STEEL AUTHORITY OF INDIA Ltd.

SALEM STEEL PLANT, SALEM, TAMIL NADU - 636013

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INTERNSHIP REPORT

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SAVEETHA ENGINEERING COLLEGE

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ABSTRACT

This report details a 14-day internship at the **Computer & Information Technology (C&IT) Department** of **Salem Steel Plant (SAIL)**. The objective was to study the integration of Information Technology within a heavy manufacturing environment. The training covered the complete data lifecycle, beginning with **Operational Technology (OT)** observations in the Hot and Cold Rolling Mills, where Level-1 (PLC) and Level-2 (Automation) systems were analyzed.

The study proceeded to the **IT Infrastructure**, involving a technical audit of the plant's **Collapsed Core Network Architecture** and redundant Fiber Optic Ring Topology. Critical ERP workflows were examined, specifically the **Payroll** and **Material Management Systems**, supported by an **Oracle 11g Real Application Clusters (RAC)** backend. The internship concluded with a review of the Data Center, focusing on High Availability (HA) through SAN storage and tape-based disaster recovery solutions.

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CHAPTER 1: INTRODUCTION

1.1 About Salem Steel Plant (SAIL)

Salem Steel Plant (SSP), a special steel unit of the Steel Authority of India Ltd (SAIL), is a pioneering industry in the production of stainless steel. The plant is headquartered in Salem, Tamil Nadu, and its products are marketed through an extensive domestic network with branches in major cities including Ahmedabad, Bangalore, Chennai, Mumbai, and New Delhi.

The plant operates as a self-sufficient industrial township. Beyond its core manufacturing units—which include the Steel Melting Shop (SMS), Hot Rolling Mill (HRM), and Cold Rolling Mill (CRM)—SSP manages comprehensive support infrastructure. This includes a dedicated Water Supply system drawing from the Cauvery River , a Central Engineering Shop (CES) for fabrication , and a Central Electrical Maintenance (CEM) department for power distribution. Additionally, SSP fulfills its Corporate Social Responsibility (CSR) through educational and medical initiatives, including a hospital equipped with modern facilities like ICUs and operation theatres.

1.2 Overview of C&IT Department

The Computer and Information Technology (C&IT) department serves as the digital backbone of the Salem Steel Plant. Its primary mandate is to cater to the functional requirements of critical business units, including Material Management, Finance & Accounts, Payroll, and Production Planning for various production lines such as SMS, HRM, and CRM.

Unlike standard IT support, the C&IT department operates on a real-time basis, ensuring that manufacturing data is instantly available for decision-making. The department maintains a robust infrastructure comprising:

- **Central Servers:** Hosting the Enterprise Resource Planning (ERP) applications.
- **Network Backbone:** A fiber-optic network connecting core and area switches to approximately 400 clients across the plant.
- **Software Stack:** Utilizing Oracle 11g databases for backend data management and .NET frameworks for frontend applications.

The C&IT department acts as the central integration point, ensuring that isolated manufacturing processes are unified into a cohesive information system that drives plant productivity.

1.3 Objectives of the Internship

The primary objective of this 14-day In-Plant Training was to bridge the gap between academic Computer Science concepts and their practical application in a heavy manufacturing environment. Specific objectives included:

1. **Understanding Industrial Automation:** To observe the translation of physical manufacturing processes (HRM/CRM) into digital logic through Level-1 (PLC) and Level-2 (Process Model) automation.
2. **Analyzing Enterprise Infrastructure:** To audit the hardware and network architectures required to support mission-critical operations, specifically focusing on Server Redundancy and Storage Area Networks (SAN).
3. **Studying Network Topologies:** To examine the practical implementation of Local Area Networks (LAN) in an industrial setting, focusing on fiber optic redundancy and switch hierarchy.
4. **Exploring Business Logic Integration:** To understand how software systems (Payroll, Material Management) integrate with plant operations to ensure efficiency, consistency, and profitability.

