COROS TO WINCC MIGRATION FOR MITTAL STEEL, SALDANHA

Grant Bergstedt and Greg Jackson

Systems Automation and Management (SAM), 13-15 Rembrandt St, Petervale, Bryanston, ZA. Tel. +2711 803 0570

Abstract: A migration from the obsolete COROS SCADA to Simatic WinCC HMI was performed for Mittal Steel's plant in Saldanha. Two HMI systems were created: one to interface to a PLC process bus and one to a Simadyn-D process bus. The migration was performed by manually generating SCADA graphics generating tags through AS/OS compile and SPE for the respective systems. The entire project was made accessible through Simatic Manager in order to follow good engineering practice guidelines. Siemens option packages Simatic Audit, Connectivity Pack, Dat@Monitor and Logon were also engineered for the system.

Key words: COROS, PLC, SCADA, Symadyn-D.

1. INTRODUCTION

Figure 1: Mittal Steel's Plant, Saldanha

Mittal Steel, Saldanha is a state-of-the-art Mill producing mostly thin and ultra thin steel sheets rolled up into coils ready for shipment. There are roughly four sections that make up the mill and its processes. The sections concerned for the sake of this document are the Thin Slab Caster and the Mill.

Mittal Steel, Saldanha desired to replace their existing COROS SCADA located at the Thin Slab Caster and The Mill. The decision was based on the limited Support available for this product and the inability to keep up with and interface to technological advances.

Simatic WinCC was identified as the preferred HMI SCADA to interface to the existing PLC Networks of S7-400 on the Caster Section and Simadyn D on the mill section. Advantages for the migration include: Advanced Support availability, Access to Future Version upgrades, and the ability to remain adaptable in a fast evolving technical environment.

2. USER REQUIREMENT

The objective of the project was to upgrade the SCADA system from COROS to WinCC using good engineering practice guidelines whilst altering the experience for the plant operators as little as possible. Enhancements to the system were only permitted once approval from plant operators as well as plant maintenance engineers was met. Where possible, the COROS and WinCC systems were to operate in parallel in order to make the changeover a gradual one. Monitoring of user actions through auditing software and exporting of historical data were also required. Procedure documents and training manuals were to be created for all stages of engineering. As the plant is live and constantly changing, no design freeze was permitted.

2.1. Mill User Requirements

The setpoint archiving was to be identical in operation to that of the COROS for both manual and automatic mode.

2.2. TSC User Requirements

Process and alarm tag generation was to be done through an AS/OS compile.

3. DESIGN PHILOSOPHY

Figure 2 shows the Enhanced Waterfall Model describing the design process. The philosophy behind the design was to create standards early in order minimise changes after software development had begun.

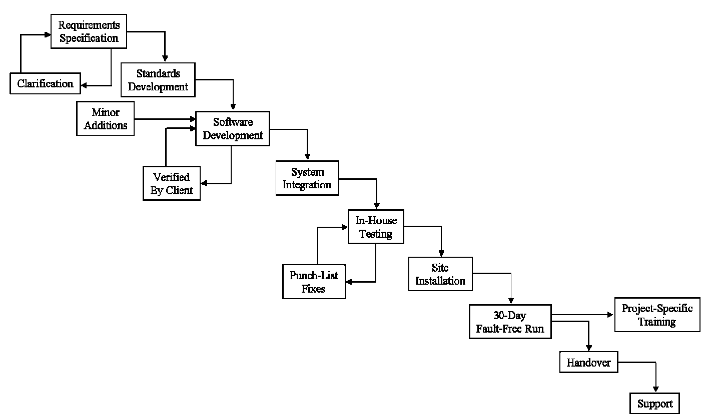

Figure 2: Enhanced Waterfall Model

3.1. Concepts

In order for the project to run smoothly and finish on time, an FDS document was drafted for approval by Mittal Steel. It was important to create standards early in the project since SCADA graphics were generated manually and it was not possible to create a globally referenced library within WinCC.

Since no design freeze was permitted, objects had to be modular and easily configurable. A design library was created for all customised objects used in the SCADA. C-scripts were standardised and referenced as functions. Wherever possible, hidden text and I/O fields were used to store non-standard data for the faceplates. This was done so that object configuration took place at a single point.

