# Leveraging TEWI Platform to Enhance Scientific Collaboration on Universities

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**Abstract.** *This paper presents core functionalities of TEWI platform which will be leveraged in terms of supporting scientific cooperation for students and university employees when working on scientific projects, publications, doctoral processes or grants. This document provides also basic information on PLM plat-form and how it fits into scientific activities.*
**Keywords:** *TEWI, PLM Windchill, project management, scientific cooperation.*

## 1. Introduction

The aim of TEWI project (where TEWI is a polish abbreviation of Technologia, Edukacja, Wiedzia, Informacje – Technology, Information, Knowledge and Education) is to build an interregional network that connects uni-versity units to enable them access to advanced information systems. The application of modern software – integrated 3D CAD/CAM with PLM[1] systems (Product Life Cycle

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[1]PLM – is the process of management whole product lifecycle, from sketch and design, through manufacturing, to product retreat and utilization. It also includes also post-sale analysis, servicing, concept and change management etc.

Management) and advanced applications for engineering computation and automatic project documenting will allow to conduct scientific activity on all university nodes on the level that could have never been reached before. The research and development that leveraged TEWI platform will surely have multiple applications in industry and will help to create innovative products. Detailed description of platform's application can be found under [1]. To achieve goals mentioned, the Windchill system has been deployed on Technical University of Łódź, Warszawa and Białystok.

As a part of TEWI project, developers are supposed to deliver 46 products and services that will be responsible for realization platform's contract and requirements. In this paper some of those services will be described, as use cases for or-ganization and support of scientific cooperation between university employees.

PLM (Product Lifecycle Management) as the core domain of TEWI platform is a rapidly developing domain of business which can be compared to ERP. In the Product Lifecycle Management companies face obstacles while trying to manage product content and new product development processes, which would enable them to work more proficiently. Their success relies on having efficient business processes and effective development of complex information assets including product designs, service documentation, and regulatory submissions. PLM Applications, which are production-proven content and process management software, should offer solutions that are fast, secure, and requiring only a Web browser to access. This can streamline certain processes especially in case of working in an environment where many scientists are working in a "remote" mode.

## 1.1. Example Enterprise PLM Architecture

At first it is important to acquaint with a typical PLM architecture. The following diagram provides a general architectural overview of a PLM solution [2]:

**Client Tier** – Contains the products that people use to access PLM solution (CAD[2] tools, browser).
**Application Tier** – Contains the web server[3] and application servers. The application servers contain the business logic, provide the interfaces to integrations to

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[2]Construction Aided Design is the use of computer technology for the process of designing engineering objects and design-documentation.

[3]Web server is used to provide access to the application via web browser. The web server is responsible for hosting static content as well as dynamic.

other systems. The application tier is typically placed in a protected zone for applications and, in highly secured deployments, the web server is often placed within a demilitarized zone. Vaults are physical storage spaces (remote file servers).
**Database Tier** –The database or data tier is typically where the metadata is stored in a Relational Database Management System such as Oracle or SQL Server. LDAP is used for user storage and authentication.
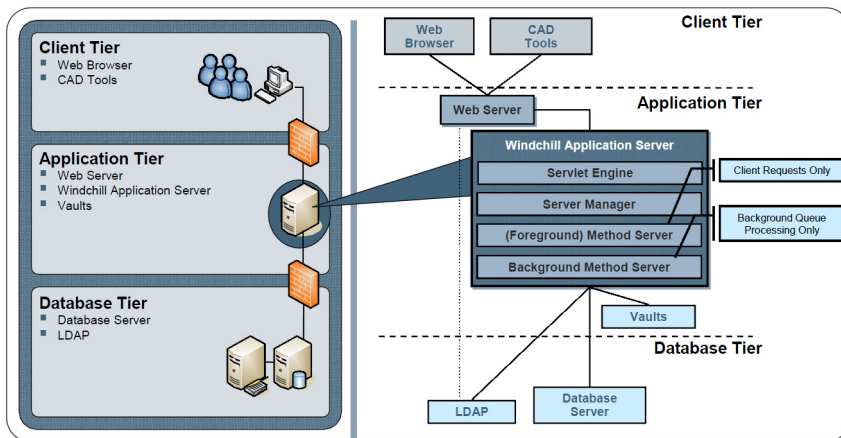