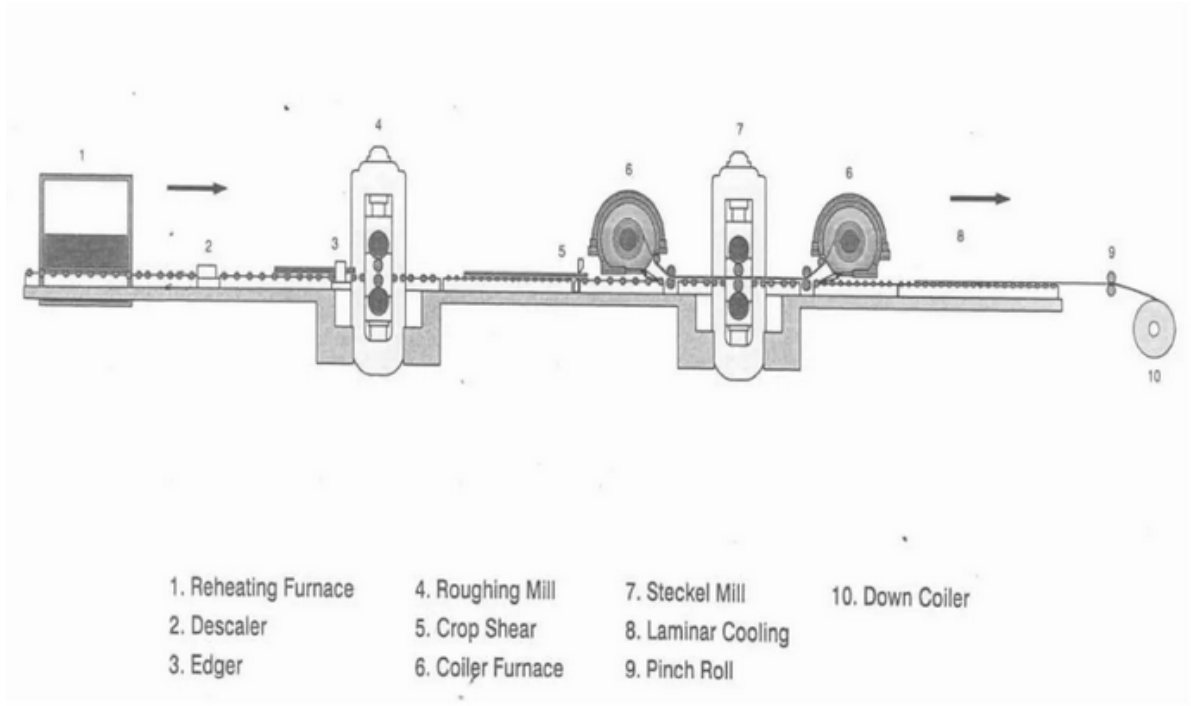
CHAPTER 2: PLANT OVERVIEW & PROCESS AUTOMATION (OT)

2.1 The Manufacturing Workflow (Slab to Coil)

On Day 3 of my internship, I visited the plant floor. To be honest, I really couldn't believe my eyes when I first entered. The machines were so big that I went blank for a moment. Even though the Safety Engineering department had guided me, I didn't know who to ask about these enormous machines.

I found a banner near the entrance that explained the complete workflow. I decided to follow the process step by step to understand how a raw steel slab becomes a finished coil. I saw huge slabs, likely weighing several tons, which were a dull white color before being loaded into the furnace. The autonomous movement of these slabs grabbed my attention instantly.

2.2 Hot Rolling Mill (HRM) Observations



I observed the entire heating and rolling process here. The most unforgettable moment was seeing the slab come out of the furnace. It was loaded 3 to 4 at a time, and for the first time in my life, I saw the color of "Lava" in reality.

2.2.1 Level-1 Automation: PLC & Manual Control

After the slab was heated, it went to the **Roughing Mill**. I noted down in my logbook that this machine is a **4-Hi Reversing Mill**. Its job is to reduce the thick slab into a thinner **25mm Transfer Bar**.

