Using the Sensor Edge Server to Communicate to Sensor Devices

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This white paper discusses in detail the design and deployment of a closed loop automatic identification and data collection system using Oracle' Sensor Edge Server. The system is used in a manufacturing assembly line to provide better material visibility and labor efficiency.

Introduction

RFID (Radio Frequency Identification) technology is poised to dramatically impact and improve the way manufacturers; distributors and retailers do business and interact with each other. Many of these entities in the supply chain are already experimenting or implementing with RFID technology. While there is considerable research and development going on in the RFID hardware segment and presence of mature ERP systems exist, there was still some amount of desirable action to be taken in the middleware area. However with the release of the Oracle's Application Server 10.1.3, many of the middleware problems seems to have been resolved.

This paper presents the description of a working closed loop RFID system that is still in the development and testing stage. This system uses the Sensor Edge Server as the middleware that provides connectivity to the RF Hardware, collects the data, filters it and dispatches it to an Oracle ERP system for further processing. The immediate benefits were enhanced material visibility and tracking of labor efficiency.

The Case

X Ltd is a manufacturing organization and produces assemblies that are further used by manufacturers in producing large infrastructure equipment. X Ltd has an assembly line through which this assembly takes shape as it moves from the first to the ninth operation. The line is approximately 100 meters in length with operations at almost equal intervals. Below is the sequence of operations that take place in the assembly line.

Operation Sequence	Operation
10	Assemble components and weld sheets
20	Assemble and weld block assembly
30	Set up core
40	Assembly welding
50	Complete the welding
60	Adjust bracket on assembly
70	Complete adaptor
80	Outer shell and core assembly
90	QC testing

An operator except for operation 50 that is a robot welder and is used when the line capacity is nearing saturation mans all operations.

The requirement was to track the Work In Process Inventory as it moves through the assembly line. There was also a requirement to track the labor efficiency at each operation.

The organization used Oracle WIP but does not have resources to make move and resource and material transactions at each of the operations. The requirement was for an automatic system that would collect all this data.

The Solution
When X Ltd approached us for a solution, a closed loop RFID system was suggested to achieve the objectives of being able to track material visibility and labor efficiency without manual intervention.
It was suggested that three antennas be positioned at the three bottleneck operations of 10, 50 and 90. The antennas were positioned above the conveyor with interrogators installed alongside. Active tags were used and were programmed with the WIP Job number in oracle applications.
These tags were then placed along with the job card. The job card is printed out of oracle and is placed in a plastic sheet that travels along with the assembly.
With the RFID hardware and ERP application issues resolved, the selection of the middleware piece was decided in favor of the Sensor Edge Server released in the 10.1.3 version of the application server. Figure below shows the above outlined solution.

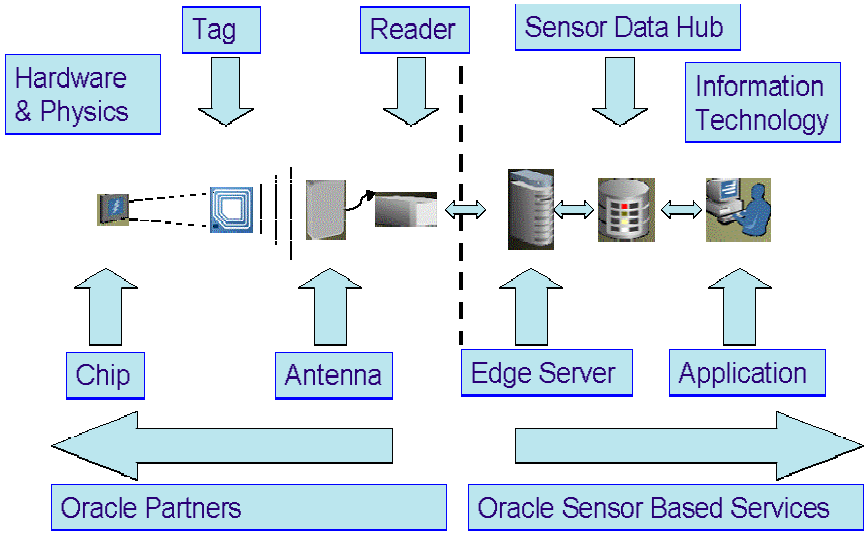

Fig. 1 Schematic diagram of the proposed solution

Configuring the Sensor Edge Server
In the development phase the server was installed on a machine running Windows XP. Following are the requirements for running OC4J and Sensor edge Server –

Memory	512 MB
Disk Space	550 MB
Temporary Directory Space	256 MB
Swap Space	1.5 GB

Before the Oracle Sensor Edge Server is installed, OC4J must be installed. In previous releases, OC4J was packaged as part of the Oracle Sensor Edge Server installation. In release 10.1.3, to make upgrading OC4J easier, it is not included as part of the Oracle Sensor Edge Server installation and must be installed before you install Oracle Sensor Edge Server.

Configuring the sensor edge server
The configuration and administration of the edge server is performed through the console. The basic features, which the edge server performs, are –

- Sensor Data Collection
- Sensor Data Filtering
- Sensor Data Dispatching

- Sensor Data Archive and Rules
- Sensor Server and Device Management
- Sensor Edge Mobile
- SES Console

Data Collection
Oracle Sensor Edge Server provides an extensible driver architecture that integrates with any sensor source such as Radio Frequency Identification (RFID) readers and printers.
Since the server provides drivers that can be used with many industry available readers one such driver was configured to provide connectivity to the reader. Apart from the software libraries provided by the RFID Hardware vendor, some settings have to be changed in the driver configuration through the console.