Figure 1. PLM Application architecture consisting of a client, application and database tier

The components in a particular solution could vary to some degree. For example, you can use a Web server and servlet engine that is one component (such as WebSphere with its embedded HTTP Server) instead of the individual components shown in the diagram. Also, you can have a different set of clients that users access or there maybe customized code that introduces additional components [3]

Performance issues can occur in any of the components in the three tiers shown in the diagram or can result from the communication that takes place between the tiers or between components in single tier. For the TEWI platform is reachable through a remote desktop on a Virtual Machine. The environment is virtualized which brings many obvious advantages like better testing and development environments, consolidation of servers, dynamic load balancing and disaster recovery.

Below you can find the description of basic use cases implemented in case of the project creation possibilities on the TEWI Windchill platform.

# 2. Managing projects on universities using ProjectLink

## 2.1. Requirements identification for project set-up

Each and every service that will be implemented as a part of TEWI platform will have to realize a certain aspect of functionality that will definitely improve the quality of scientific research on given university unit. To accomplish that goal one has to clearly identify requirements regarding given problem in the context of suitability of platform characteristics to real user needs.

It is very often that people from university organize various projects and require to start scientific collaboration between other people. Such projects may include:

- Realizing research work as a part of standard university program

- Working on papers, publications, presentations etc.

- Realizing own ideas by university employees within public scholarships, grants, presentations, symposia, contests etc.

- Realizing other ideas coordinated by university employees and performed in cooperation with students.

Having analyzed points above it is clear, that as a matter of fact each form of scientific activity can be regarded as a project [4]. This happens because project-specific approach is always generic enough and it shapes the overall structure of work, by defining a bunch of factors independent from environment (regardless if it is commercial, private, or scientific). Such factors are for instance:

- Team working on a project

- Project plan elements with deadline dates and delivery plan

- Reporting capabilities

- Milestones that define progress in the project

- Data structure that fits current project characteristics

- Communication environment, task definition and delegation, responsibility di-vision, reporting process

## 2.2. Creating new project

When a need for new project emerges in the form of collaboration request or data exchange necessity, a user can take advantage of creating project functionality in Windchil ProjectLink system. During creation of new project the following parameters can be entered:

- Project name

- Project template (used to pre-define some of artifacts such as folder structure, team or access rights)

- Generic type of access rights

- Soft type of a project (this can be used to define additional attributes on a pro-ject)

- Estimated start date

- Estimated end date

- Estimated duration

- Team template, which will define role structure for people working on the pro-ject

- Invitation message, which will be sent to team members

- Additional attribute values (defined earlier by the soft type)

In the figure 2 can find an example panel for creating new project in Windchill ProjectLink system.

## 2.3. Setting team

Apparently the main objective of creating a project is to set up a working environment for collaboration between many people working on the same problem. That is why the functionality of setting roles for users is critically important. Those roles have to clearly reflect responsibility for certain users and their access privileges in the context of project's resources [4]. To achieve that, Windchill ProjectLink offers following system objects:

Figure 2. Creating new project

- *Team* – reflects responsibility scheme on a project. A team is technically real-ized by a set of roles, to which users can be assigned. That is why a team itself is only a template that will be filled with real users as the project progresses.

- *Role* – each project participant must belong to at least one role in the project. The role shapes not only a logical responsibility of given user, but also is used to determine access right to resources and manage task delegation process.

- *User* – single person or entity, such as student, researcher, university employee, lecturer, external partner, etc.

- *Group* – a set of users defined in the system under one distinguished name. Groups allow managing roles and users in more flexible way, since a group can contain both users, and other groups. When filling a role with particular users one can use then groups as well.

In the figure 3 there is a sample definition of a team.
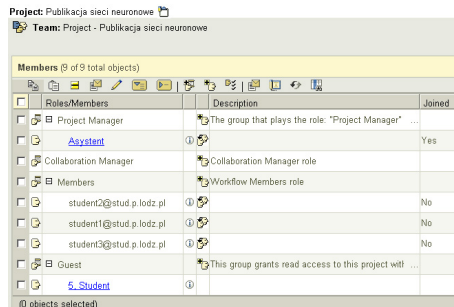
Figure 3. Defining structure of team

## 2.4. Folder structure and user data

One of the most important functionality in the context of data exchange is ability to create common data repository.