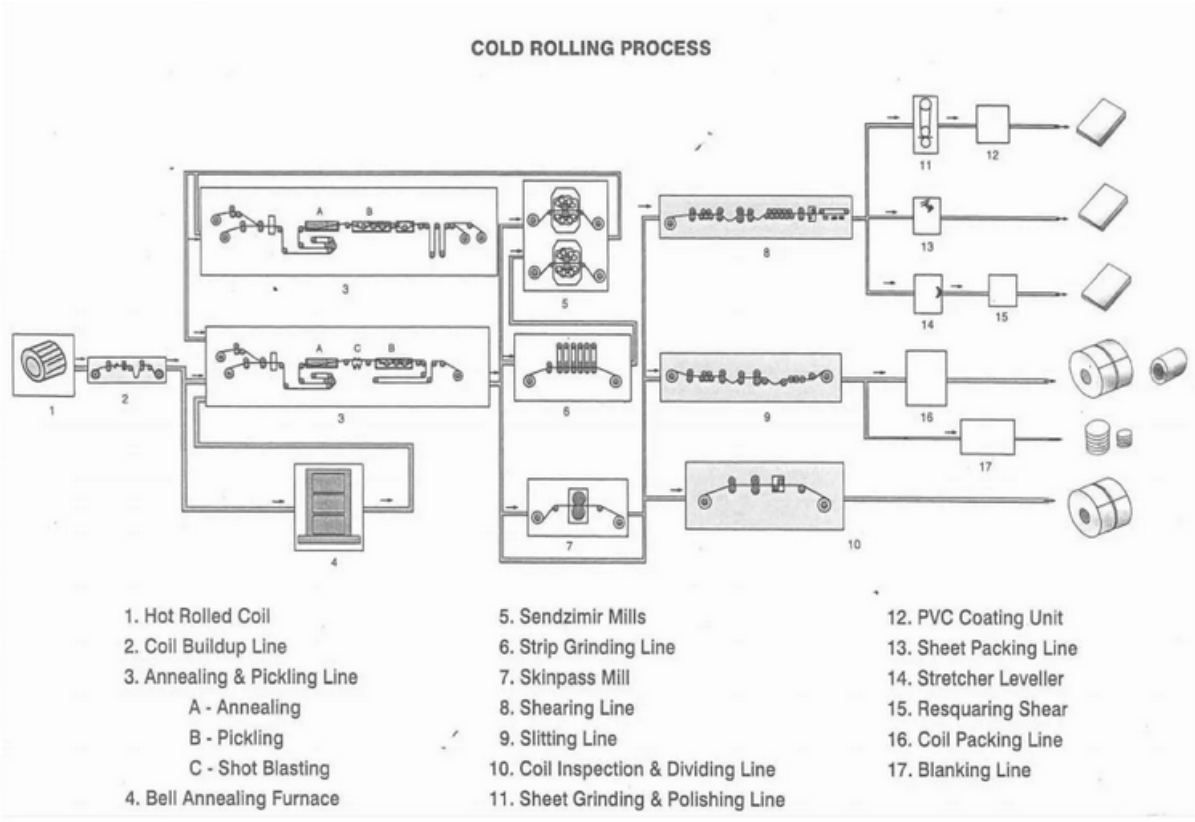
I observed that this stage uses **Level-1 Automation**. This means the control is mostly handled by PLCs (Programmable Logic Controllers) and the operators. It relies on heavy mechanical force rather than complex software models.

2.2.2 Level-2 Automation: Process Models (AGC/HGC)

The next step was the **Steckel Mill**. This machine was different. I watched the steel go back and forth between the rollers, getting thinner with every pass.

This is where the "Computer Science" part kicks in. My notes show that this mill runs on **Level-2 Automation**. It uses specific technologies like **HGC (Hydraulic Gap Control)** and **AGC (Automatic Gauge Control)**. Instead of just manual control, a computer model calculates the gap to get the final product down to **2.5mm** precision.

2.3 Cold Rolling Mill (CRM) Observations



After seeing the hot "lava" steel in HRM, I visited the Cold Rolling Mill. The vibe here was completely different. The process covered the cold rolling of steel and the post-processing of stainless steel to make it shiny and smooth.

