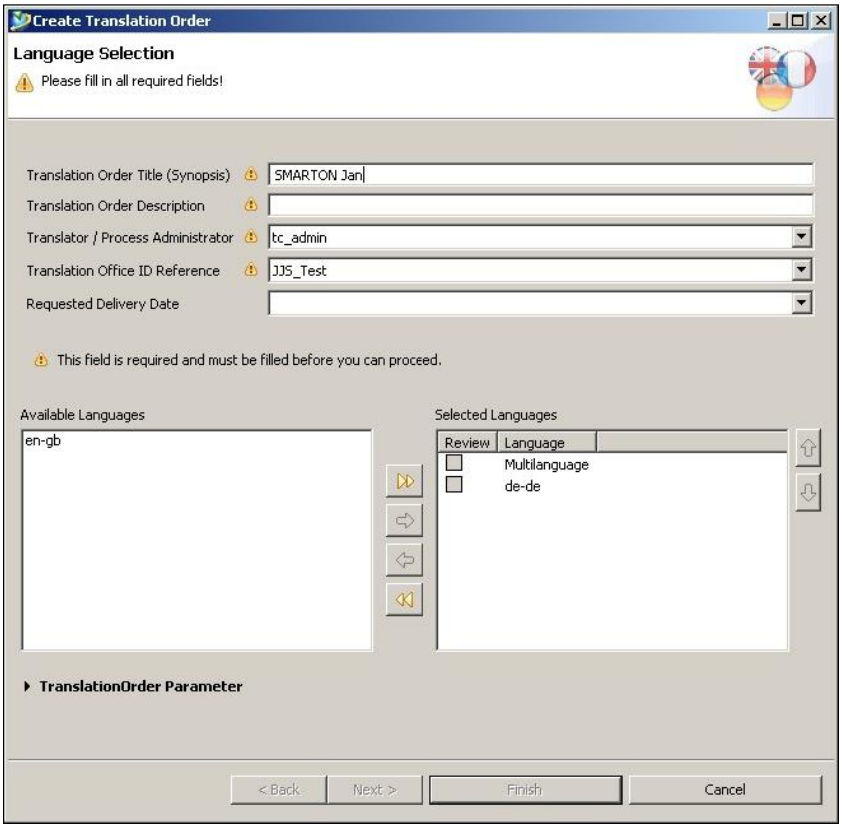



***Figure 24*** *Example of new translation order dialog*

Translation office extracts the zip file and after translation sends it back to the authors via email. Translated topics are stored in the system as own objects but they are related to the source topic so that for example in publishing process the right language is automatically chosen for publication.

## 6.4 Management system in Teamcenter CMS

According to Boiko Management system consist repository, administration, connections and workflow management. This division is adaptable also for the management system

in Teamcenter CMS, where the enterprise knowledge is managed in Teamcenter and Content management in content management application itself.

**Repository**

Teamcenter CMS repository is working as the base of the whole system. Teamcenter PLM system and Teamcenter CMS use in Teamcenter 8 version the different repositories. This cause that XML objects can be searched from the Teamcenter 8 interface but not opened to Teamcenter CMS. Also relations between Teamcenter 8 and Teamcenter CMS objects cannot be made. Figure 25 illustrate the two different repositories and how the engineers and authors are working with it. In the figure Teamcenter has two different repositories one for product life-cycle information and one for content management data, but Teamcenter works as a door for both of repositories. The exchange of repository information with XML data is handled by attribute mappings.

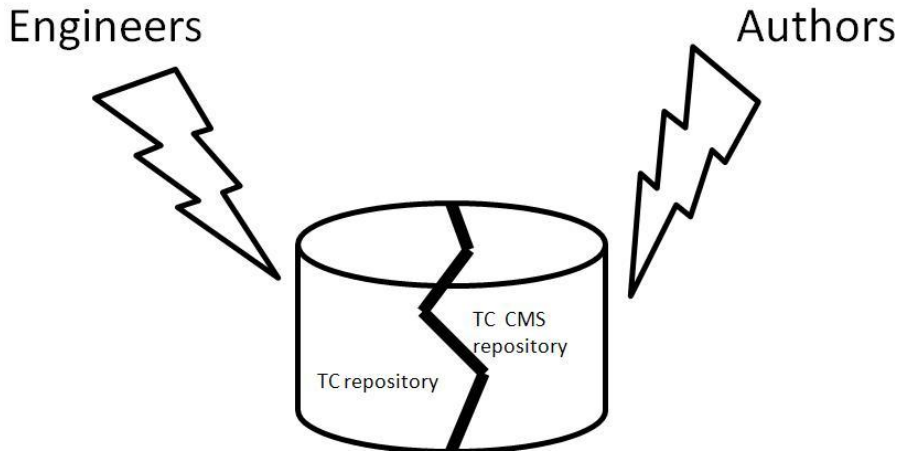



***Figure 25*** *Illustration of engineers and authors working with different repositories*

Repository is the place where the data is stored and retrieved to CMS module. XML elements and images are picked up from the repository or from outside source when author needs then in the publication. Repository stores all the metadata information of the objects which can be view on Teamcenter 8 client.

**Administration**

Administration of Teamcenter CMS is made trough the Teamcenter CMS Administration interface which is presented in APPENDIX 2. It is the place where application administrators can define:

- The integration of schemas and stylesheets
- The definition of structure templates and topic types
- The definition of publication and topic templates

- The integration of XML tools
- Creation of style types as collections of stylesheets
- Administration of user profiles, languages, translation offices, and other data
- The permissions for the user roles and the tasks that user perform in the application

Teamcenter CMS does not need to be configured in any way after installation but features above must be defined before authors can start their authoring work. Application administrator's task however, does not include the creation of stylesheets or DTDs and schemas but just installing them to the system. Administrator main task is to support the authors on their work and manage the authoring environment.

**Connections**

Teamcenter CMS is possible to connect with Teamcenter 8 with custom integration solutions. As default Teamcenter CMS is integrated only to XML editor tools. Also some custom solutions to ERP integrations exists.

**Workflows**

When authors freeze a topic, it does not mean that the life-cycle state of the topic changes in the system. Freezing can be understood as a working state which shows that topic is ready to send in workflows to gain for example life-cycle state Released.

Workflows are enterprise process flows where serial of actions is executed by different users in defined order. In the workflow the enterprise business practices and procedures are turned into different process templates. In Content Management enterprises can use workflows to process topics through release cycles between documentation process participants. Content management uses workflows which are defined in Teamcenter 8 Workflow Designer. Workflows can for example manage the translation processes and for publishing to a server.

In the Figure 26 is presented an example of the translation order workflow in Teamcenter CMS system.

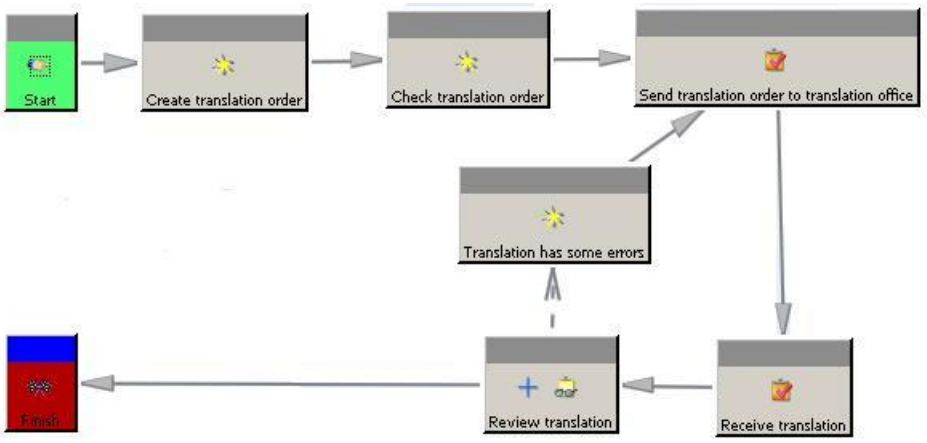



***Figure 26*** *Example of the Teamcenter CMS translation workflow*

When author want to create new translation, he has to fill the translation order and send it to translation workflow. Authors can use the translation delivery object to create a .zip file containing all the objects needed to send to the translation office. In next step the translation order appears in process initiator user´s inbox who checks that the translation order is ok. In the next step the zip file and order is delivered to translation office via email where translation will be made base on the order. After translation the translation sends the translated topic in zip packet, back to the appropriate person. Person reviews the translation and imports accepted, translated topics to the Teamcenter CMS system by the Receive Translation function. The translations are registered in the Teamcenter CMS so the process can be trace later on.

## 6.5 Publication system in Teamcenter CMS

Publications process starts for example reviewing and freezing the publication. In the following is presented the publishing process in Teamcenter Content Management.

