Digital Building Design Management in Computer Aided Design: An Overview

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Abstract: *The problem of managing all the information in building design is a real challenge. Electronic Document Management is growing rapidly and generates the need to structure of design information across building design companies. Lithuanian standardization organizations, professional associations, user groups, individual companies dońt have unified rules of CAD (Computer Aided Design) standards and guidelines in building design industry. The most important issue in efficient IT application is the standardized reference of all data definitions.*

Keywords: Computer Aided Design, Electronic Document Management, Product Data Management, Building Information Technology.

Introduction:

In today's fast paced economy, building design companies with multiple enterprises such as architecture, engineering and construction (AEC) are seeking for new efficient ways to streamline their business processes, so that the project development time and costs can be reduced. Project development time is typically long due to a considerable volume of documents that required to be transferred between the members of different project teams. Another possible reason for high project development time and costs is that even typical projects have to be developed from the bases, since there is no centrally and easy accessible information storage. It is based on well-know fact that designers spend 75% of their time searching for the appropriate documents, and only 25 % of the time actually modifying it. As an efficient solution the mentioned above problems is the application of the product data management (PDM) systems, that facilitate the management of documents pertinent to particular enterprises, projects and work groups in computer networks. In addition to the basic file management capabilities, PDM systems contain enhanced features related to the life-cycle, revision history and version management of particular classes of documents. A number of commercial tools have been created for

document management, project information sharing, online communication, design workflow, construction workflow, time control, and securing information. The case study presented in this work demonstrates how PDM system has become an important element in keeping control of company design activities. It served as a central repository for design information, and digital data documenting the progress.

Generic Model of Digital Design Data Archive:

A growth of the work intensity in building design companies creates the difficulties of management information flows in the projects. In fact, project management can be accomplished as document life cycle control. The successful application of PDM systems strongly depends on the appropriate structure of the central archive for design information. Preserving information in digital forms is much more difficult than preserving information in forms such as paper. This is not only a problem for traditional archives, but also for many organizations that have never thought of themselves as performing an archival function. The workflow presented for the archive of the construction design documentation is based on ISO Reference Model for an Open Archival Information System (OAIS) for a data repository system. The role provided by each of the entities in OAIS can be described briefly as follows:
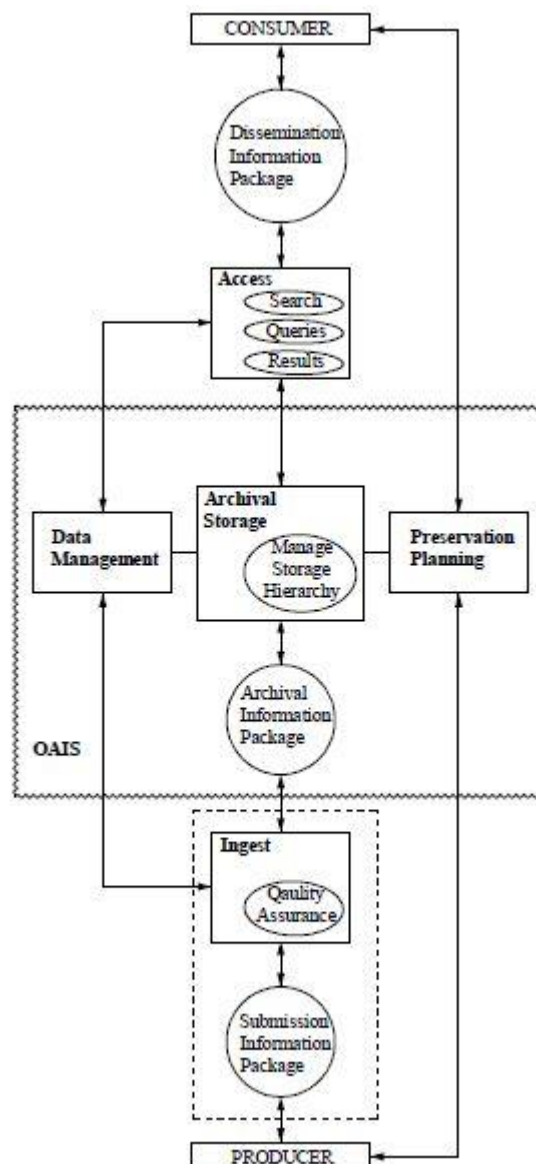
- **Ingest**: This entity provides the services and functions to accept Submission Information Packages (SIPs) from Producers (or from internal elements under Administration control) and prepare the contents for storage and management within the archive.