2.3.1 Sendzimir Mill & Precision Control

While the HRM was about brute force and heat, the CRM was about precision. I learned about the **Sendzimir Mill** (or Z-Mill). Unlike the big 4-roller setup in the hot mill, this uses a cluster of rollers to exert extreme pressure on the cold steel. This allows them to reduce the thickness to be paper-thin while maintaining a perfect surface finish. This showed me how automation shifts from "power control" in HRM to "quality control" in CRM.

CHAPTER 3: IT INFRASTRUCTURE & HARDWARE

3.1 Server Architecture (3-Tier Model)

Day 13 was the most anticipated day of my internship because I finally got the opportunity to visit the Server Room. Since childhood, server rooms have been the most fascinating places for me, and seeing one in a massive industry like this was a dream come true.

During the visit, I learned that they don't just put everything on one computer. They follow a **3-Tier Architecture**.

- **Tier 1 (Client):** The employees use web browsers on their PCs to access the system.
- **Tier 2 (Application):** The request goes to the Application Servers. I noted these are **HP ProLiant DL 360P** servers running **Windows Server 2008 R2**. They use **ASP.NET** and **C#** to handle the frontend logic.
- **Tier 3 (Database):** The actual data processing happens on the backend servers, which are completely separate.

3.2 Database Servers: Oracle 11g RAC & HP Integrity Systems

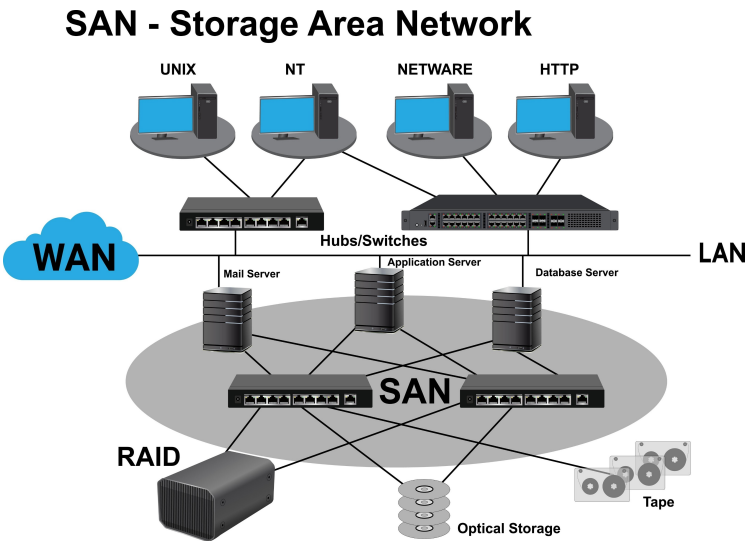
The backend systems blew my mind. Unlike the Windows servers I am used to, the core database runs on **HP Integrity RX2800 i4** servers.

The most interesting thing I learned was about **Oracle 11g RAC (Real Application Clusters)**. The officials explained that the database is configured in an **Active-Active** mode. This means two servers work together at the same time. If one server fails, the other one takes over instantly without stopping the plant. This was the first time I saw someone explain such a complicated concept in a beginner-friendly way.

3.3 Storage Area Network (SAN): HP PA6000 & RAID Configuration

I used to think servers had big hard drives inside them, but I was wrong. I observed that the servers connect to a separate "box" for storage called a **SAN (Storage Area Network)**.

They use an **HP PA6000** storage system with a capacity of **8 TB**. The guide explained that they use **RAID 5** configuration, which gives them about 3 TB of usable, safe space. This setup ensures that even if a hard disk breaks, the data is not lost.