**Publishing form**

When author wants a publication to be published the right publication must be chosen. Publication which is not frozen cannot be published. Author must fill in the publishing form in Teamcenter CMS. Publication form can be seen on the publishing dialog in Figure 27:

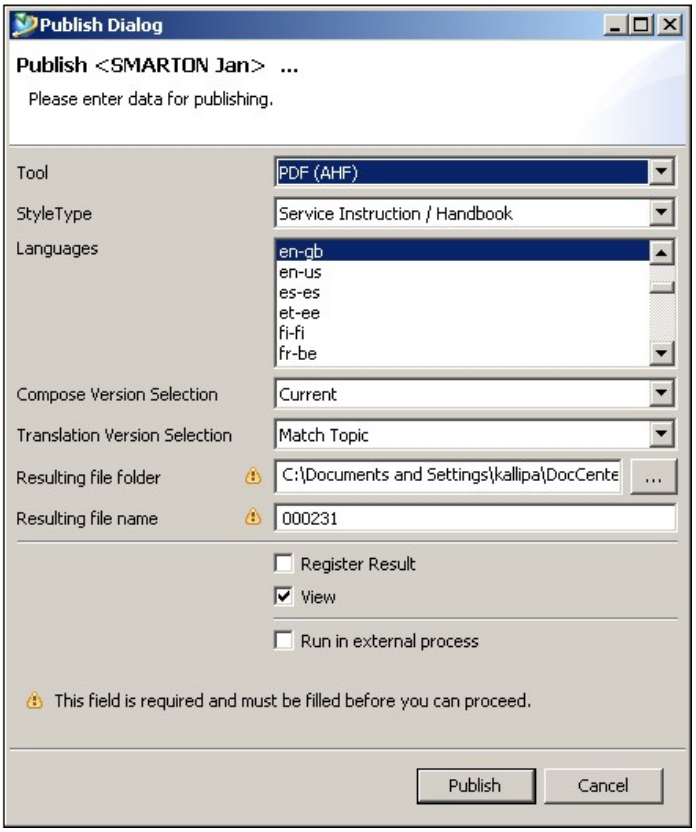



***Figure 27*** *Teamcenter publishing dialog*

Form includes the information about publishing tool, output format, and language, version selection for the publication and for translations. It also includes the storing name and place for the published document.

**Publishing tool**

Teamcenter CMS is integrated with separate commercial publishing tools to publish documents in right delivery format. One of the publishing tools is for example XYEnterprise XML Professional Publisher (XPP). XPP is tool for high quality and automated publishing engine that formats XML, SGML, database feeds and any ASCII tagged content into complex formatted postscript and PDF deliverables. Nevertheless, the formatted postscripts and PDF are not often enough for delivery formats. Enterprises are showing nowadays more interest for dynamic web delivery which has own publishing tools. (Content Management Administration Guide 2009)

**Style type**

Teamcenter CMS needs at least one style sheet installed for the system to publish the documentation. Style sheets are represented by a source file used for transforming the XML data. They are not used only in publishing but also for instance to transform the data when topics are imported and exported from the system or topics are viewer or edited. Style sheet is an object in Teamcenter CMS and it can be related to style type, topic type and a tool. Style type is a compile of different stylesheets. Sometimes

publication is published with several different stylesheets, meaning that the outfit of the different parts of the document diverges from each other. The with style type these stylesheet can be parsed as together.

## 6.6 Summary

Teamcenter CMS applies the single sourcing methodology by enabling to create re-usable, modular topics and structured documentation. With XML Teamcenter CMS offers and effective way to create, assemble and manage the single XML elements.
Teamcenter Content Management (Teamcenter CMS) is Siemens PLM Software's solution to create and publish product documentation in product life-cycle management (PLM) environment. Teamcenter Content Management is add-on module in Teamcenter 8 PLM software. Teamcenter CMS is originally developed by a small German IT-provider KGU-Consulting GmbH which sold the program rights to Siemens PLM Software. Nowadays KGU is working as partner of the SPLMS and helps on developing of Teamcenter CMS.

Teamcenter CMS can be divided, according to the Boiko's enterprise wide CMS division, to three different parts. These parts are Teamcenter CMS client (collection system), Teamcenter CMS server (publication system) and Teamcenter CMS repository (Administration system).

Teamcenter CMS collection system consists of Teamcenter CMS client user interface and XML editor. Teamcenter CMS has not own XML editor tool but enables integration with several professional XML editors. Teamcenter CMS server is the link between repository and client. It also works as publishing server and it is integrated with publishing tools. Teamcenter CMS repository includes the workflow management and works as the database for CMS objects. It is however, different repository than Teamcenter 8 PLM system uses even behind it is same kind of data model.

Teamcenter CMS client enables creating, editing and searching the content elements which is called in Teamcenter CMS topics. Client works as a work place for authors when they are attaching the needed topic to the publication. Client includes all needed functionalities such as sending objects to workflow, revisioning, graphic management, translation process and so on, to create and publish the right kind of document.

Teamcenter repository works as administration tools for Teamcenter CMS. Teamcenter CMS client includes administration interface for system administrator. Repository includes also the Teamcenter 8 interface where system administrator defines the workflows. Through administration interface system administrator however assembles DTDs and schemas, stylesheets and tools that author needs on their work. System administration work is to take care that authoring environment is usable for document authors.

Teamcenter CMS server has the publishing services running. When authors want to publish the publication, he fills the publishing form in author's interface to define which kind of document he wants to be generated. Authors choose the stylesheet, language and

the output format for the documentation. Teamcenter supports over 20 languages and several different outputs formats such as PDF, CD/DVD, Paper and WEB online help for example.

# 7 CASE STUDY: KONECRANES OYJ

This case focuses on Konecranes Finland Oy's one of the present technical documentation creation processes on equipment business area. An XN chain hoist manual, which is a one type of technical document, is used as an example document in the case study. The process might apply to other technical manuals also, such as service manuals for example, but in this study it is not meaningful to leaf through all technical documents and their creation in Konecranes. Intention of the case is to get an understanding of the demands which international, machinery industry enterprise set for documentation process and for technical documents. XN product family's owner´s manual works as good example of the technical document which machinery industry produces. The case study contains short presentation of the whole company, scenario of how XN chain hoist documentation process works, features that Konecranes equipment is demanding of their XN family customer documentation

## 7.1 Company profile

Konecranes Finland Oy is Finnish company which is headquartered at Hyvinkää. It is an affiliate of Konecranes Oyj Corporation which is the world´s largest supplier of industrial cranes. In this thesis Konecranes is used as the name of the company. It is a group of lifting businesses that offers a various range of different kinds of advanced lifting solutions to industries around the world since the 1930s and nowadays it is one of the largest crane manufacturer and the largest crane service company in the world. KCI Konecranes was initially a division of Kone Corporation until 1994 when Kone Corporation listed on to Helsinki Stock exchange. Listing on stock exchange cause that Kone Corporation reorganized and its business areas were separated to KCI Konecranes with crane operations and to Kone with elevator business. In 1996 KCI Konecranes listed as own company to Helsinki Stock Exchange and in 2006 KCI Konecranes drops the KCI from the brand name. Now Konecranes is operating in 43 countries, has 470 service depots and 545 locations around the world with over 9,782 employees. It sales was on year 2009 1,671 million. (Konecranes Annual report 2009; www.konecranes.com)

Konecranes Finland Oy is arranged into two business areas – Equipment, which includes for a wide range of industries pre-designed components, cranes and material handling solutions; and Service offers service and maintenance solutions for all industries crane brands. Business area Equipments offers material handling solutions for all types of process industries. Handling solutions includes for example electric overhead cranes, nuclear cranes, shipyard cranes grab, light industrial cranes, wire rope

hoists and chain hoists. Lifting capacities of these products reach from the 50 up to 2000 metric tons. Konecranes is marketing the products through a multi-brand portfolio. In this portfolio the brands are Konecranes corporate brand, StahlCraneSystems, SWF, Verlinde and R&M brands. Difference between brands are that Konecranes branded products are directly sold to end-users when others brands are sold to distributors.

Service business area offers for instance inspections, repair and improvements, spare parts and modernization for the different lifting solutions. It is a clear market leader in crane service. From hoists and cranes that service maintains, only 25 percent are Konecranes manufactured products.