Set IPAddress to the hostname or IP address. If it runs on the same machine as the Edge Server, enter 127.0.0.1.
Set PortNo to the port number. The default is 6666.
Set the AntennaSeqIDList to the list of identifiers for each antenna.
Set AntennaMappedDeviceNameList to the list of mapped device names associated with each antenna.

Sensor Data Filtering
Data streaming in from sensors connected to Sensor Edge Server arrives in a wide range of formats, and includes unnecessary or redundant information. Before the Oracle Sensor Edge Server sensor data is passed on to enterprise applications, Sensor Edge Server performs data cleansing by filtering the data from individual sensors and groups of sensors. This process normalizes the sensor data into a consistent format. Groups of sensors can be treated as single logical entities for filtering purposes. In this particular case a simple rule of First In Last Out was applied. A java script filter was written to read retain the first and last read at an operation. All other reads were filtered.

Sensor Data Dispatching
Dispatchers are plug-ins that enable two-way communication with applications. The main output of Oracle Sensor Edge Server is filtered data events. These data events are provided already minimized and normalized.

In this particular case the data was dispatched to Oracle WIP. The PML dispatcher was configured to write the tag id, reader location and the time of the read to a directory location.

Converting the data to meaningful ERP data
The data collected from the RFID system was then mapped to data that was picked up from the Oracle ERP and sent back in the form of Open Move Transactions and Resource Transactions Interface. As the Tag Id was the Job number and the readers mapped to operations, the system provided visibility to material as well as resource transactions at those operations. Figure 2 below shows the sequence of operations in the process.

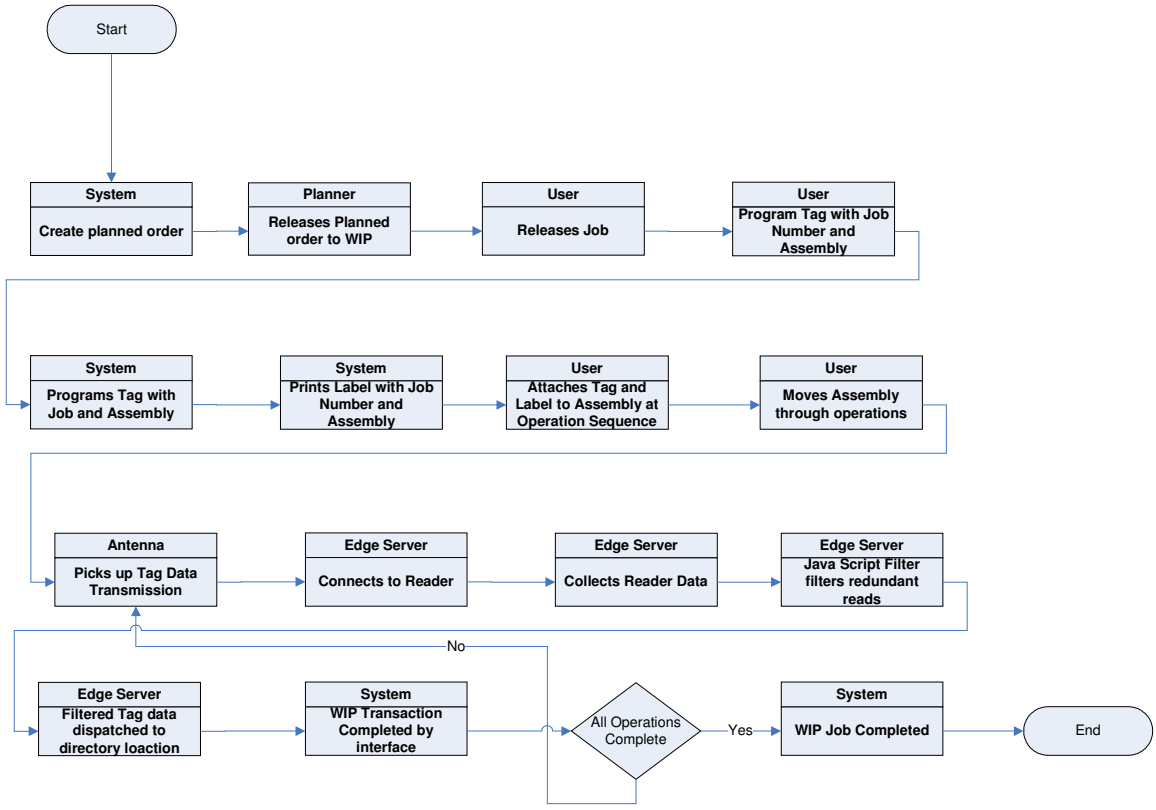

Fig.2 Process flow diagram

Conclusion & Going Forward

The above design has been deployed in a development phase and has been collecting data now for some time. Some of the questions that have been thrown up are –

(i)Amount of data that the sensor edge sever can handle.

(ii)Speed of the operations

(iii)Cost effectiveness

However, the server is performing with satisfaction the functions it is designed for – collecting data from devices, filtering the data and dispatching the data to an ERP application.