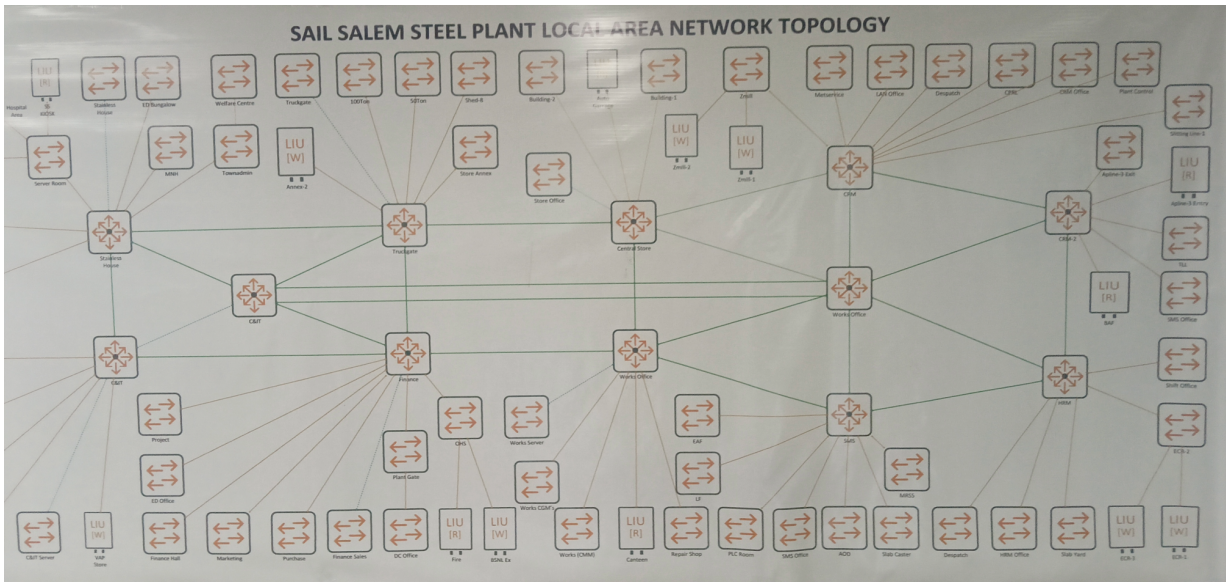


3.4 Disaster Recovery: Tape Library & Backup Strategies

Finally, I saw the **Tape Library**. It looked like a machine from a movie. They use **HP Data Protector** software and magnetic tape drives for backups.

I learned that this is the ultimate safety net. While hard drives are fast, tapes are reliable for long-term storage. Seeing these physical tapes made me realize how serious the industry is about protecting their data from crashes or attacks. This visit gave me clarity on things I had only read in books.

CHAPTER 4: NETWORK ARCHITECTURE



4.1 Local Area Network (LAN) Topology

Day 7 was unlike all other days because I saw what I read in books for the first time in real life. I got the opportunity to interact with the Network Manager of SSP. This session was special to me because "Computer Networks" was a subject I had the most questions about while studying in my 2nd semester.

Back then, I thought networking was just about LAN cables, modems, and switches. But while talking to him, I raised various questions that I failed to find answers to back in college. He explained the plant's Local Area Network topology clearly. This conversation enabled me to finally understand how to manage thousands of computers under one network and how to provide security for an entire industry.

4.2 The Collapsed Core Architecture

The most interesting thing I observed on the network map was the architecture they followed. It was not the simple "Star" or "Bus" topology we study in textbooks.

I learned that the plant uses a **Collapsed Core Architecture**. Instead of having multiple complex layers of switches that slow down the data, they have a strong central backbone. I saw on the map that the critical departments are connected directly to this central core, ensuring that data travels as fast as possible.

4.3 Optical Fiber Backbone (12-Core Ring & Redundancy)

I used to think all internet cables were the same, but here I realized why the medium matters. Since the factory has huge furnaces and motors, copper cables would face interference. So, they use **Optical Fiber Cables (OFC)** everywhere.

Looking at the legend on the map, I found two specific types of connections:

- **The Green Loop:** This is a **12-Core OFC** ring that connects the main hubs like C&IT and the Works Office. The manager explained that this ring structure provides **redundancy**. If the cable gets cut on one side, the data automatically travels around the other side so the plant never goes offline.
- **The Orange Lines:** These are **6-Core OFC** cables that connect the outer departments like the Slab Yard back to the core.

4.4 Switching Hierarchy: L3 Core vs. L2 Edge Switches

The manager also clarified a major doubt I had about switches. On the map legend, I saw two different symbols for switches, and he explained the difference.

