# Windchill System Architecture Landscape within TEWI Administrative Domain

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**Abstract.** *This paper covers some chosen aspects of Windchill system architecture elements that are crucial from TEWI administration standpoint. Those aspects are above all: Windchill overall architecture landscape, system components and common administrative activities for TEWI platform maintenance.*
**Keywords:** *TEWI, PLM, Windchill, system administration, administrative domain, administration tasks, TEWI architecture, system overview, architecture landscape.*

## 1. Introduction

One of the TEWI project goals (where TEWI is a polish abbreviation of Technologia, Edukacja, Wiedza, Informacje – Technology, Information, Knowledge and Innovation) is to leverage best practices proven in PLM industry by using the PDM framework implementation – Windchill [1].

In this paper the focus is put on the Windchill administration area that is crucial from TEWI platform maintenance standpoint. These topics mostly relate to the typical administrative activities and duties performed on a running Windchill instance and aimed at making system available 24 hours a day.

In addition, the overall system architecture will be presented in the context of the administration tasks. These general architecture elements must be correctly understood, since Windchill system, as a typical multi-tier web application, must be subject to regular maintenance works from bottom database layer to resolving high-level network issues when communicating with system clients.

## 2. Windchill architecture overview

### 2.1. Windchill system components

In order to use Windchill system, the following required system components must be in place:

- Network Access

- Software:

  - Web Browser
  - Creo Elements/Pro
  - Workgroup Manager
  - JRE
  - Bootstrap
  - Security Settings

- Windchill Server URL Address

- Windchill User Account

- E-mail Application (Optional)

The figure 1 captures the core Windchill system components:

The main idea behind this architecture was to introduce scalable and easily manageable solution for operating in a heterogeneous environment. In a three-tier architecture, one relies on a lightweight client to access the server. Contrary to two-tier applications, business logic is not part of the client. It is separately stored on the server tier. All the business objects, including metadata and contents, are kept under the control of the database tier. Windchill is a three-tier architecture application, and therefore offers several benefits. Any updates made to business
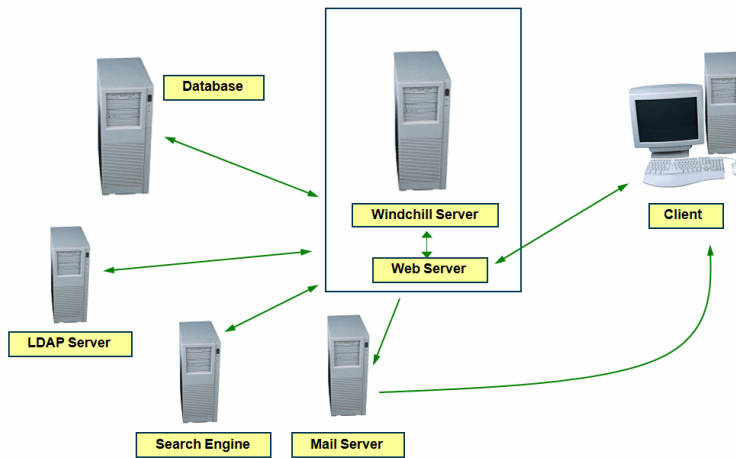
Figure 1. Windchill general architecture [8]

logic are dynamically delivered to all the clients. Windchill uses a Web browser as the major client; therefore, little or no training is required since users are familiar with the browser [6]. Moreover, in a three-tier architecture, data protection and security is simpler to obtain. Therefore, it makes sense to run critical business processes that work with security sensitive data on the server. If performance bottlenecks occur, the server process can be moved to other servers at runtime. This load balancing feature is very important in large implementations. It is also easier and faster to exchange a component on the server than to furnish numerous PCs with new program versions. [8]

## 2.2. Role of the TEWI System Administrator

The TEWI administrator is responsible for day-to-day maintenance of Windchill environment. It is the system administrator's responsibility to install the software, and update the system with all the necessary patches. Over time, the system may suffer performance degradation. In that case, the system administrator takes the necessary measures to improve performance by identifying bottlenecks and then correcting them. Other responsibilities may include performing routine backup procedures and maintenance of the server log files. The system administrator also manages the background queues to identify and prevent future failures

of Windchill services. If a component fails, the system administrator troubleshoots
the problem. [8]

## 2.3. Windchill port usage

In order to make Windchill environment operate correctly, it is administrator's
responsibility to provide access through the commonly used Windchill ports. The
following table summarizes the port usage that must be kept in mind: [8]

| Port Number | Required For |
| --- | --- |
| 80 | HTTP |
| 389 | LDAP |
| 443 | HTTPS |
| 1433 | SQL Server database |
| 1521 | Oracle database |
| 6000 | SCMI ClearCase |
| 7222 | Enterprise Systems, JMS port (*) |
| 8006 | Servlet shutdown port |
| 8010 | Servlet listener port |
| 8080 | Windchill Index Search (*) |
| 9300 | Cognos core (*) |
| 10002 | Info*Engine task processor |
| 110011 | Windchill PartsLink RMI (*) |
| 13000-16999 | Index Search engine (*) |

(*) - not applicable in TEWI environment.