Ideal Product Data Oy and Konecranes Oyj started their co-operation on year 2005, when Konecranes started a pilot project with Ideal. Target of the project was to investigate Teamcenter's and NX's suitability as a design system. In the first phase project applied only for heavy lifting and R&D unit. Today Teamcenter and NX are used in several locations around the world. (www.konecranes.com)

## 7.2 XN5 Electric chain hoist as a product

XN5 Electric chain hoist belongs to XN electric chain hoist product family and, which is part of light lifting equipments group. XN5 is pre-designed, modularized and generic product which gives to a customer the possibility to build a hoist that fulfills their needs. Picture of XN electric chain hoist is presented in Figure 28. The hoist is available for example with hook suspension, push trolley, and with motorized trolley versions which give user possibilities to adapt hoist in the right use. In the other word the hoist is a configurable product with optional features. Standard features of the product are:


***Figure 28*** *XN electric chain hoist*

- Sturdy control pendant and cable
- Electrical upper and lower limit switch
- IP55 Complete protection against dust and foreign bodies
- Dual speed
- Galvanized load chain
- Mechanical overload protection
- Chain collector bag
- Built-in control panel
- Stepless speed control for travelling motion (for hoist with electrical trolley)

And optional features:

- Stepless speed control for lifting motion
- Thermal motor protection
- IP55+ protection
- Insulation class H hoisting motor
- Single phase power supply
- Stainless steel load chain and hook
- Explosion proof version etc.

As seen, XN hoist family has seven optional features which bring dozens of different variations to choose from. All of variants have their own individual owner´s manual, service manual and spare part catalog. (www.konecranes.com)

## 7.3 Technical manuals in Konecranes Standard lifting Oyj

Konecranes Equipment produces several different kind of technical documentation which depend the complexity of the product. In the other side are the products which can include some small amount of variations but basically, most orders has the same documentation. To create a right kind of documentation, configurator has to find the correct document component from the PDM documentation model. In this case document only consists of one component which has a variety of language options. Configurator chooses the right language and attaches the document to the order.

Some products however are not that simple. The most complex products are totally customer configurable and have a lot of variations. When we are speaking of this kind of product in Konecranes, in the documentation creation process the document configurator has to find the right document elements from the documentation model using the attributes from the order and technical features. Because product might have a lot of different configurations, document variants, separate tool called DocEngine is used to collect document elements from the generic structure and parse the final document as the right kind.

Nevertheless, these two documentations are not enough. There exists the third document type which is more item specific than the others. This means that documentation has to focus more to single part and parts in the structure. This documentation is called spare part documentation. Spare parts include all product spare parts, alternative items, replacing parts, serial number from-to and selection rules. Parts are often sold in sets and different documentations have to be collected based on spare part sets, which are walking hand in hand with product variation.

All these three document type have to be able to produce:

- In 8 different sales brands.
- In over 20 different languages.
- With right localization data (For example 2 different Unit systems (metric, U.S) and frequencies 50/60 Hertz).

- With newest document revisions.
- In three different technical documentation types, owner's manual / service manual / spare part catalogs.
- A customer specific documentation.
- A documentation which supports product varieties.
- A documentation which supports as built product structures and spare parts.

These features apply to XN chain hoist products but would be a challenge for any documentation process. Every product family has their individual needs for the documentation. As seen XN chain hoist is already quite complicated product, it has a lot of different variations, mostly because of different standard and optional features. When these technical features is added to the features in documentation, as results there exist a full stack of different document variations.

## 7.4 Overview of KC documentation process

Konecranes Equipment produces almost 100 percent of the all order specific product documentations in house. At present Konecranes Equipment, in the case of standard lifting equipment uses highly automated document creation process. Process has several different stages and it uses several different tools on the process, as the results configured customer documentation is printed out by pressing one button.

### 7.4.1 Authoring process

XN chain hoist family product documentation has its own documentation team. Teams are working close to other technical personnel, so technical help is close when needed.

Documents are comprised of elements which are authored with word-processor tool Microsoft Word (MSWord). Elements consist of normal text and images; and they do not include any XML, HTML or other formats. MSWord enables to structure the document by using format tags. Format tags for example in the case of MSWord can be called Word styles. Styles in the MSWord are used to label content for example by heading level, body text, numbering, and bullets and so on. Labeling helps authors on formatting documentation so that they can concentrate on creating information. Authors are using style templates which they have to follow to get content standardized. The templates contains areas where author types text, specifies images and attaches other media. Some macros are also used in the documentation to manage tiny information chunks for example by localization. One example of this is choosing right units of measurements for the documentation by the target country. Content element size changes a lot; it can be a single paragraph or even a full, translated document.

When the elements are ready to be published they are stored to one of the Konecranes PDM system's database for later use. In PDM system, elements are tied for a generic document structure which is consisting of document items. Generic document

structures are configurable and therefore they include all element options for the product document such as language options, brand options and so on. Document structure is not tied during it life cycle to the actual physic generic product structure. Figure 29 shows the example of simple, generic document structure and how the word elements are related to the structure.

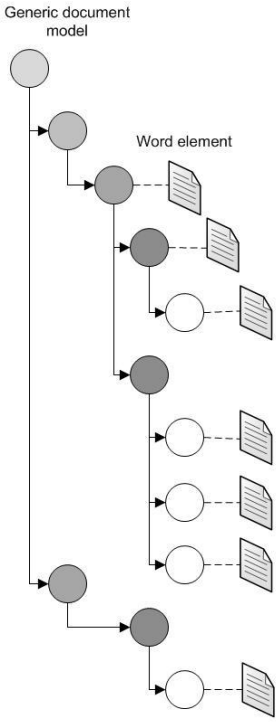



***Figure 29*** *Example of simple generic documentation structure with word files*

PDM system ties elements to a configurable structure, like parts are tied in the configurable product structure. When single document elements are revisioned, the generic document structure chooses automatically the right newest element revisions with revision rule, keeping the documentation always on the latest version and up-to-date.

### 7.4.2 Documentation process

Documentation process of the chain hoist's owner´s manual is presented in Figure 30. The whole documentation process starts when the customer orders the chain hoist. Customer chooses the features that he wants to be included in the hoist that is ordered. Product order specific technical attributes, for example language, delivery format (Paper, CD, Paper + CD, Email), brand, and so on, are entered to the sales configurator which store the order to one of the Konecranes specific ERP system. Orders are processed in ERP system and passes through the order approve process. After the process, when the order is approved, order is transferred from ERP to the PDM system. The order is related with individual serial number, which the XN chain hoist gets after its passes the test bench in the end of production line.

