

Win in the flat world

Supply Chain Traceability with RFID and SAP

– Mayank Shridhar, Amit Dilip Deshpande

Abstract

Real Time Visibility into assets and products across the supply chain, a critical business need, is fast becoming a reality. This paper makes the case for a central, Real Time Event Repository based on the SAP Object Event Repository (OER) architecture for RFID-enabled supply chain operations in the Retail and CPG industries.

In this paper, we examine:

- » *How data amassed from RFID infrastructure can be integrated with Enterprise Systems using SAP OER for different business processes.*
- » *How to accomplish trading partner collaboration.*

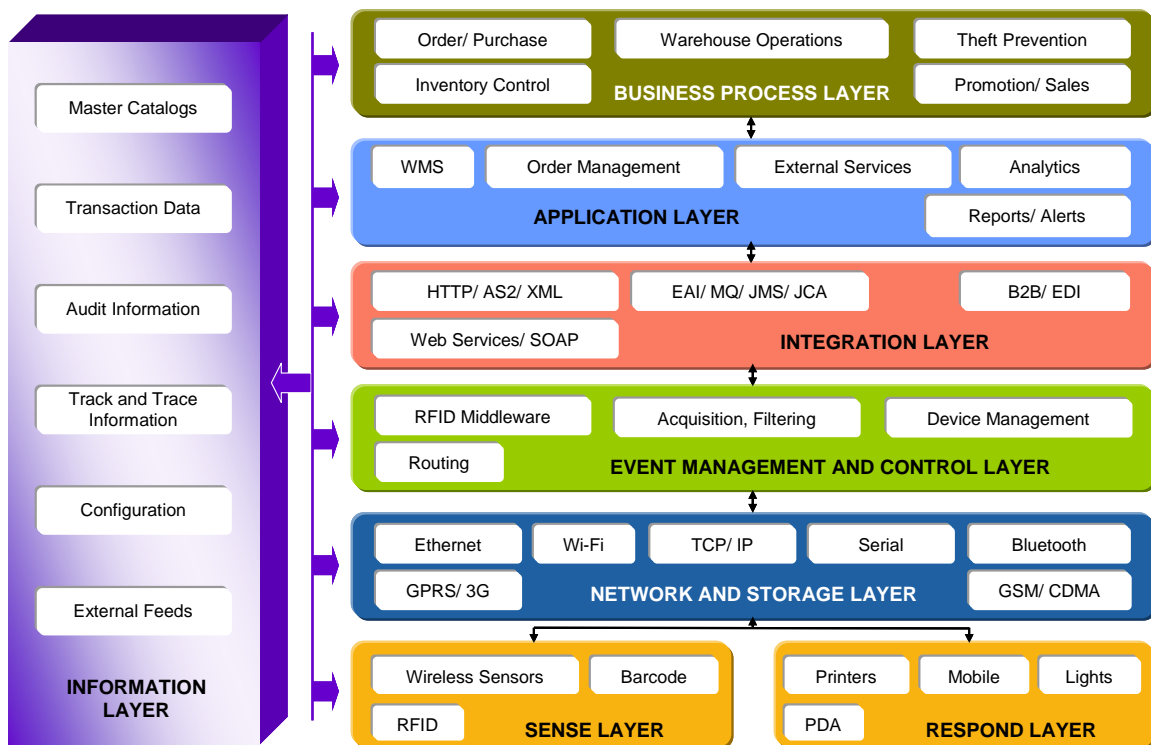


Background

More and more retailers and CPG companies are employing RFID technology in their supply chain to streamline business processes requiring visibility as well as to maintain an operational edge over the competition. While several organizations are still assessing the benefits of adopting RFID into practice, certain big-box retailers have already mandated their suppliers to comply with RFID-tagging at pallet or even case levels. Therefore, for any CPG player that wants to stay ahead in the race of preferred suppliers, it is not just an imperative to oblige with the mandate but it is also an opportunity to derive benefits. This paper analyzes the need for a central repository to capture all the information flowing between different trading partners and how to integrate it with their existing WMS systems.

An RFID solution has several components, namely, hardware comprising readers, tags, sensors and other devices; network infrastructure which connects these devices to the system; local site-middleware (residing on a separate site-server or embedded on the device itself) that communicates with the devices to collect data; legacy enterprise applications like WMS; exchange infrastructure or integrators that enable communication between the middleware and enterprise applications, and various repositories which house the information flowing between different systems. Each of these components might be physically situated at different locations. Infosys has defined the following logical 7-layer reference model, comprising all the necessary components for an RFID deployment. The architecture diagrams in this paper follow the color-coding used in this model.