## 2.4. Managing Windchill services

Windchill system runs as a web server in the front-end, but to make it work
correctly many other services must be up and running. Those include not only
database or business logic server, but also additional components like search en-
gine, LDAP, business reporting or Info*Engine adapters. These are typical Wind-
chill service list: [7]

| Windchill component | Service name |
|---|---|
| Web Server (Apache) | Apache |
| LDAP Server | Windchill Directory Server |
| Database (Oracle) | OracleServiceWIND |
|  | OracleOraDB11g_home1TNSListener |
| Windchill | Server Manager |
|  | Method Server |
| Business Reporting | Cognos |
| Search Engine | Search Engine Service |

As a TEWI administrator, one must be aware of all the Windchill components and their corresponding operating system services. An administrator routinely works with the following major Windchill components:

- Web Server, such as Apache

- LDAP Server, such as Windchill Directory Server

- Database, such as Oracle

- Windchill Servers, such as Server Manager and Method Servert

- Business Reporting Server, such as Cognos

- Search Engine

Some components spawn more than one operating system process. For example, Apache Web server is represented by only one operating system service, but Oracle database initiates multiple services.

When started, the Windchill Directory Server initiates only one process or service. Oracle database creates several operating system services during installation and configuration. For Windchill to function, listener and instance must be started successfully.

The Windchill component itself is represented by the Server Manager and Method Server. The Server Manager monitors the Method Server and its availability, while the Method Server establishes the necessary connection with the database instance. The business reporting component Cognos uses a service to process all reporting requests. The search engine, an optional component, is also represented by a service. [5]

# 3. Windchill configuration

## 3.1. System Administration utilities

Windchill provides several utilities for routine system administration activities: Windchill command, Windchill shell, xconfmanager, and the JMX clients.

One utilizes the Windchill command to invoke various Windchill actions, while the Windchill shell sets up the correct Windchill environment variables before initiating any Windchill command or script. The xconfmanager is a command line utility that is run to add, remove, or modify properties in any Windchill property file. [8]

Java Management Extensions (JMX) provide a foundation for the management and monitoring of Java applications, such as Windchill, via the usage of MBeans. MBean is an abbreviated term for managed bean. Windchill has its own set of MBeans that are used to manage and monitor the application.

Windchill Configuration Assistant (WCA) is used to automatically tune several Windchill properties for best performance. [5]

## 3.2. Global properties management

To manage site property settings, Windchill no longer recommends usage of a text editor to edit individual property files. Instead, all site changes to property files are maintained in the site.xconf file located in the directory where Windchill is installed. One uses the Windchill utilities to update the site.xconf file and then propagate the changes to property files. [8]

As shown in the figure 2, making property changes through the provided Windchill utilities always updates the site.xconf file. Windchill then propagates the changes to properties files using the site.xconf file and the xconf files that it maintains. In this diagram, the declarations.xconf file has references to three sample internal xconf files, which are then used by Windchill to update referenced property files.

Whenever one changes a property setting using the xconfmanager or the JMX client, Windchill creates backup of all xconf and property files that are updated in the .xconf-backup directory where Windchill is installed. [7]
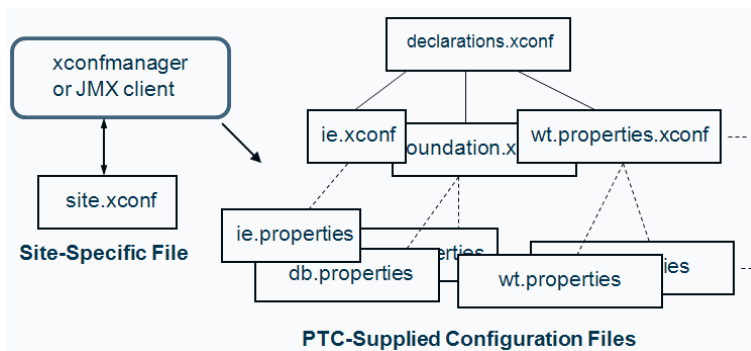
Figure 2. Site properties hierarchy [8]

# 4. Typical TEWI system administrator activities

There are pleny of tasks that must be performed on the regular basis. In this chapter one can take a closer look on the typical activities being performed every day, week and month.

## 4.1. Daily tasks

A Windchill deployment is a complex system with multiple components and data repositories. Proper maintenance of Windchill is an ongoing process. The following checklist of Windchill maintenance activities should be considered an essential part of the daily Windchill administration: [8]

- Perform and verify scheduled system backups.

- Monitor system availability.

- Monitor queues.

- Monitor file vaults.

- Monitor CPU and memory usage by Windchill processes.

- Check system logs.

- Check database schema statistics.

- Monitor network health.

- Review PTC Technical Support subscription E-mails.

Additional tasks can be added if other products are installed or if the TEWI platform is subject to further development and customizations. One of the most important task is to monitor the server health and react to any abnormalities.[6] This activity requires constant observation of the server status page. An example status information is presented on the figure 3.