3.2. User Administration

Figure 3 shows the access rights of the respective users of the system. Any high level login was to time out after five minutes to protect against unauthorised access to setpoints and commands.

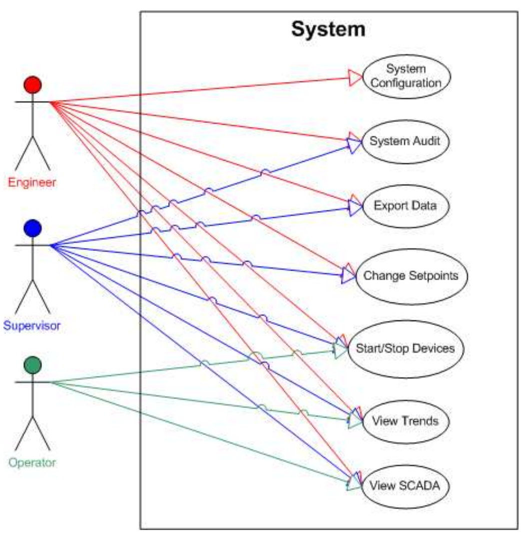

Figure 3: Use Case Analysis

3.3. SCADA Structure

To enhance navigation, the original SCADA navigation page was fragmented into sections and displayed through the “Picture Tree Manager”. However, since certain pages were accessed more than others, the existing navigation bar was retained and hotkeys were assigned to the buttons.

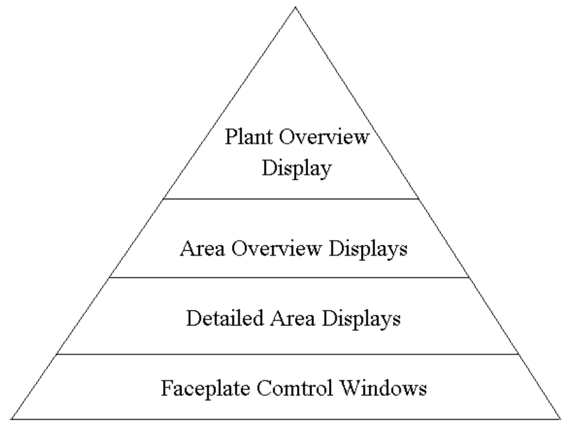

Figure 4: Navigation Hierarchy

3.4. Centralised Engineering

Figure 5 shows the project on the Engineering Station (ES). Through S7, it was possible to integrate both the RHF and TSC COROS projects into one project. All the components of the project were engineered on the ES and then downloaded to the respective servers and clients. The benefit of centralised engineering is that there is only one point where configuration changes can take place which assists in controlling and tracking changes.

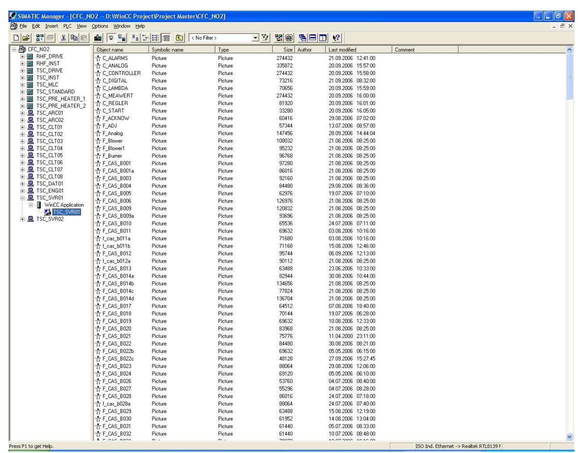

Figure 5: Centralised Project on Engineering Station

4. MILL

The Mill consists of four interconnected Master Simadyn D PLC’s controlling the Hot Strip Mill and Temper Mill operations in the plant. The Hardware Architecture of the current Mill replicates that of the previous COROS System Highlighting the client’s requirement to keep the same look and feel for ease of use and engineering. This resulted in the client deciding to go ahead with a non-redundant HMI system.

All Engineering standards were created in the beginning and preceded by confirmation and agreement from the client.

