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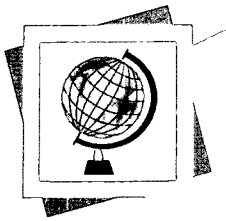

Distributed Considerations for RFID Deployments

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목 차

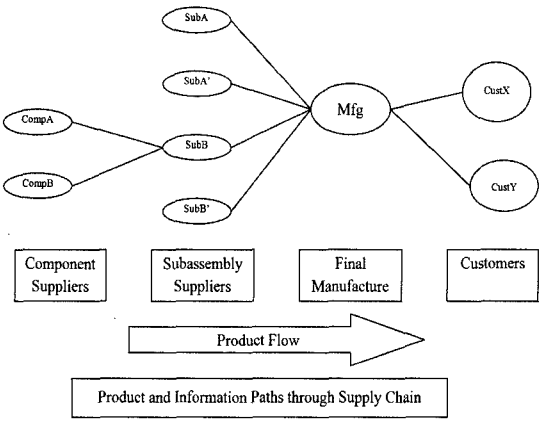
1. General

RFID presents an opportunity to incorporate deep automation and monitoring into the line of business processes and the backend data coordination. This is a more direct joining of the Line of Business technologies such as factory automation to the ERP and WMS systems out through B2B linkages. Ideally, this would allow for a series of connected systems throughout the supply chain that identifies assets, materials, and products. By directly sensing the location and the state of any given element in the supply chain, the classic MBA tools become much more valuable in determining and guiding the state of the enterprise. This visibility comes at a price. There are a number of realities that need to be incorporated into these designs to make them practical to implement and use. This article will outline some of the opportunities and challenges for these type deployments.

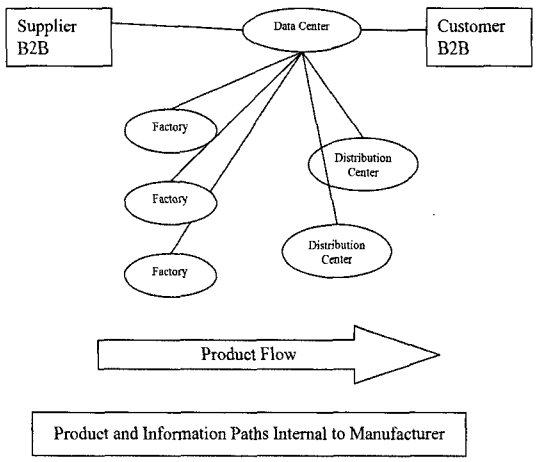
2. Description of Environment

For the purposes of this article, we will consider an extended supply chain starting with subassembly manufacturers, an integration manufacturer, and consumers. This also applies to the logistics operations (and providers) that affect the transfer of the materials; however, they are not explicitly called out in order to simplify the discussion. In practical application there will be large numbers of suppliers, customers, and intermediaries. Each of these may have their own RFID, B2B and security environments.

The above diagram illustrates the relationships



between the creators and consumers in the supply chain. The product flow moves in only one direction in this example. The return and repair functions will use the same or similar pathways but are not detailed in order to maintain simplicity.



The internal diagram for the manufacturer identifies the information connections between the individual facilities that are owned and operated by the manufacturer. The assumption that is made for our discussion is that all of the facilities (factories, distribution centers, data center, etc.) are all in separate physical locations. Co-location of these facilities is not common, but would simplify many of our issues.

3. Pre RFID Deployments

In these environments, often the geographic distances between facilities could be quite large, with leaps between assembly and distribution points covering continents. These distances and customs of operation generally result in loose process coupling where tracking of individual items would be manpower intensive. Best planning and reporting practices for these environments take into account the uncertainty and predictable delays and snapshot nature of reporting. This means that there is a need of additional inventories in order to accommodate uncertainty in production.

4. Convergence of Line of Business (LOB) and IT

The Line of Business (production line, distribution, etc.) and the IT operations become more closely coupled with the introduction of RFID (or near real-time) information. Some of the technology and personnel functions in these two domains will overlap as the overall technology strategy is designed. This is a common challenge that is faced as computer technology advances to the point that the LOB operations can take advantage of standard computer platforms. Similar circumstances have occurred in other fields such as communications technologies.

4.1 Organizational Considerations

As the technology becomes more seamlessly

connected, the design, ownership and maintenance of the systems becomes more completely interdependent. The architecture of the system will also imply a good deal about the organizational changes that will be necessary to support the enhancements. Often the Line of Business technology owners and the IT owners are within different and disconnected areas within the corporation. It is important to try and identify the departments that will be impacted by the move into RFID as part of the design process. Changes in the technical design and service level agreements may require the additional commitment of resources outside of your current department's domain.

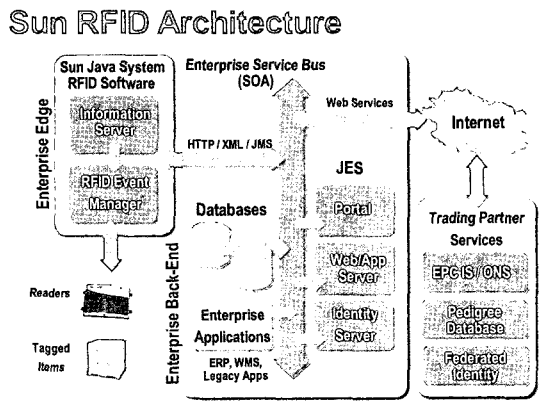
4.2 Technology Considerations

One of the characteristics of technology convergence is the conflict and contrast of the parametric (or performance) behaviors of the systems involved. Some of the very key elements are: availability, scalability, manageability, security (identity), and integration. The first behaviors (availability and scalability) are generally high on the priority list for LOB and automation systems. The idea is that automation control systems should have minimum down time and should not throttle throughput. Below is listed a number of the systemic behaviors that are crucial to operating with the addition of RFID into the environment. I have indicated the Sun technical elements that can be used to satisfy these requirements.