- **Archival Storage:** This entity provides the services and functions for the storage, maintenance and retrieval of Archival Information Packages (AIP).

- **Data Management:** This entity provides the services and functions for populating, maintaining, and accessing both Descriptive Information which identifies and documents archive holdings and administrative data used to manage the archive.

- **Administration:** This entity provides the services and functions for the overall operation of the archive system.

- **Preservation Planning**: This entity provides the services and functions for monitoring the environment of the archive and providing recommendations to ensure that the information stored in the archive remains accessible to the designated user community over the long term, even if the original computing environment becomes obsolete.

> ➢ **Access:** This entity provides the services and functions that support consumers in determining the existence, description, location and availability of information stored in the archive, and allowing consumers to request and receive information products.

For the definition of information handled by OAIS the paradigm of the information object is applied. Every submission of information to an OAIS by a Producer, and every dissemination of information to a Consumer, occurs as one or more discrete transmissions. Therefore, it is convenient to define the concept of an Information Package. Three different types of the packages are implemented:

- Submission Information Package (SIP).

- Archival Information Package (AIP).

- Dissemination Information Package (DIP).

Within the OAIS one or more SIPs are transformed into one or more Archival Information Packages (AIP) for preservation. The AIP has a complete set of Preservation Description Information (PDI) for the associated Content Information. In response to a request, the OAIS provides all or a part of an AIP to a Consumer in the form of a Dissemination Information Package (DIP). The DIP may also include collections of AIPs, and it may or may not have complete PDI. The Packaging Information will necessarily be present in some form so that the Consumer can clearly distinguish the information that was requested.

Archival Information System

Framework for Archiving Digital Design Documentation:

The structure of the digital design documentation archive has to be tailored towards the specific needs of the Design Company and requirements of the construction regulatory laws. For the design management of the building, most documents and communication were exchanged electronically and reflect in a way the name of the project. The developed PDM system stores all documents and communications related to a project in a document repository that facilitates keeping track of those documents throughout the duration of a project and later on. The archive is meant to store in a structured way all kinds of documents and communications to clients, consultants, suppliers and subcontractors. Due the project centric nature of the construction industry the structure of archiving of the design documents reflects the main parts of the project.
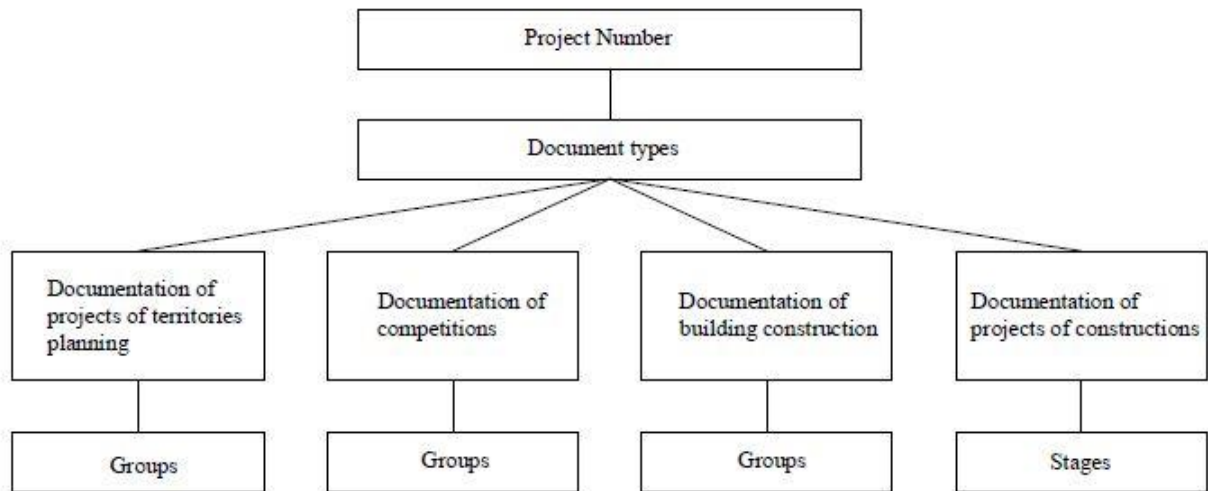
Lithuanian Classification of Project Documentation