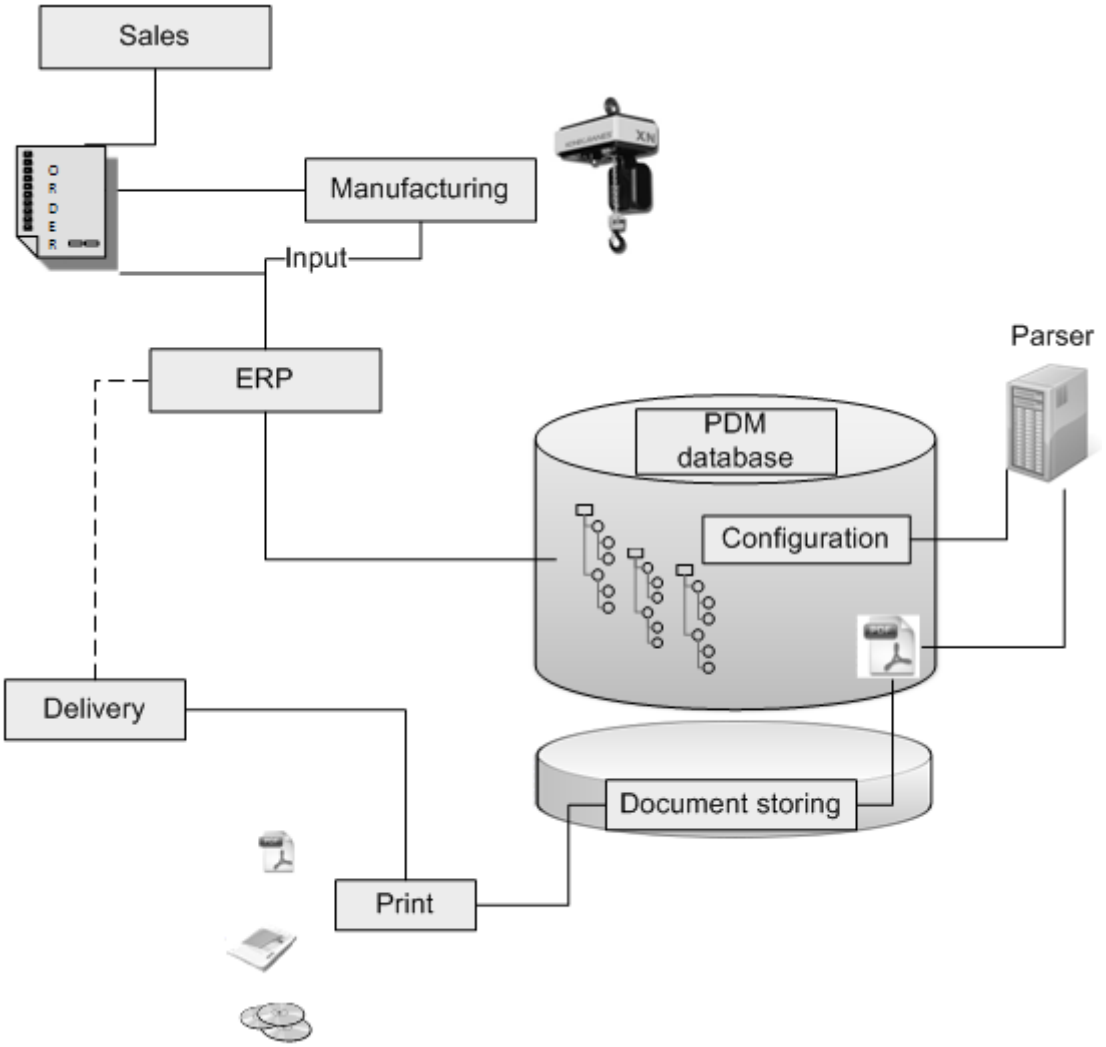



***Figure 30*** *Konecranes´s documentation process for XN chain hoist owner´s manual (modified Kantonen 2006)*

When product has got the individual serial number a separate document configurator picks up automatically the right element options and latest element versions from the configurable document structure. Document configuration uses technical features and order data (order attributes) on collection. Document structure with elements related is static structure and is not modified any way during the document generation process.

When needed MSWord elements are gathered together, they are exported from PDM system to tool called DocEngine. DocEngine build the whole configured As-built product, owner´s manual from MSWord document elements with the help of Microsoft Word and some rule templates. Is also converts the as-built manual to Portable Document Format (PDF). The original MSWord files are deleted in DocEngine or alternatively stored in the database. Generated PDF file is imported back to defined file server which is situated in PDM system. In the end as-built owner´s manual attached to the actual product order to wait printing to order defined delivery format.

When the customer specific XN chain hoist product is in packaging stage, the order specific configurated owner´s manual is printed to paper or burned to CD using separate

tool called MediaEngine. The whole documentation is printed completely in the right production site and it is ready for mapping. From the Figure 31 can be seen the similarity between generic product structure and generic documentation structure. Figure shows also how the owner´s manual is configured from the generic product structure and the word elements.

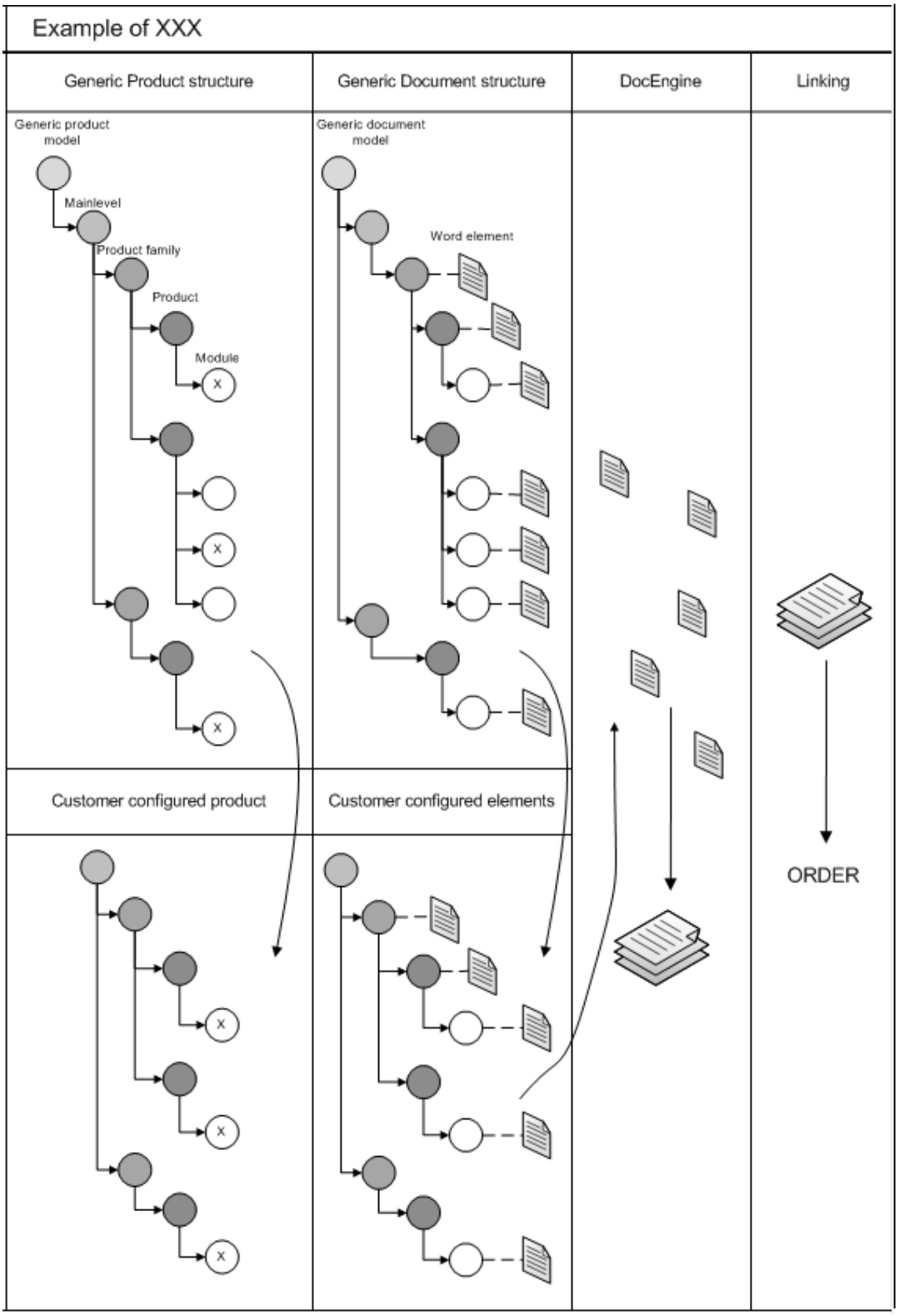



***Figure 31*** *Example of the generation of configured owner´s manual*

Even if the process sounds quite complicated, and includes different tools and stages in the process the only manual phases are:

- Creating document elements with Microsoft Word

- Attach them to document items in PDM system
- Entering order to sales configurator
- Approving the order in ERP
- Entering order number to MediaEngine
- File printed manual to binder

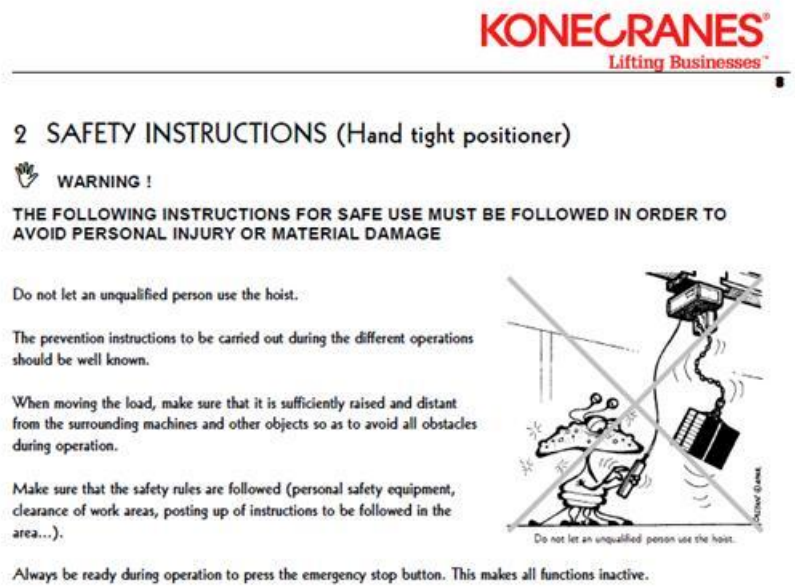
System is very effective; it is creating successfully 200 000 product specific documents per year and has already produced over 1 million documents during its life time.

## 7.5 XN hoist owner´s manual

As the result of the process, over 100 pages long XN chain hoist owner´s manual is generated. Even Robinson et al. (1991) divides the technical manuals to operator manuals (owner´s manuals), and to maintenance and repair manuals, in XN chain hoists the differences between those two manuals are not so clear. Owner´s manual include also sections which Robinson would classify to belong for maintenance and repair manuals. Following figures introduces some sections of the XN5 hoist owner's manual. (XN owner´s manual)

**Safety Instructions**

Safety instructions inform a customer about actions that are not permitted with the product or its equipments. It advices personnel to use the product safely in the right environment and helps avoiding personnel injuries or material damages. It includes also right operation procedures to protect product from environment conditions to keep it in a good shape and to increase products life time. See example of safety instructions in Figure 32.