Windchill system offers in this area a couple of functionalities, one those is a folder tree. It is technically the same approach is in operation system – one can create a folder structure and put data in it, simultaneously tagging that data with additional meta-information.

Sample objects that can be stored on data repository are:

- Text document with project specification

- PDF documents with knowledge materials

- Presentations for sharing feedback and task delegation

- ZIP files with distributable version of created software

- Library files for third-party components

- Binary files for tools used on a project (e.g. external utilities)

- Any other files necessary to manage a project

In most cases on data repository one will keep only text documents (relatively Word files or Latex sources) for paper or doctoral thesis. The figure 4 depicts sample folder structure for a software project.
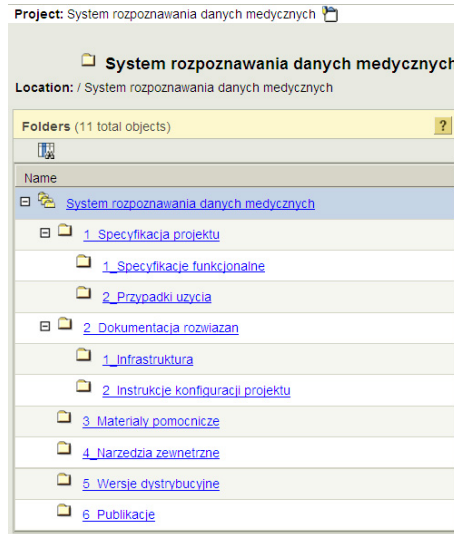
Figure 4. Folder structure in sample project

In this case it is obvious that folder structure in Windchill system is supposed to reflect project artifacts and, in a way, a delivery process as such, with stages: from design, through specification and implementation to code documentation and creation of distributable versions. This is why PLM approach is also suitable in any kind of projects.

It is worth emphasis at this point that all data held on Windchill system are by default visible for all project members. It means every participant can view, download, edit, and finally upload data on a server. Such operations in Windchill terminology are called *check-out* (downloading object for edition) and *check-in* (uploading changes on server). The system will automatically increment object's version, which makes it easy to observe and maintain object's history and (if needed) reverse it to one of previous states.

Figures 5-7 depict process how to create and modify sample document. Please note the ability to enter comments for each document version, which enables to clarify changes applied in document.

Similarly to creating new project, each document in Windchill system can have its own soft type that defines a set of additional attributes on the document. Those attributes can be both optional and mandatory, but most important is that users have
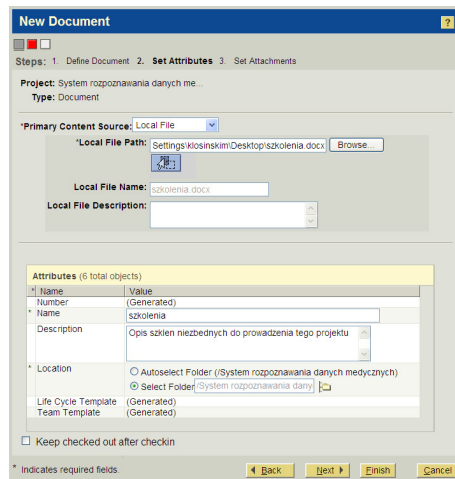
Figure 5. Creating new document with file content

the opportunity to enter some values during creation of document. Such additional attributes can be used for various purposes:

- Classification of resources in the project according to whatever criteria

- Simplification of search process (one can use soft attributes value to narrow search criteria)

- Keeping whatever meta-information, mostly for reporting purposes, like:

  - Resolution of graphic objects
  - Length of video clip in multimedia objects
  - Number of words in a text document

- Tagging objects with some meta-information (like revision number from SVN taken from external server)