4.1. Hardware Installation

The Simadyn D to WinCC connections is based on a 10 Mbps Ethernet Network. The WinCC Servers have CP1613 Network cards for this application.

An Engineering station utilises the Centralised Engineering Concept allowing for easier engineering and Integration of multiple Projects.

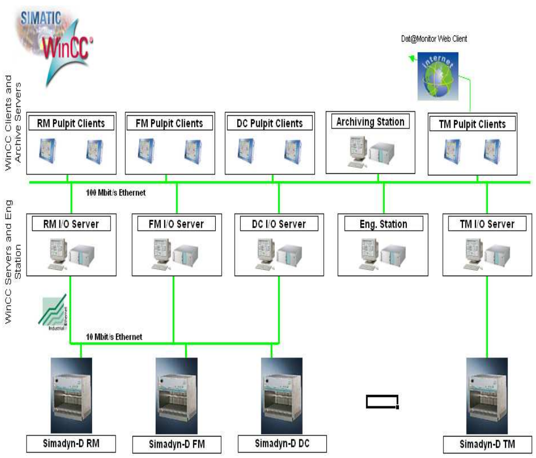

Figure 6: Mill Hardware Configuration

4.2. Redundancy

Client requirements resulted in a non-redundant Server System. Options have been discussed with client to minimize the risk in the event of a failure.

Options include:

- Having a hot Swappable Server Machine available for when a fault occurs which results in a couple of hours downtime.
- Inserting a full redundant system for each Server station resulting in added engineering and configuration needed in the future.

4.3. SPE

SPE (Systematic Project Engineering) is proprietary software developed for mill applications that provides for easy importing of tags from Simadyn D to WinCC.

4.4. Alarming

The WinCC alarm editor is used to import the SPE created text files into the correct format.

Alarming events are activated from one message tag per Simadyn D group. This helps limit the overall tag count in WinCC.

4.5. Tag generation

Using the “Address List Import PMC Driver” V6.0.2 software, all the tags are imported into WinCC automatically from the generated SPE text file.

All the tag Groups and individual process tags are imported into WinCC in the correct Format. No added Engineering is required and the Tags can be used accordingly. Internal Tags were made use of and are generated as any ordinary tag would be created.

4.6. Parallel operation

Included as on of the users requirements, parallel connection between the COROS and WinCC machines is required to facilitate debugging and optimisation. This activity is to occur for a short while until The WinCC functionality and representation is identical to the COROS.

For each WinCC Server added, a job must be allowed for within the Simadyn D. A specialist was obtained to write these jobs for SAM. Each WinCC Server station is then given its own Mac address and the Process tag holders are assigned unique communication send and receive addresses.

All graphical and user archive functionality in WinCC operates perfectly in Parallel with the operation of COROS. Caution must be taken with user archives as will be discussed later.

Limitations of the system do not allow alarming to operate in parallel and therefore can be commissioned when graphical and user archive functionality is signed off.

4.7. User Archiving

The data registers within the Simadyn D are non-retentive. This raised concern for the client and lead to the user’s requirements of wanting a database to store all vital set points.

Correct execution of this system includes the following:

- The operator will insert all critical set points manually using Faceplates. These values are then transferred and stored into the SQL Server.
- In the event of the PLC resetting, the set points are automatically transferred to the PLC registers.

Added features include the ability to monitor what event caused a change within the archive and when it happened.

5. THIN SLAB CASTER

The Thin Slab Caster (TSC) consists of five interconnected PLC's controlling all the steel casting operations in the plant. The obsolete Thin Slab Caster and Roller Hearth Furnace projects were upgraded from two single user type systems into an integrated client/server system with built in redundancy.

5.1. *Hardware Installation*

The upgrade merged the standalone COROS projects into one centrally configured project (Fig. 7). The servers communicated with the Process Buss on a 100Mbps ISO Industrial Ethernet line. The Servers communicated with the Clients and Archiving Servers on a 1Gbps TCP/IP line.