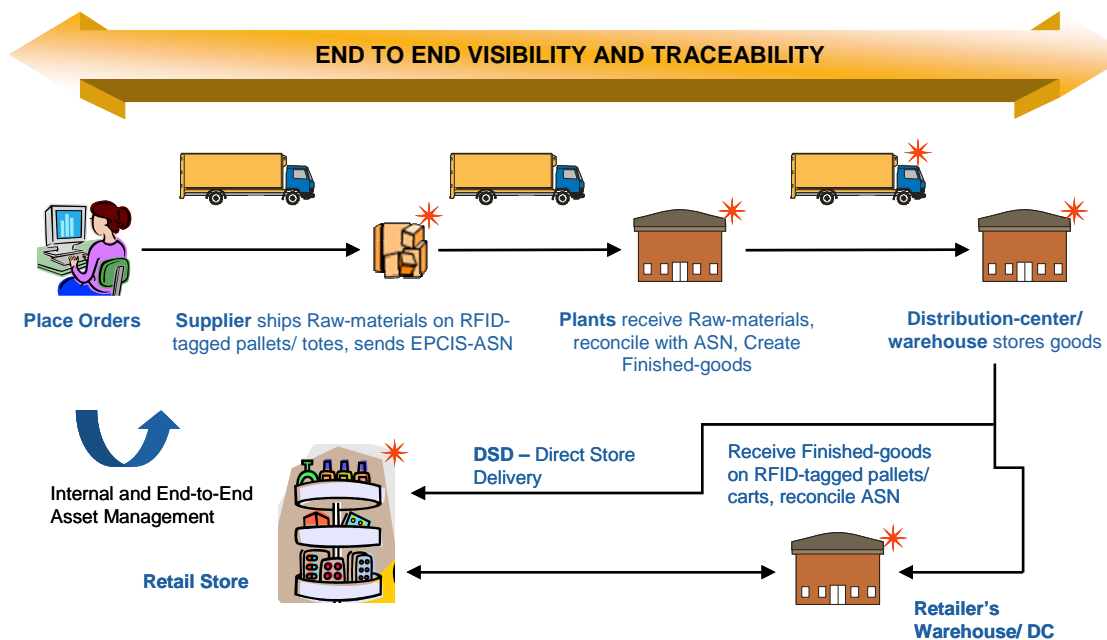
Figure 1: Infosys 7-Layer RFID Reference Model



RFID in Action in the Supply Chain

An automatic identification and data capture technology requiring minimal manual intervention, RFID enables seamless communication between different systems and helps them to share accurate information. It also allows the serialization of products with EPC-numbering schemes, thus enabling them to be tracked at an unprecedented level of granularity. Consequently, a great amount of information is made available. The two Unique Selling Propositions (USPs) of RFID are therefore “**visibility**” and “**information**”. Since the data is captured automatically, it gives organizations the potential to respond to real-world, physical events on a “**real-time**” basis, in other words, as and when they occur. A simplistic view of an RFID-enabled supply chain is presented in the diagram below:

Figure 2: RFID-Enabled Supply Chain



However, it is seen that not all the supply chain players that deployed RFID in their business processes have garnered its promised benefits. Some of them faced the following challenges:

- The investment in RFID was not leveraged to its full potential and therefore did not generate sufficient Return on Investment (ROI).
- Since the solutions were vendor-hosted and dependent on proprietary technology rather than standards, there was no end-to-end traceability.
- Investments in RFID were only seen as a way to stay in harmony with industry mandates or trends, and not as a source of value-addition.

Typically, these problems would occur in one or more of the following instances:

- When RFID is deployed as a point-solution in which the flow of information is not integrated with the enterprise systems.
- When the benefits were observed by piloting certain business processes in a restricted precinct, rather than streamlining multiple processes across the chain.
- When there is no integration with trading partners, because they are either not RFID-enabled or do not exchange the necessary RFID-event information.

In order to realize the true potential of RFID, it is indispensable for organizations to enable business processes across the value chain and provide end-to-end traceability by capturing information throughout the life-cycle of the RFID-tagged assets or products.