- Searching object with certain soft attribute value

On the figure 8 it is shown a way how to enter such meta-information during creation of document.
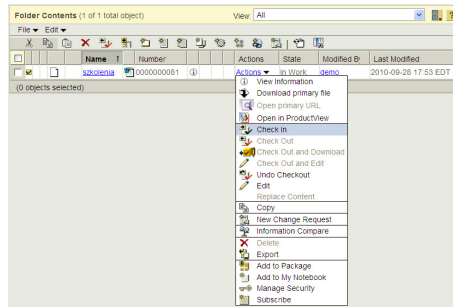
Figure 6. Document view in the folder and modification option
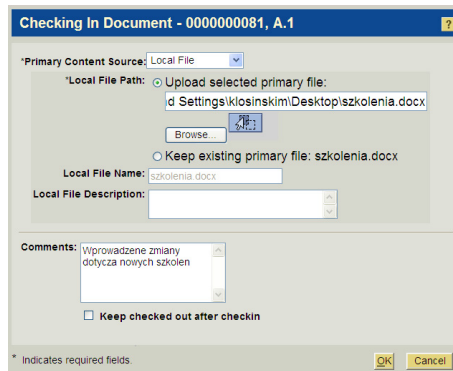


Figure 7. Uploading changes in document on server

To summarize, the ability to exchange information and support for collaboration on project's resources is one the fundamental functionality offered by TEWI platform. This in fact realizes the requirement of supporting scientific collaboration on universities, which in turn stands in the heart of TEWI idea.

## 2.5. Creating new project plan

After setting up new project and designing a space for data exchange in the form of folder structure, TEWI platform offers ability to create a project plan with task definitions and work breakdown structure (WBS, [5]). The project plan mechanism in Windchill ProjectLink system is relatively complex and elaborated, however one doesn't have to use all its functionalities to manage project plan and it can

Figure 8. Setting additional attribute on object

be used with the same power for simple plans with task for certain users. Figures 9-10 depict sample project plan created in Windchill ProjectLink:



Figure 9. General project plan

Project plan model consist of following objects:

- *Project summary* – higher level container for introducing structure of concrete tasks.

- *Activity* – a concrete task assigned to given person or group together with esti-mated finish date and detailed description

- *Milestone* – description of expected state of a project at given time. Used to define project progress indicators.

- *Deliverable* – object representing one concrete artifact or aspect of project to be delivered at a certain time. This can be used both to distribute project's de-
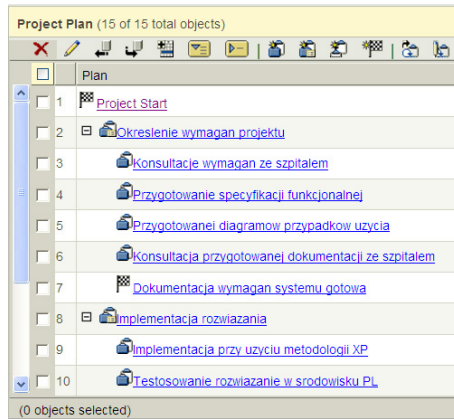
Figure 10. Setting task structure (WBS)

liverables across participants and precisely determine delivery time of given project's elements.

As one can freely nest Project Summary objects in each other, it is therefore possible (as depicted on fig. 10) to create work breakdown structure (WBS) and visualize it in Windchill ProjectLink together with responsible roles. This in turn al-lows Project Manager to track and control progress on project, both in terms of structure and timeframes.

Moreover, in order to assign tasks to a certain user (in other words to create an *assignment*) one only has to set the property *owner* and choose user from project team.

## 2.6. Configuring mail notifications

When there is a place for data exchange and scientific collaboration, it very often that people would like to know about changes made in project resources right away. This can be achieved when people working on a project get email notifications every time a change on resources takes place. The process of enabling such notification on given resources is called *subscription*.