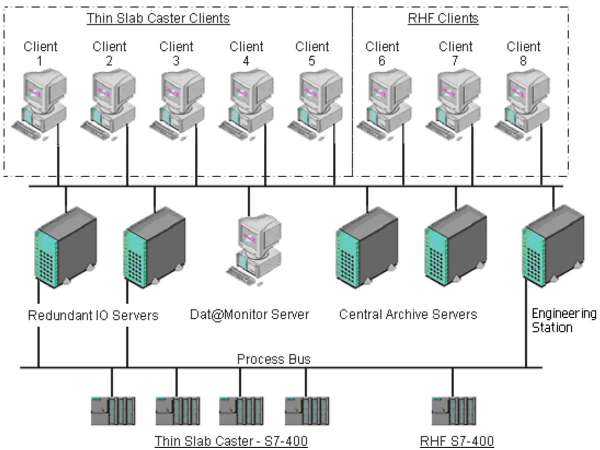

Figure 7 Hardware Configuration

5.2. *Redundancy*

Redundant systems increase availability and guarantee that the archiving of the process data and messages will not be interrupted in the event of a server failure.

All process values and messages are processed and achieved on both servers. Each server processes its own data. If one of the servers fails, the clients that are connected will automatically be rerouted to the other server. The process can be monitored on the clients and can be seen to take place almost without interruption. During the changeover, no data will be lost and the process can continue to operate. Once the failed server is returned to an operational state, WinCC will proceed to synchronise the server by updating all the data that was recorded by the redundant server since the fault occurred.

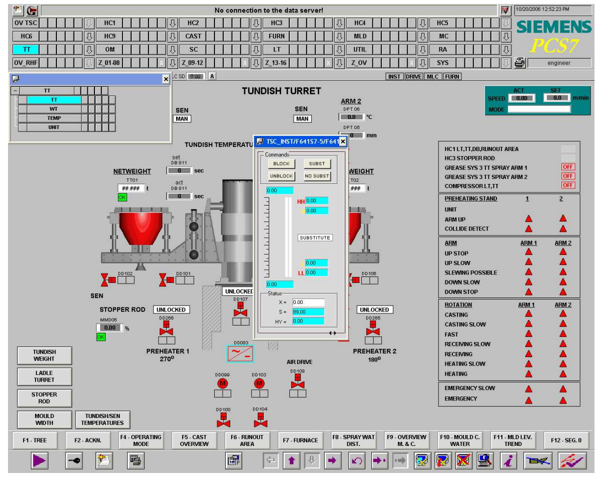

Figure 8: Tundish Turret Representation in WinCC

5.3. *Faceplates*

Faceplates were used extensively, to make operation easy on the HMI. A similar control and display philosophy was implemented on all device faceplates. The faceplate was designed to close automatically when the operator changed the background page or when changes were made to certain values. Figure 9 shows an exploded view of a button that calls a faceplate.

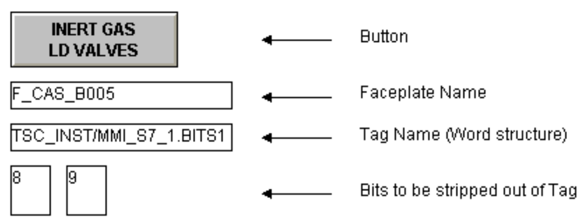

Figure 9: Exploded View of Button

5.4. *Tag Generation*

At the client's request, tags were to be brought into WinCC via the "AS/OS Compile" method (the only exception being the RHF, which contained unstructured tags. Since the PLC had been programmed with COROS in mind, it was necessary to make minor changes to the PLC software to get the AS/OS compile to work. One major effect of this was the generation of tags of Word data type instead of bit data type for the status indications and commands.

5.4.1. *Bit Stripping*

A "bit-stripping" operation had to be performed in order to extract the correct bit from the Word-type tags.

WinCC's built-in bit-stripper was used when stripping one bit from one tag. For command signals and complex mimics, a bitwise AND was used.

5.5. Trending

The trends were designed to match the COROS trends as closely as possible. Since the operators on site print trends often, it was necessary to ensure that the background was not printed.

The data for the trends were stored on a separate pair of redundant archiving servers.