KONECRANES
Lifting Businesses

2 SAFETY INSTRUCTIONS (Hand tight positioner)

WARNING !

THE FOLLOWING INSTRUCTIONS FOR SAFE USE MUST BE FOLLOWED IN ORDER TO AVOID PERSONAL INJURY OR MATERIAL DAMAGE

Do not let an unqualified person use the hoist.

The prevention instructions to be carried out during the different operations should be well known.

When moving the load, make sure that it is sufficiently raised and distant from the surrounding machines and other objects so as to avoid all obstacles during operation.

Make sure that the safety rules are followed (personal safety equipment, clearance of work areas, posting up of instructions to be followed in the area...).

Do not let an unqualified person use the hoist.

Always be ready during operation to press the emergency stop button. This makes all functions inactive.

***Figure 32*** *Example of XN chain hoist's safety instructions (XN owner´s manual)*

On the top of the figure can be seen the Konecranes brand which has to be substituted with the right logo when the product is sold by distributor. Figure shows what king of safety instructions the manual contains and also an instructive graphics which advice how not to use the product.

**Technical characteristics**

Technical characteristic of the product include all basic technical information of the product and equipments attached to it. Equipments can be for example Stepless, Trolleys, traveling machinery, Hand tight and so on. Technical characteristic section has technical data tables which tell for instance hoist's Max loads, speed, Finite Element Method (FEM) data and motor power. It also shows dimensional drawings of the product, some assembly and section drawings with callouts and part lists to explain how the hoist is working; and circuit broad drawings.

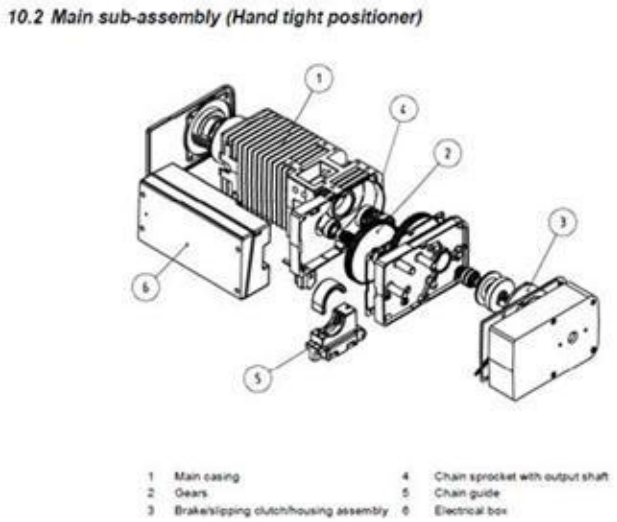
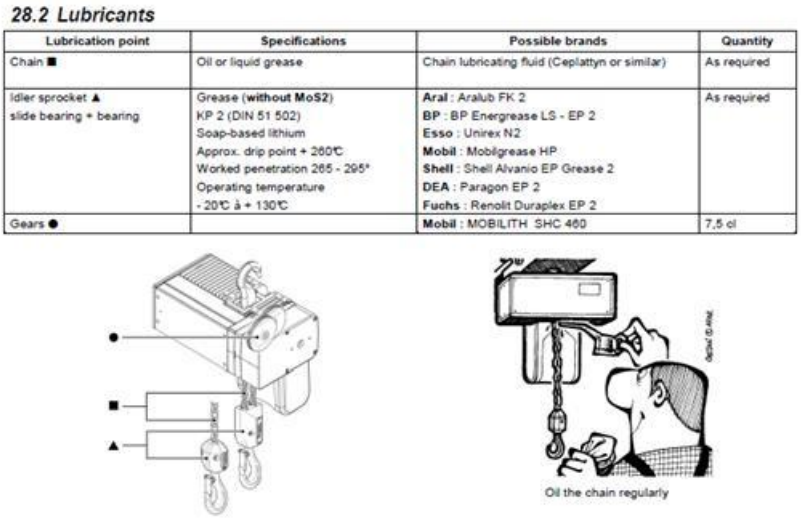



***Figure 33*** *Example of XN chain hoist's technical information (XN owner´s manual)*

Figure 33 presents the main sub-assembly of the chain hoist. Figure includes the assembly's main part's callouts and the names of them.

**Maintenance information**

Maintenance chapter include instructions for different kind of maintenance procedures and information for example about lubricating the parts, oil change information, spare parts, product adjustments and so on. Maintenance procedures are such that even a customer's own technical service personnel, to whom chain hoist is an unfamiliar product, can accomplish the needed maintenance operations. Example of maintenance information is presented in Figure 34.



*28.2 Lubricants*

| Lubrication point | Specifications | Possible brands | Quantity |
|---|---|---|---|
| Chain ■ | Oil or liquid grease | Chain lubricating fluid (Ceplattyn or similar) | As required |
| Idler sprocket ▲<br>slide bearing + bearing | Grease (**without MoS2**)<br>KP 2 (DIN 51 502)<br>Soap-based lithium<br>Approx. drip point + 260°C<br>Worked penetration 265 - 295*<br>Operating temperature<br>- 20°C à + 130°C | **Aral** : Aralub FK 2<br>**BP** : BP Energrease LS - EP 2<br>**Esso** : Unirex N2<br>**Mobil** : Mobilgrease HP<br>**Shell** : Shell Alvania EP Grease 2<br>**DEA** : Paragon EP 2<br>**Fuchs** : Renolit Duraplex EP 2 | As required |
| Gears ● | | **Mobil** : MOBILITH SHC 460 | 7,5 cl |



***Figure 34*** *Example of XN chain hoist's maintenance information (XN owner´s manual)*

Figure shows the oil types and brands that should be use on the lubricating. Instruction includes a graphic which illustrates where to pour the oil and how.

## 7.6 Demands for documentation and the documentation process

From the Konecranes owner´s manual creation process it is possible to see what demands heavy machinery industry has for their technical documentation and its process. In the following is several demands what the case study shows:

- Documentation has to support several different languages and alphabetic
- Documentation has to support the multi-brand portfolio
- Documentation process has to be effective and run by customer order
- Documentation has to be customer specific and follow the customer order
- Document element's revisioning and versioning has to be controlled
- Documents have to include the newest revisions of document elements
- Other business processes has to support the documentation process
- Documents have to be localized easily
- Documentation process must be able to create several different manuals for different purposes
- Authoring must be easy and standardized
- Documentation must support graphics and graphic translations
- Documentation has to support in some level the cross-media publishing
- Documentation has to support configurable products and as-built structures
- Documentation system has to generate over 500 configured technical documents per week, cost effectively.

- Published manual has to follow the product during its life-cycle in the enterprise PDM system.
- Document must meet the delivery times

These demands can be kept as universal challenges for the technical documentation and its creation process in any other enterprise which is working in heavy machinery industry.

# 8 RESULTS

The purpose of this thesis was to investigate how Teamcenter Content Management system suits for creating technical documentation for the demanding machinery industry use, where products are often based on configurable product model. The case study of the thesis introduced one example of the documentation process in the demanding machinery industry and one type of the technical documentation, owner´s manual of the XN chain hoist. From the case study was recognized the features that heavy machine industry requires of their documents and documentation process.

To evaluate Teamcenter CMS two matrixes were carried out based on the document and documentation process requirement list. The matrixes help on evaluating the Teamcenter CMS and its prospects subjectively and to highlights the Teamcenter capabilities and solutions. Matrixes consist of the document and documentation process requirements which were figured out from the theoretical part and the case study part of the thesis. Document process requirement evaluation matrix is presented on page 72 and the document requirement evaluation matrix in the page 73. Matrixes present the Teamcenter CMS capabilities and solutions related to document and document process requirements. Points from 1-4 has been used to describe subjectively how well Teamcenter support the requirements which is faced.

At the time of writing the thesis, Teamcenter CMS was used in other parts of the world but only some test installations were made in Finland. Most of the existing installations are integrated with Teamcenter Enterprise which is older version of Teamcenter. First installations in Finland of Teamcenter 8 version with Teamcenter CMS were made in spring 2010.