### 4.2. Weekly tasks

The following checklist of Windchill maintenance activities should be considered an essential part of the weekly Windchill administration. [6]

- Monitor disk space usage to ensure the availability of disk space.

    – Maintain data growth curves.
    – Identify deviations.
    – Predict when additional storage devices are added.
    – Check disc space usage in file vaults and replica vaults, backup repository and database server data file locations.

- Remove unreferenced files in file vaults after each backup.

- Defragment Windows disks for optimal disk performance.

- Use monitoring tools to perform system checks

    – Web Server
        * mod_status and mod_info modules
    – Application Server and Servlet Engine
        * Server Status utility
        * JConsole and VisualVM
    – Directory Server
        * Control Panel
        * JMX Clients
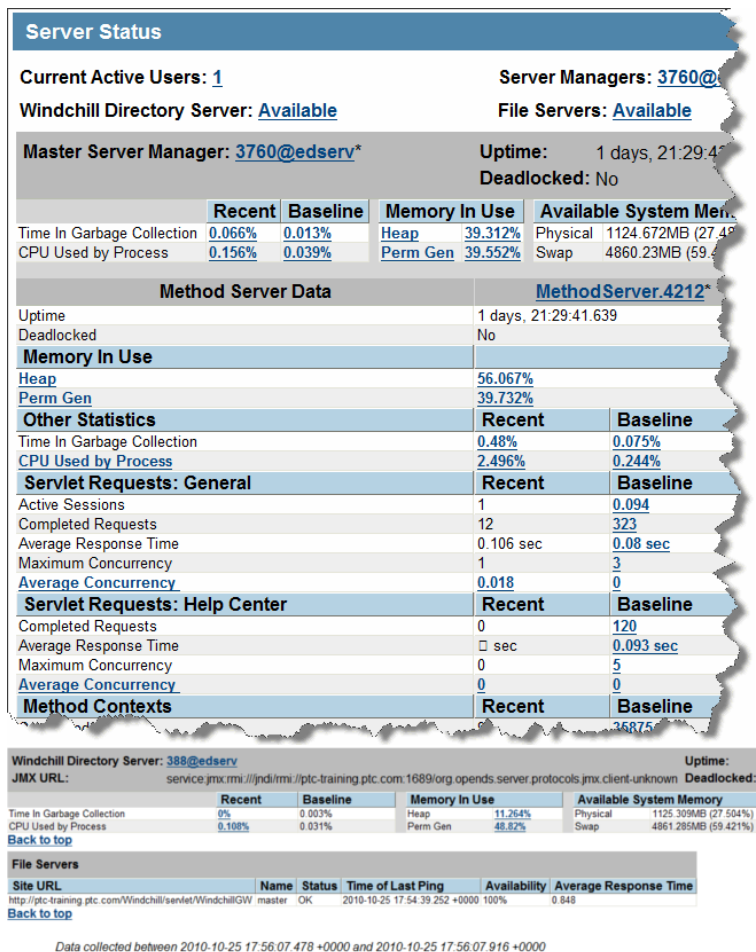
Figure 3. Windchill server status page [8]

– Database

* Oracle – ADDM Reports
* SQL Server – Database Engine Tuning Advisor

• Perform database maintenance and act on database tool recommendations:
Database maintenance is critical to overall system performance. There are

other tasks besides updating the schema statistics that often need to be performed. These tasks include rebuilding indexes and adding disk space.

## 4.3. Monthly tasks

The following checklist of Windchill maintenance activities are an essential part of the monthly Windchill administration.[8]

- Using system validation and benchmark process, perform performance tests to assure system health.

- Resolve disconnected principals, such as users, by repairing or deleting them.

- If using file servers for replication, perform a replication test.

- Run database diagnostics utilities to diagnose and correct database integrity issues.

- Rebuild Windchill Directory Server indexes to maintain performance.

- Clean up data leftover in personal workspaces when a user is deleted from Windchill.

- Clone or rehost the production server to a test server.

Essentially, the ability to keep performance at the reasonable rate is the most important monthly activity. Daily monitoring of certain performance attributes like CPU usage and Java garbage collection, contributes to performance assurance. However, to truly measure performance and ensure user satisfaction, one has to regularly test the system against accepted performance benchmarks. The goal is to keep performance measurements within a reasonable margin as the database grows over time. [8]

That is why from time to time one should run dedicated performance test set using JMeter technology to assure benchmarking. This will allow the administrator to detect possible performance leaks beforehand and prepare an adequate mitigation plan.

# 5. Summary

In this paper the basic TEWI administrative view has been presented in the context of the Windchill architecture and maintenance. It has been critically important since the very beginning of the TEWI platform start-up to maintain all TEWI-related services intact. All the administrative activities have been aimed at minimizing system downtime as well as keeping overall performance and user experience at the highest level possible.

To achieve this goal the administrators have to perform various tasks according to the PTC Windchill Administration guidelines and best practices. Those activities cover all three layers of the Windchill multi-tier architecture: database, business logic engine and the presentation server. By having all components under control, the TEWI administrators are capable of keeping TEWI platform online all days round, 24 hours a day, 365 days a year.

# Acknowledgment

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