After subscription to given object (this can be whatever object in a folder, project plan, forum post etc), a user will be notified about selected event that occur on the object. Sample configuration of such notifications is presented on figure 11. All notifications are sent automatically to email address entered in user profile.
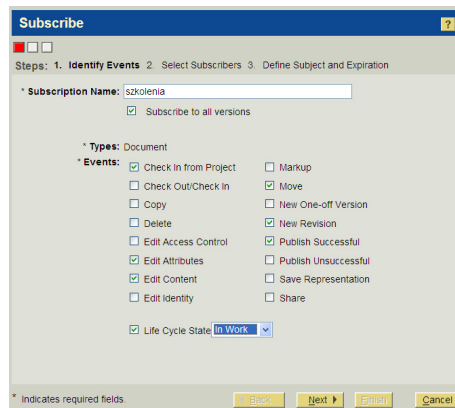
Figure 11. Subscribing to events on object

## 2.7. Meeting management

Regardless of dispersed project environment, it is very often that project members should meet in real life and have regular discussion. For instance, project plan needs to be updated, tasks delegated, ideas confronted and accepted, reviewed, rejected etc. TEWI platform offers standard functionality for managing organization of real life meeting using "Meetings" tab in Windchill ProjectLink.

In the figure 12 one can find how to create a new meeting, so that all other participant could receive all necessary information beforehand:

- Meeting place

- Required and optional participants

- Date and time

- Meeting agenda

- List of affected system objects (whatever objects from Windchill ProjectLink)

It is worth mentioning that those notifications about new meeting will be automatically sent to all invited project members. This facilities meeting management from project manager point of view, and additionally it helps regular meeting attendees to prepare to a meeting thoroughly.
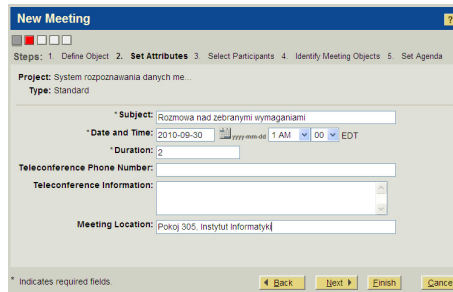
Figure 12. Creating new meeting

## 2.8. Discussions on a project

The last functionality of TEWI platform described in this paper that supports scientific cooperation is discussion panel in the form of simple forum page. Although it is not so elaborated forum engine in comparison to current well-known web forums, but it definitely does its job well enough. On the figure 13 there are sample posts with tree hierarchy:
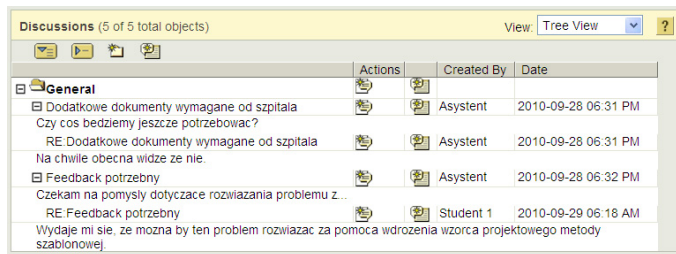


Figure 13. Sample forum posts

Moreover, during creating new post, one can attach additional information like:

- File attachments

- Links to whatever business object in Windchill (this helps to conduct a discus-sion in the context of particular documents).

One can therefore say that together with this last functionality Windchill system can be leveraged as a high-power, dedicated platform for project manage-

Figure 14. Creating new post (or replying to one)

ment, which in the context of scientific activities on universities ideally addresses current needs for information exchange and cooperation.

## 3. Summary

TEWI platform stands for innovation and unleashing power on existing university units. Each form of scientific collaboration can be regarded as a project, from lecturing, through publications, papers and proceedings, to scholarships, grants, and doctoral thesis processes. This is why project approach served by TEWI platform together with its flexible functionalities brings to new level scientific activity on all affected university units. Thanks to Windchill ProjectLink system it is possible to easily share documents, binary files, specifications, engineering sketches and other resources between project members. It is also very straightforward to set up role model that reflects responsibility map on a project. In addition to that one can use those roles to determine access rights to certain project resources. A simple project plan can be introduced to visualize work breakdown structure and identify project deliverables. Last, but not least, on can easily manage discussions and real-life meetings, which will definitely contribute to improvement of communication between project participants. All factors mentioned above can be also gathered in a project template, which can be easily reused in the future.

These all advantages of TEWI platform makes it extremely powerful in the context of work organization on projects and usability on universities. Thanks to this it will be much easier to conduct scientific projects that need to organize collaboration between many people, even from different university units. That will in

turn eventually contribute to increasing value of a university and help it in shaping its own strategy to be much more competitive.

## Acknowledgement

## References

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