***Table 2*** *Document process requirement evaluation matrix*

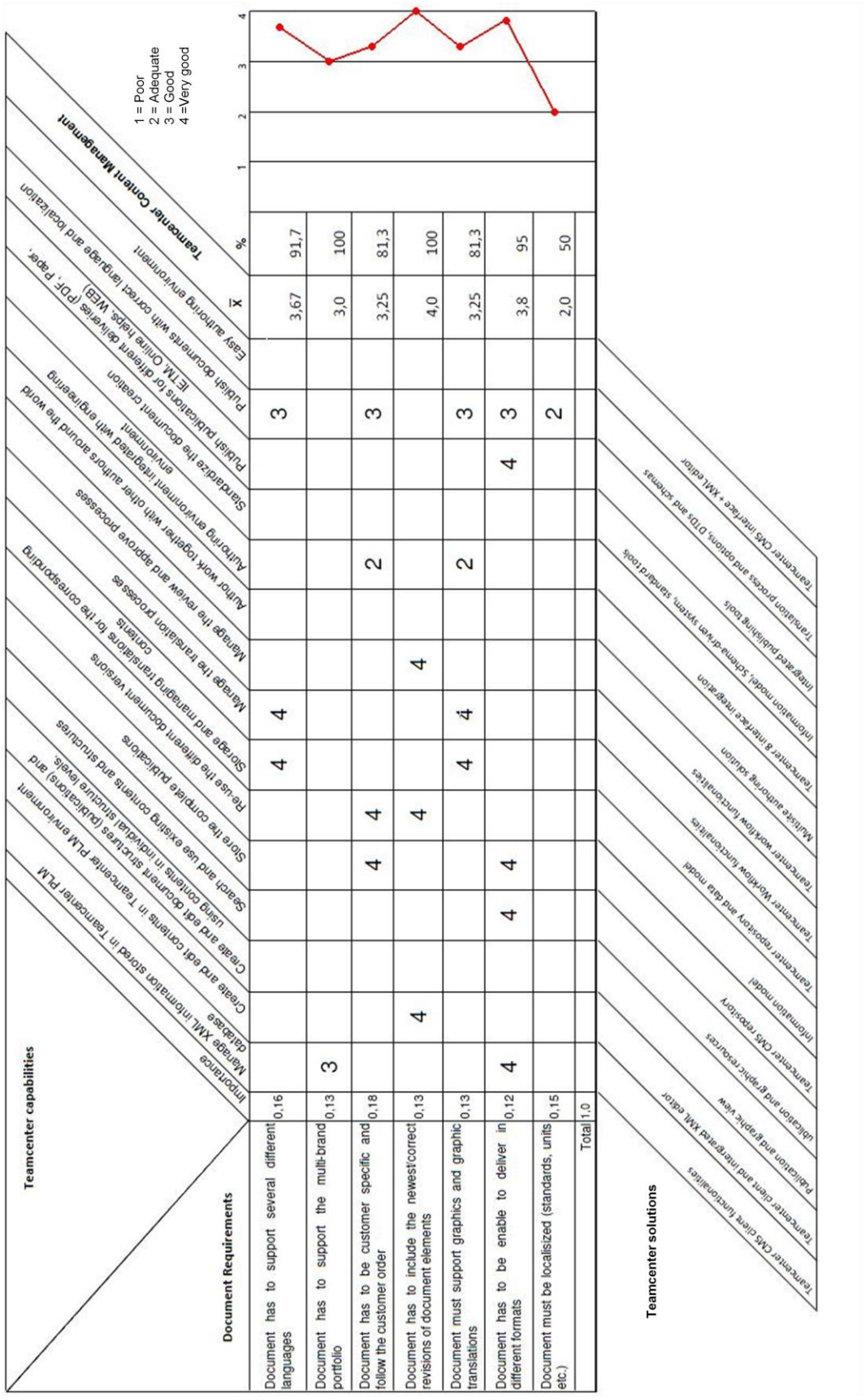
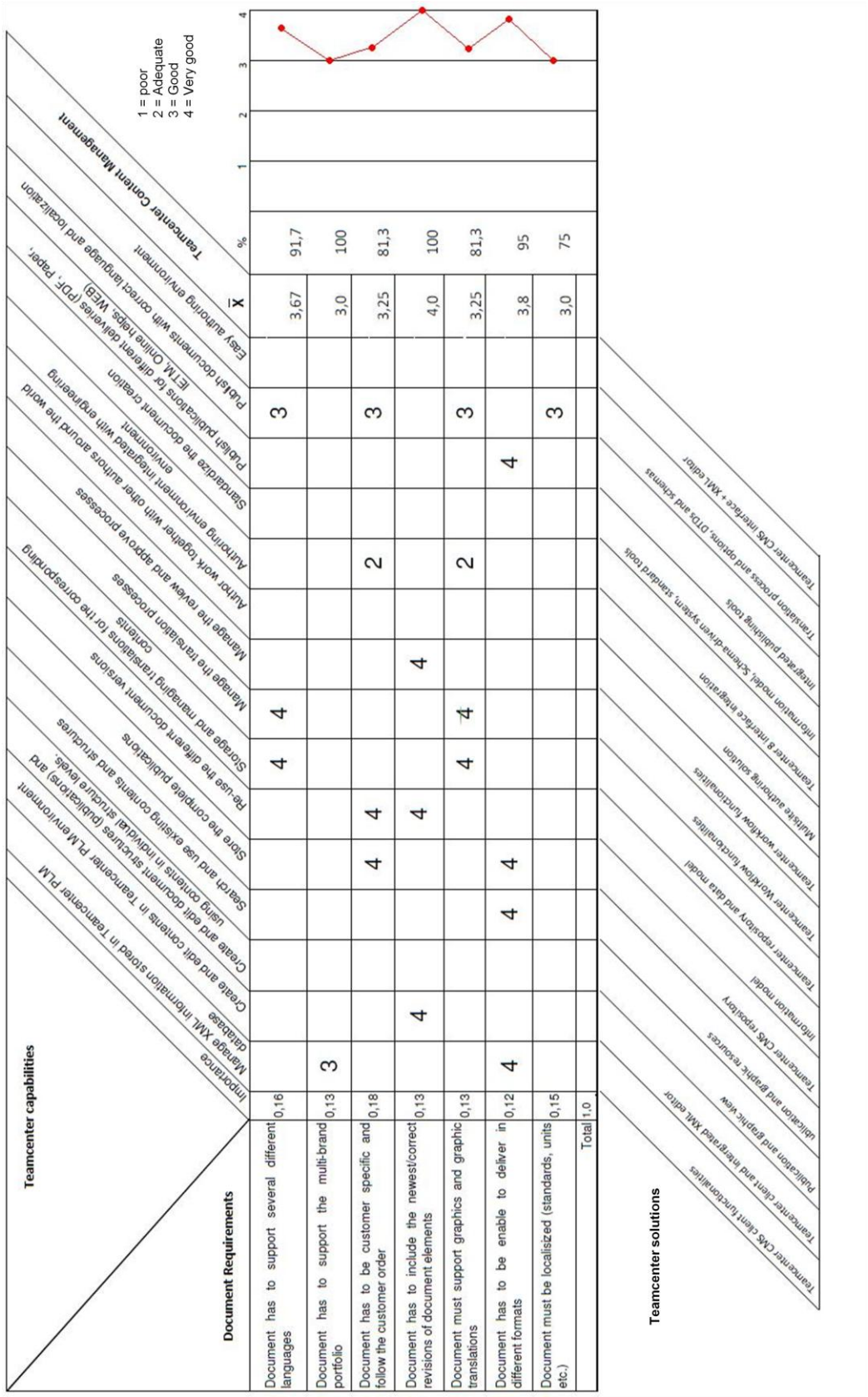


***Table 3*** *Document requirement evaluation matrix*



## 8.1 Conclusion

Teamcenter CMS offers an easy to use environment for authoring. It can be easily used trough the Teamcenter user interface, which offers standard environment to manage the enterprise documentation. Authors do not have to work anymore in the separate environment from the other product development across the globe. Author can easily create and edit, search and retrieve the information from the same source and use information in different publications.

Authoring interface is integrated with several commercial, professional XML editors. These editors enable authors to create document elements easily, without a special knowledge of eXtensible Markup Language (XML). The authoring comes, despite of using XML, closer to the word-processing authoring which is easier to adapt by non-technical authors. XML works also as great language to create non-format-tied information modules and publish the information in different output formats, for example normal text, HTML and so on. Because of XML and the publishing stylesheets, authors can concentrate to create the contents and they do not have to think the output formats or language of the end-delivery. XML truly makes the documentation to meet industry standards and thanks to the predefined information model, where DTDs and XML schemas set the rules for the XML authoring. XML information chunks bring also the reusability on the higher level, saving authors time and enterprise money.