This classification is governed by Lithuanian construction regulatory law. For the illustration one part documentation of projects of the construction is shown separately. Lithuanian standardization organizations, professional associations, user groups, individual companies don't have unified rules of CAD standards and guidelines in building design industry. This is a first attempt in Lithuania to provide unified reference of all document definitions. On the other hand, this standardized reference is the most important issue for development of the efficient IT applications. The direct implementation of the document classification system leads to overcrowded hierarchical tree of project information. In order to overcome these difficulties document file naming schema is established for native CAD models. This file naming schema is associated with standardized design document classification.

Implementation Technology of AEC Design Archive:

For the implementation of the developed model, the AEC digital design archive was chosen, that is "eChange" PDM software of the company "Empresa Solutions". For more information about basic features of "eChange", the interested reader is referred to. While "eChange" was designed with the CAD sector and engineers as the primary users, the system can be used to store any type of file that can reside on a computer's file system. In our case the largest Lithuanian building design company uses "eChange" to manage all of their office documents in addition to the CAD drawings they generate. Lithuanian company performs complete residential and industrial building design that includes architecture, construction and engineering (AEC). UAB Lithuanian Construction Design Institute (Lietuvos Statybu Projektavimo Institutas), which is engaged in the

design of construction units and project management has increasing the number of projects per year, at the same time having designed more and more complex objects, the implementation of efficient PDM system has become essential. Tasks that need to be performed for implementation design document archive included:

➢ Initialization file organization sheet with prescribed project number selection of document format.

➢ Preparation of electronic document files automated transmission from SIP to AIP. Management of the development team.

The processing of implementation include following steps:

➢ The design company starting a new project activates structure for a new collection of the digital design data. The project leader or the administrator of the archive initiates this process by entering new project number. By this operation, in the vault of the technical documentation a new tree representing structure of the project documentation is appeared and the SIP of the new project is initialized.

➢ Each designer of the building design company working with "Architectural Desktop" software and using "Project Navigator "directly connects to general file organization system. By this way separate documents of CAD design are created. Each designer has knowledge about development of the whole project bringing CAD documents into project structure. If changes are made in one part of the project documentation the system automatically shows and other designer can follow what's going on. That is maintained design chain. At each time the numbers of design chain have information about changes in CAD documents.

➢ The same tree structure of the project documentation is appeared in the AIP where is "eChange"PDM system. After synchronizing all electronic documents in SIP according to the design parts the archive administrator sets "Archived "status for the documents before that putting them into AIP "eChange"system. By this operation project structure with design information are automatically transformed from SIP into AIP. In AIP all project documents gain "Released "status and if all information is correct documents gain "Archived "status.

➢ After transforming from SIP into AIP all project documentation obtain metadata properties. The Dublin Core metadata scheme is applied as an initial basis on which the development of more specific relational standard within proposed digital design data

archive is performed. There is underway of automated attribution of properties and all documentation that is placed in to project structure adequate catalogues. Hereby all project information being in "eChange" system are accessible for users and groups according to permissions for each document type. The "eChange" system also provides different levels of access rights to documents View/Copy, Check Out/In, Release, Archive, and Delete.

Conclusion: The first digital project documentation archive is developed in Lithuanian AEC industry. The modeling of the archive of the construction design documentation is based on reference model for an Open Archival Information System (OAIS). For the creation and management of this archive PDM system of "Empresa Solutions "is implemented. The main strategy was to develop the dynamic archive with information flows in the both directions of the design process chain: consumer-design-archive. The adoption of this digital archive provides an efficient basis for an automatization of Lithuanian construction regulatory rules for building design documentation.

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