The Sun architecture (described below) illustrates the placement of the Sun Java System RFID Software as the transformation point between the fast series of events coming from

RFID Infrastructure Requirements		Sun fit with RFID Requirements
❶ Robust systems that provide redundancy and fail over will be a must – the data must continue to flow.	Availability	Java/ JBME, Jini, RIO and Java Enterprise System
❷ Suitable architectures that facilitate the timely management of all the data that will be generated	Scalability	Java/ JBME, Jini, Java Enterprise System
❸ Need ability to remotely configure, provision, manage, diagnose and rectify any potential issues	Manageability	Java/ JBME, Jini, JMX, Sun Directory
❹ Ability to securely exchange information with only authorized trading partners is required	Identity/ Security	Java, Sun Access and Identity Management and Liberty
❺ Ability to integrate data with existing enterprise systems and with with business partners is key	Integration	Service Oriented Architecture (SOA), Integration and Sun Portal

the RFID readers (and other sensor devices). This architecture, as described, can be deployed in a distributed fashion across multiple locations. By having the messages go via HTTP/XML/JMS, the overall system is not relying on close coupled communications. This same bus can service numerous locations. Note that the Information Server is kept also at the architecture edge. This allows transaction traffic to be minimized across the bus and reduces dependency on a larger feedback loop.



5. Levels of logic within the deployment

RFID events, at their most fundamental, are a stream of tag reads from an individual reader. The next layer identifies and extracts a unique instance of a tag by a reader, the next layer

takes compound sensor (reader and other devices) and creates a representation of a unique physical event. It is at that level that the actual message created is abstracted from the technologies that created it. More simply put, the message on the bus could have been generated by a sensor system such as RFID, bar code, keyboard input or any other method. This level of abstraction is important because it isolates the enterprise applications from the generating technology thereby allowing the sensor technology to change and evolve without having to change the application.

This is a fairly simple unidirectional consideration for abstraction. More complex decisions must be made for the design regarding the use of this data in feedback systems. We have designed systems for clients that used RFID and other sensor data to decide the routing path of packages. The information was being read upon receipt on a conveyor, and the package would be redirected via a diverter automatically. If the decision was made back in the enterprise application, this might mean that the message would travel out of the facility, out of the country, across the internet into the data center where the enterprise application resided. The process would impose large delays, require immediate response by the application, and not be tolerant of communications downtimes. The correct decision was to use a locally sited Event Manager that was configured to analyze the multiple RFID and sensor inputs, send an action out to the diverter control, and issue a message to the enterprise application as to the outcome.

The use of the Event Manager in this case as the decision maker is a simple example of localizing the logic to the appropriate level in the overall architecture. This is all well and good, but this is just the sunny-day picture of an operation that has unlimited and constantly available bandwidth throughout all of the elements. Two of the key design considerations are practical bandwidth and disconnected operations.

6. Bandwidth and Feedback Latency

In the simplest of designs, the read of a tag will result in the recognition of a business event for the back-end systems. The next step of value is taking that information and using it to act upon the tagged item. This could be as simple as triggering an actuator and feeding that item into a different workflow. Early pilots in RFID generated by data center teams would try to aggregate and analyze the data coming out of RFID readers at the enterprise application. These attempts did not yield satisfactory results. The output of these readers in real usage can, when used in quantity, generate more information then a reasonable enterprise application is deployed to handle. In order to handle this without additional logic layers, the foundation platform (servers and network infrastructure) would have to be scaled up greatly and at great expense.

The additional problem comes about when messages are needed back by the RFID enabled facility in near real time. The ability of most configurations of enterprise applications and enterprise infrastructure to handle fast turnaround transactions over internet communications would be insufficient and inconsistent for this type of a deployment.

7. Disconnected operations

Ideally, the temporary failure of a communication link should not cause a halt of the operations of any given operations line or facility. The simplest action is to cache the messages that are leaving the individual facility until the connection is restored. This will allow for the proper accounting of transactions that occurred during the disconnection. Certain logic and storage should be located within the facility in order to allow decisions operations to continue even when connection to the data center is temporarily severed.

8. Final Thoughts

Establishing a master plan for the long term implementation of RFID enabled (or, more generally, sensor network enabled) enterprise is a good steering tool. Given the nature of the new technology opportunities and changing business environment, it should be implemented in short phases giving careful consideration to agility of the overall enterprise.

Author History

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Jim Del Rossi is the Chief Engagement Manager for Sun Client Solutions, Desktop and Mobility Practice - RFID. Jim brings twenty years of design and management experience to this position. Advises CxO level clients on strategic use of technologies. Extensive background in developing and leading teams in advanced systems technologies for applications in the Media and Entertainment, CPG/Retail, Finance, Telecommunications, and Graphics industries amongst others. Experience has ranged from technologist and consultant to executive IS/IT management. Before joining Sun, Jim was an independent Technology Management Consultant operating as acting CTO for companies entering into the Internet forum. Clients included Citibank and emerging companies in the Finance and Web Services industries. As Vice President of Applications Development for Viacom, Jim created technology strategies for the business and ran a department for all the IT supported business functions (HR, Finance, Legal, Tax, etc.). Other experience includes WDC/ABC, AIG, and engineering consulting.

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