Teamcenter CMS system is integrated with Teamcenter PLM environment, which brings authoring to same environment with engineering. However, it cannot be said that the integration is complete or that these two systems works together seamlessly. The integration does not reach the level where the Teamcenter CMS understands the engineering objects for instance items, item revision, documents and so on. The reason is likely the different information data model behind the whole systems. In other words Teamcenter client interface is more like window to these two different systems, which are separated with wall. Present integration does not support the information exchange between systems, without exporting the data to outside source. The incomplete integration causes, that all benefits that PLM is offering cannot be used on the documentation process. Teamcenter also has its own terminology which might cause misunderstanding between Teamcenter and Teamcenter CMS users.

Even through the integration is incomplete, at present authors can use the Teamcenter workflows to manage the life-cycles of the topics and publications. Teamcenter offers good environment to create and execute the right life-cycle workflows and so it offers competent version and revision management. Different life-cycle statuses keep consistently the used topics on newest and make sure that the document is up-to-date. Workflow capabilities enable also an effective translation processes. Topics are sent straight to translation office and after translation related to the

source topic. Only topics which needs translation are translated which helps orders to stay in budget and schedule.

Publishing process is also well automated. Authors just set the right publishing settings when different publishing tools collect the right graphic options and languages from the publication and publish the document in right delivery format. Output layout is determined with publishing stylesheets which makes the WEB page or paper sheet look like it should be looking. As a result enterprise gets fully configured and customer specific documentation to attach with product delivery.

In overall Teamcenter CMS offers authors and enterprise a standardized environment for documentation creation. Predefined information model, XML, DTDs, schemas, stylesheets and integrated tools gives a great base to create flawless, standard documentation for the certain audience. All of aforementioned leads to improved quality of documentation and authors work results. Enterprise lifts its productivity and the resulting impact of meeting schedules and budgets for product launch mainly because the documentation is now a tied part of product development process. Teamcenter Content management is suitable solution for enterprises if they are producing large documents which conform to industry standards, documents in multiple languages or documentation for configurable products. Teamcenter CMS is based on single sourcing methodology and together they form an effective system to meet challenges on documentation process.

## 8.2 Further development

It can be seen that Teamcenter CMS is in the beginning of its way to be more solid part of Teamcenter PLM system. The system works even now as good and effective authoring environment and management system for the enterprise documentation process. However it has still a lot of potential improvements to be made.

One of the biggest development targets could be the integration with engineering world. It could bring the benefits of which other CMS application can only dream of. One of the biggest benefits of improved integration would certain be the possibility to attach the documentation structure with physical structure models. Document configuration could be tied together with product configuration so the product specific product and document would be configured same time. Possibility to make relation between XML topics and engineering items would also make the documentation follow the products life-cycle and for example author could get easier input in the case of design changes.

The incomplete integration at the database level is not the only thing which could be done better. Teamcenter CMS is originally a third party software which can be seen for example in the terminology. Terminology would be nice to equalize with Teamcenter terminology, to avoid the confusion between different Teamcenter users.

Enterprises are also nowadays interested in Darwing Information Typing Architecture (DITA), which is one kind of XML-based DTD or schema for XML

standardization. It is more architectural based that fixed DTDs and schemas. At present Teamcenter versions Teamcenter 8.1 does not support the DITA standardization however partial DITA support is enabled in Teamcenter 8.2. DITA support will bring the document structures in new level, enabling new additional features for structured documentation.

## 8.3 Final words

In summary, this study succeeded well and the objective of the study was fulfilled. Study found out first the requirement for the documentation and documentation process and contrasts the Teamcenter Content Management capabilities to these requirements. During the writing process couple of challenges was faced. First challenge was on determining the Teamcenter CMS features. Teamcenter CMS module features changes a lot during the study in the way and the other. It was quite hard to recognize which features where already released, which ones were still on development stage and which ones were the extra features that CMS developer KGU was offering to the system. Second challenge was in finding out the capabilities from the Teamcenter CMS itself. Installation of Teamcenter CMS was not available until the study was in its final stages.

# BIBLIOGRAPHY

Ament, Kurt. 2003. Single sourcing: Building Modular Documentation. Norwich, NewYork U.S.A, William Andrew Publishing. 230 p. ISBN: 0-8155-1491-3.

Boiko, Bob. 2005. Content Management Bible, 2nd Edition. Wiley publishing, Inc. 2005. Indianapolis, Indiana. 1122 p. ISBN: 0-7645-7371-3.

Bolton, Davoid. Calisto, Ralph F. And Simmons Laurel R. Documentation for Global Markets: Some Practical Considerations. 1995. (Referred 29th June 2009) Http://www.stc.org/confproceed/1995/PDFs/PG149.PDF.

Contentmanaget.eu. Enterprise Content Management (ECM) – ECMS Vendors, Suppliers and Solutions. (Referred 19th January 2010). http://www.contentmanager.eu.com/cms.htm

Getting Started with Teamcenter 2007 guide. Siemens PLM software.

Hackos, JoAnn T. 2002. Content Management for Dynamic Web Delivery. John Wiley & Sons, Inc. 2002. New York. 415 p. ISBN: 0-471-08586-3.

Hackos, JoAnn. Hedlund, Tina. 2001. Making a Business Case for Single Sourcing. The Center of Information-Development Management. Denver. http://www.comtech-serv.com/pdfs/Business_Case_for_Single_Sourcing.pdf

Halpern, Marc, Miklovic Dan. Gartner, Inc. "Magic Quadrant for Manufacturing Product Life Cycle Management, 4Q07", January 4, 2008.). (Referred 28th April 2010). http://mediaproducts.gartner.com/reprints/oracle/153351.html.

Haramundanis, Katherine. 1997. The Art of Technical Documentation 2nd Edition. Digital Press 1997. 228 p. ISBN: 978-1555581824.

Heemels, Rob. Grosser, Sabine. Change management - an underestimated success factor. Tc-world e-magazine. December 2008. (Referred 23rd November 2010) http://www.tcworld.info/index.php?id=77.

Hietaniemi, Kari. 2006. Overcoming Cultural Differences in the Localization of Manuals. Pro Gradu thesis. University of Tampere, School of Modern Languages and Translation Studies.

Hietala, Antti. 2004. Towards Content Management with a Dynamic Style Guide. Pro Gradu Thesis. Department of English. University of Oulu, September 2007.

Ideal Product Data Oy company overview. (Referred 7th July 2009).
Http://www.ideal.fi/yritys.htm .

Kantonen, Ismo. 2006. Document Platform. Konecranes internal document, *not available*.

KGU Consulting GbmH, internal presentation. 2007. Teamcenter Content Management Partners – Integration and Supporting Services. 2007.

KGU Consulting – CMS – What is CMS? (Referred 14th January 2010). http://www.kgu-consulting.com/en/cms

KGU CMS concepts presentation. Internal document, not available.

Konecranes Oyj Annual report 2009.
http://www.konecranes.com/portal/eng/investors/reports_and_result_presentations/

Konecranes Oyj company overview. (Referred 27th April 2010).
http://www.konecranes.com/portal/eng/about_us/ .

O'Keefe, Sarah. 2009. Structured authoring and XML. Scriptorium Publishing Services, 2009.
Inc. Http://www.scriptorium.com/structure.pdf .

O´Reylly xml.com. (Referred 1st April 2010). XML form the inside out webpage.
http://www.xml.com/pub/a/98/10/guide0.html?page=2

Pöyhönen, Matti. Tiusanen, Asko. 1991. Käyttöohje on osa tuotetta: käyttöohjeen laatijan opas. 3rd Edition. Helsinki, Pohjola-yhtiöt. 48p. ISSN: 0780-9816.

Riitahuhta, A. & Pulkkinen, A. Desing for Configuration, Springer. ISBN 3-540-67739-9, Tampere, 2001.

Robertson, J. 2002. How to evaluate a content management system. Step Two
Design Pty Ltd. Online. 23 Jan 2002. http://www.steptwo.com.au/papers/kmc_evaluate/

Robinson, Patricia A. Holstein Schoff, Gretchen. 1991. Writing and Designing Manuals: operator manuals, service manuals, manuals for international markets. 2nd Edition. Chelsea, Michican, LEWIS PUBLISHERS, INC. 1991. 186 p. ISBN: 978-0873714211.

Rockley, Ann. 2001. Content Management for Single Sourcing, STC Proceedings 2001. http://www.stc.org/confproceed/2001/PDFs/STC48-000171.PDF

Siemens PLM software 2009 (webpage). Teamcenter overview (Referred 29th June 2009). http://www.plm.automation.siemens.com/en_us/products/teamcenter/

Silver, Jerry. 2007. Improving Customer's SOA Experience with DITA. SOA WORLD MAGAZINE Oct. 7, 2007. (Referred 11th August 2009). Http://soa.sys-con.com/node/434465.

Soronen, O. 1999. Massaräätälöinti asiakasmyötäisessä tuotannossa. Helsinki, MET. 1999. 62 p.