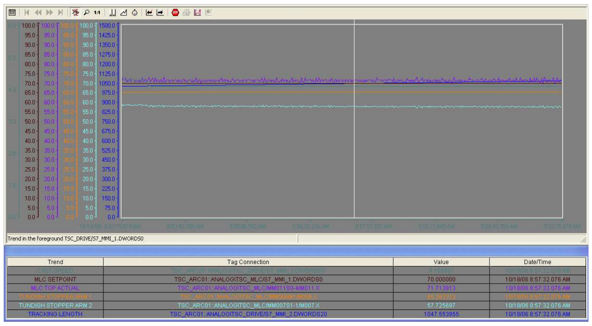

Figure 10: Trend Depicting Changes in Mould Level

6. OPTION PACKAGES

The COROS to WinCC migration provided an opportunity to enhance the system using the Simatic Option Packages Audit, Connectivity Pack, Dat@Monitor and Logon.

6.1. Connectivity Pack

An additional requirement of the system was the capability to export historical data for processing outside the SCADA system. The Connectivity Pack provided this functionality by allowing the user to query the SQL database directly and export the raw data to a CSV file.

6.2. Dat@Monitor

The Dat@Monitor serves for display and evaluation of current process statuses and historical data on office PCs. For this purpose, tools like Microsoft Internet Explorer or Excel can be used. The Dat@Monitor consisted of a Web Navigator server with current and historical process data. Apart from this, the access to a long-term archive server with Web server is also possible. The Dat@Monitor was configured to provide solely a display function - no intervention into the on-site process flow was possible.

6.3. Audit and Logon

Simatic Audit and Logon were required to control access to the not only the live SCADA but to the Engineering Station as well. Audit can be configured to create an audit trail for a variety of changes made to the system.

7. SOFTWARE INSTALLATION

Tables 1-5 (Appendix A) detail the software requirements for the TSC HMI installation.

8. CONCLUSION

The upgrade from COROS to WinCC was successful because of the formulation of concepts and standards early in the project. Approval of standardised objects was essential since it was not possible to create a global referenced library with the customised objects created.

9. ACKNOWLEDGEMENTS

We would like to thank the rest of the project team involved in this project: our project manager, Rob Allen, as well as engineers Elvin Nel, Hugo Steenkamp and Grant Matthews.

We also would like to thank Rocco de Villiers and Tommie Chambers, from Siemens AG, South Africa and Siemens AG, Germany for supplying technical support.

Also, thanks to Richard Holcroft, and Patrick Flanagan from Mittal Steel, Saldanha for assisting with the user specification and standards.

10. APPENDIX A

Table 1: Server

Part Number	Description
6AV63811BF060DX0	WinCC system software V6.0+SP3, Runtime 65536
6AV63711CA060AX0	WinCC Option Server Operation V6.0
6AV63711CF060AX0	WinCC Option Redundancy V6.0
6GK11613AA01	Simatic Net CP1613 (ITP & RJ45)
6GK17161CB633AA0	Simatic Net Software V6.3
6AG40111SERVER	Windows 2003

Table 2: Engineering Station

Part Number	Description
6AV63811BQ060DX0	WinCC system software V6.0+SP3, Complete 65536
6GK11613AA01	Simatic Net CP1613 A2 (ITP & RJ45)
6GK17161CB633AA0	Simatic Net Software V6.3
6AG40111ENGINEER	Windows XP Prof

Table 3: Client

Part Number	Description
6AV63811BF060DX0	WinCC system software V6.0+SP3, Runtime 128
6AG40111ENGINEER	Windows XP Professional

Table 4: Archiving Server

Part Number	Description
6AV63811BC060DX0	WinCC system software V6.0+SP3, Runtime 128
6AV63711CA060AX0	WinCC Option Server Operation V6.0
6AV63711CF060AX0	WinCC Option Redundancy V6.0
6AV63711DQ060EX0	WinCC Archive PowerPack V6 Upgrading from 512 to 30000 tags
6AG40111HISTORIAN	Windows 2003

Table 5: Dat@Monitor

Part Number	Description
6AV63811BC060DX0	WinCC system software V6.0+SP3, Runtime 128
6AV63711DN060BX1	WinCC Option Dat@Monitor V6.0 SP1 Server & 10 Client
6AG40111HISTORIAN	Windows 2003