- **L3 Switches:** These are placed in the core locations. They act like routers and handle the security logic to separate different departments.
- **L2 Switches:** These are the edge switches used in office rooms to simply connect the PCs and printers to the network.

This conversation made me realize that networking is not just about connecting wires. It is about designing a system that is secure, redundant, and easy to manage.

CHAPTER 5: ENTERPRISE INFORMATION SYSTEMS (ERP)

5.1 Material Management System (MMS)

On Day 12, I learned about the **Material Management System**. At first, I had a funny reaction. I thought, "What? I am a CS Student; why do I have to learn about buying spare parts?".

But as the official explained it, I slowly understood the logic. I realized that to a Computer Science engineer, this is nothing but a massive **Inventory Database & Workflow Automation System**. It is the code that ensures the factory never runs out of raw materials.

5.1.1 Master Data & Procurement Workflow

I learned that before any transaction happens, the system needs "Static Data" to understand the real world.

- **Material Master:** A database table of every single item the plant uses.
- **Vendor Master:** A list of all approved suppliers.
- **Vendor Registration:** The logic to track who is supplying good quality materials.

The workflow was strict. It starts with an "Indent" (Request), moves to "Purchase Order" (Contract), and ends with "Material Receipt". This showed me how software enforces business rules.

5.1.2 Inventory Tracking Logic

This part connected the physical store to the digital database. The system tracks:

- **Material Receipt:** When items enter the plant gates, they are inspected and entered into the system.
- **Material Issue:** When a department needs a tool, they use an SIV (Store Issue Voucher).
- **Stock Overview:** This query allows the manager to see the exact count of items in the warehouse instantly.

5.2 Payroll & Human Resource Systems

On Day 6, I had a discussion with Mr. Saravana Pandian about the Payroll System. I learned that calculating salaries in a huge industry is not as simple as `Days * Pay`.

5.3 Financial Accounting System Integration

During my interaction on Day 5, I was asked, "Why do we need a C&IT department?" I gave random answers, but the officer explained the real reason: **Consistency and Profit**.

I learned that the **Financial Accounting System** acts as the final collector of all data.

- **Costing:** It pulls data from the production lines to calculate exactly how much it costs to make one ton of steel.
- **Trust:** If this computation fails, the company loses consistency. If they are not consistent, they lose the customer's trust, and eventually, the profit.

This realization grounded me. I understood that coding in the industry is not just about writing loops; it is about building trust.

CHAPTER 6: CONCLUSION

6.1 Summary of Learning

When I first entered the Salem Steel Plant on Day 1, I felt overwhelmed. Looking at the training schedule filled with unfamiliar terms, I realized how much I still had to learn. However, this 14-day journey has been a grounding experience that bridged the gap between my college textbooks and the real world.

My learning curve started with the physical plant visit on Day 3, where I saw the scale of operations from the "lava-like" slabs in the Hot Rolling Mill to the precise cold rolling in the CRM. It then moved to the technical infrastructure on Day 7 and Day 13, where I explored the "Collapsed Core" network architecture and the massive Oracle databases in the server room.

I learned that in an enterprise environment, Computer Science is not just about writing code; it is about ensuring **Reliability** and **Redundancy**. Concepts like RAID 5, Active-Active Clustering, and Fiber Optic Rings are not just exam topics they are the safety nets that keep a multi-crore industry running without downtime.

6.2 The Role of C&IT in Productivity & Efficiency

On Day 5, during my discussion with the officials, I was asked a simple question: "Why do we need a department called C&IT?". At that moment, I struggled to give a pinpoint answer.

Through this internship, I finally understood the answer. The C&IT department does not just fix computers; it drives the formula: **Smart Work ->Productivity -> Profit**.

I realized that without automation and computation, the industry would lack consistency. If a plant cannot produce consistent quality, it loses the customer's trust. And if trust breaks, the profit falls. The role of C&IT is to provide that consistency whether through the mill automation that controls steel thickness or the ERP system that ensures raw materials are ordered on time. This realization has changed my perspective on my own field of study.

Check this GitHub Repo in which I have updated my Daily Progress

Github Repo : https://github.com/Kabe-Innovates/SAIL-Internship