Suzanne Mescan 2004. Curing Publishing Woes with a Content Management System. Intercom, January 2004. http://www.stc.org/intercom/PDFs/2004/200401_22-24.pdf

Sääksvuori, A. Immonen, A. 2002. Product Lifecycle Management. Springer 2004. 247 p. ISBN: 3-540-25731-4

Teamcenter 8 Content Management Administration Guide, 2009. Publication number MT00427 A. Siemens Product Lifecycle Management Software Inc. 2009.

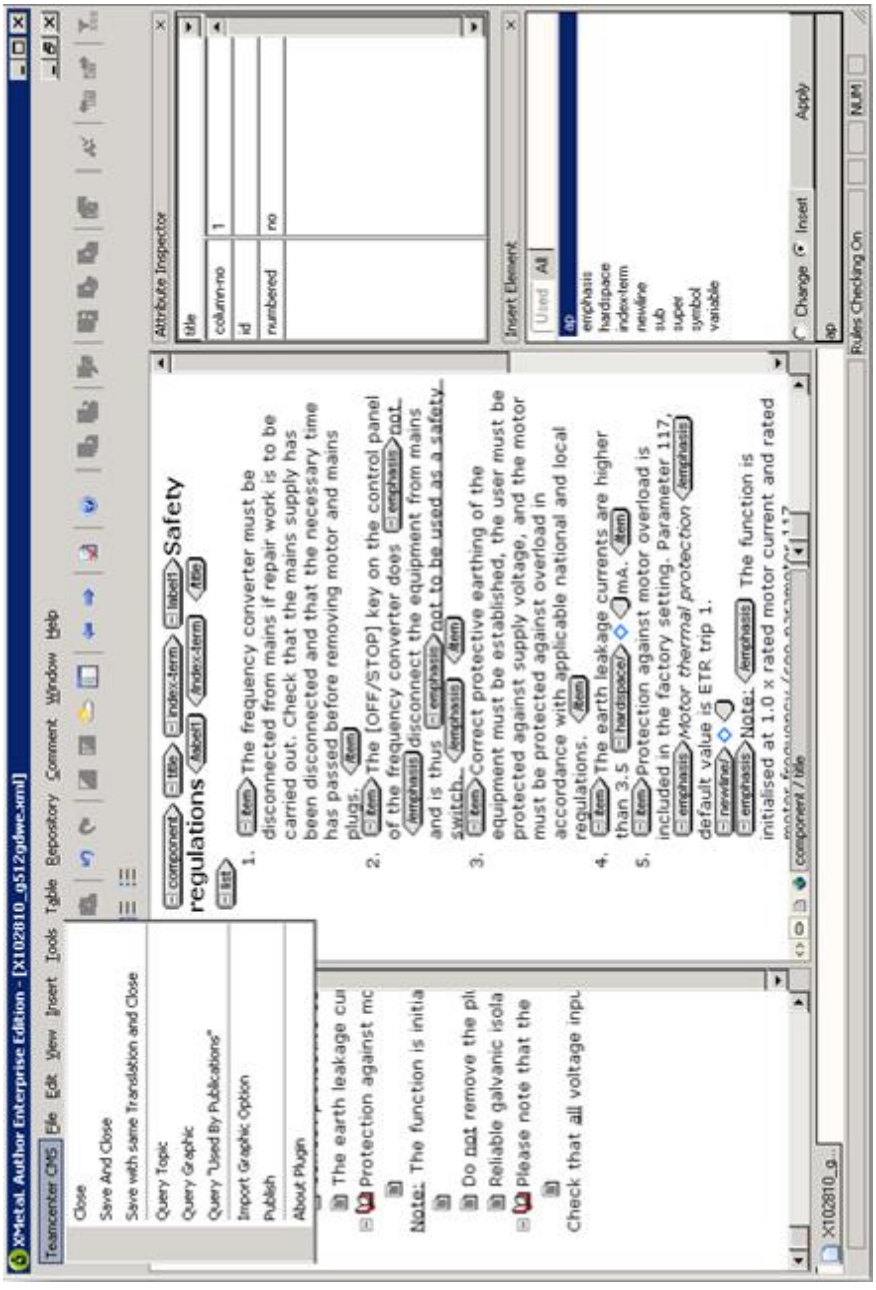
Teamcenter 8 Content Management Guide, 2009. Publication number MT00421 A. Siemens Product Lifecycle Management Software Inc. 2009.

Trish Laedtke, 2009. Content Management in Teamcenter 8 presentation. Siemens PLM Connection, PLM World, June 1-4 2009, Nashville.

w3school.com. DTD Building Blocks webpage. (Referred 20th February 2010). Http://www.w3schools.com/dtd/dtd_building.asp

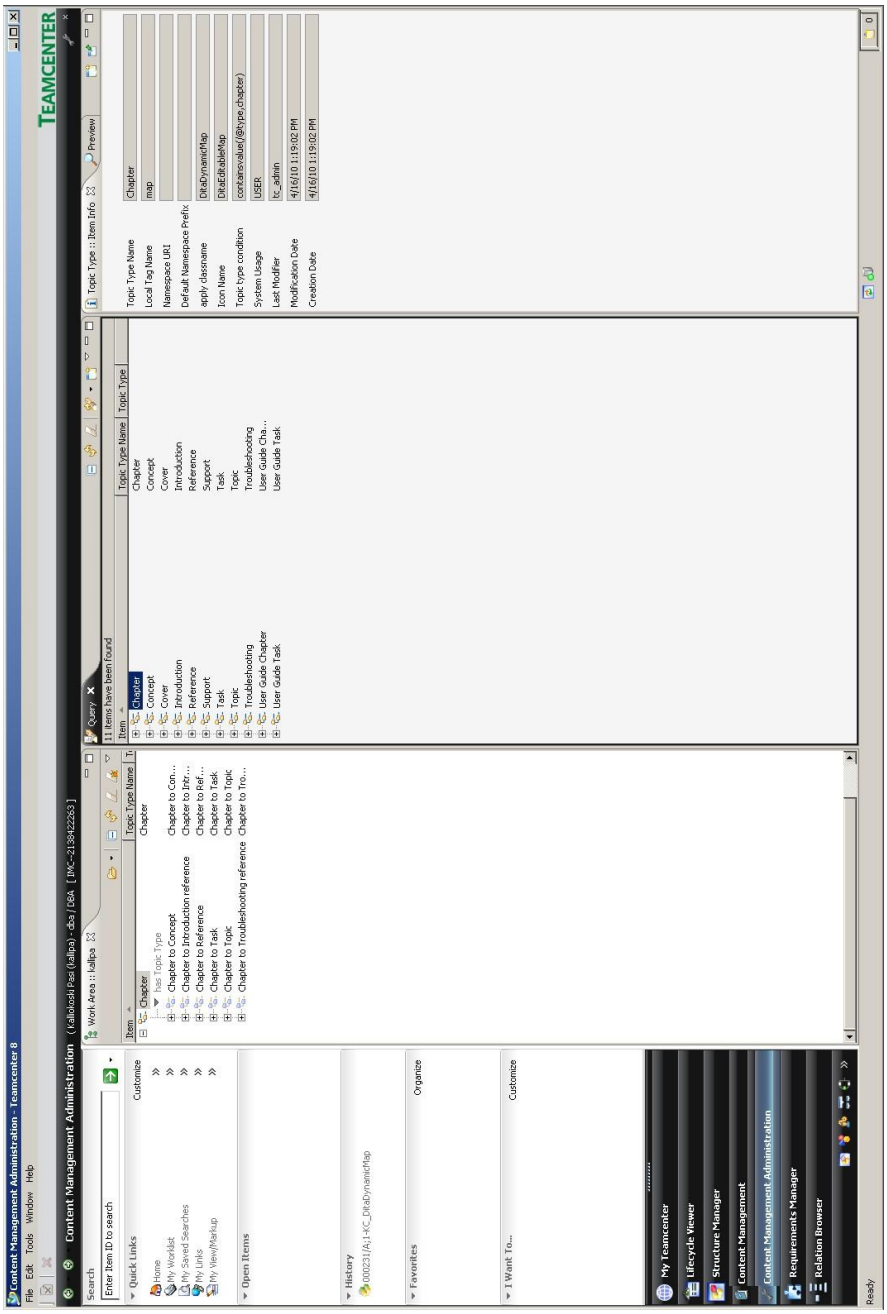
XN chain hoist owner´s manual. Konecranes, language: English.

# APPENDIX 1: XMetal XML editor interface




***APPENDIX 1:*** *Xmetal XML editor Interface*

# APPENDIX 2: Teamcenter Content Management Administration interface




***APPENDIX 2:** Teamcenter Content Management Administration interface*