Need for a Central Repository

In an RFID-enabled supply chain, partners should consider sharing relevant RFID-enabled business event data through robust and extensible systems and platforms that can meet the future tagging requirements at an item or sales-unit level.

Traditional WMS or ERP applications are not designed to hold EPC data, especially at case or sales-unit levels. As a best practice, software vendors recommend that EPC-level data should not be handled at the WMS (see “References”). It would take enormous effort and customization to build the capability in the ERP or WMS systems for handling EPC serial numbers. When multiple applications cater to the processes being RFID-enabled, the information needs to be duplicated in all of them. That would be equivalent to reinventing the wheel because the functionalities related to serialization and track & trace are already provided in products like SAP All and SAP OER, which are meant for processing and storing EPC information. Should sales unit-level tagging become a possibility in future, WMS systems would be unable to handle it. Hence, from a long-term perspective, it is wiser to use products like All and OER instead of customizing the WMS. Organizations could use a central EPCIS repository to maintain the RFID tag-IDs/ EPC numbers used in different business transactions, which can be queried by the WMS applications whenever required, thereby reducing the impact on existing systems. SAP OER 7.0 is an appropriate choice of repository due to the following reasons:

- It is an EPCIS-certified repository, providing complete track & trace visibility of products across locations. It is capable of storing RFID tag-IDs (EPC numbers), their hierarchies (e.g. pallet-case mappings) and also the details of business-relevant documents.
- It enables supply chain partners to post, query and subscribe to object-events as per EPCIS standards.
- It integrates seamlessly with SAP packages such as WM, EWM, R/3, and BI and also with non-SAP systems using web-services through SAP PI (XI).
- It provides central number range management for multiple WMS or RFID middleware instances. Hence, various WMS or SAP All systems can remotely query a central SAP OER instance to retrieve serial number ranges for their purpose (e.g. commissioning), and be assured of their uniqueness globally.

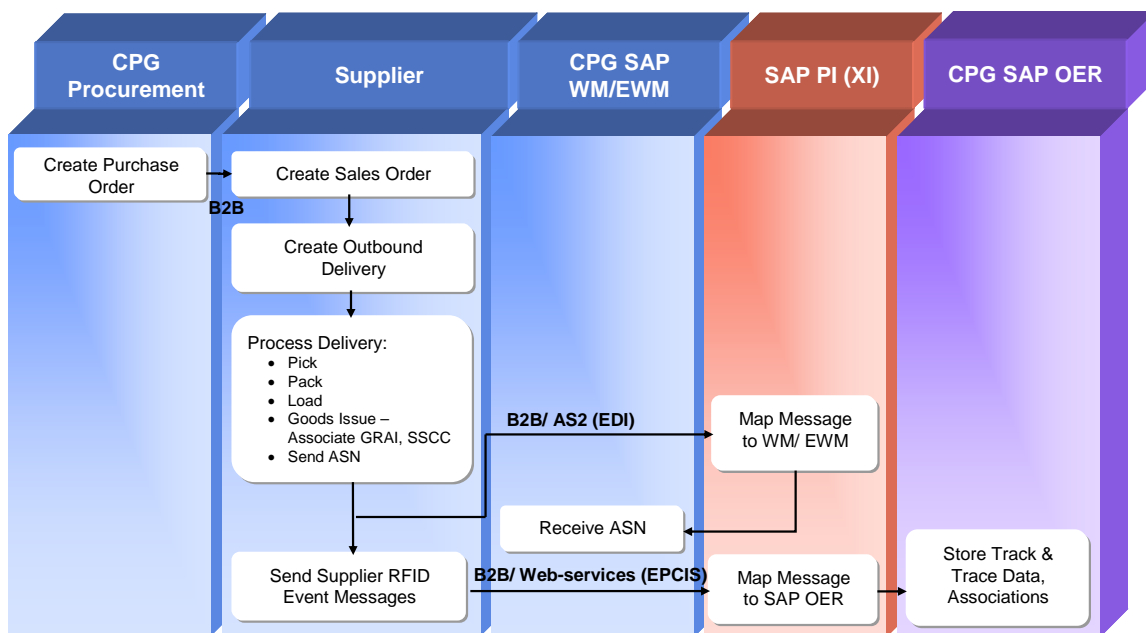
The above-mentioned features make SAP OER an ideal candidate for deployment as an extensible repository which can be used by all trading partners in the supply chain such as manufacturers, retailers and third party logistics companies. It also eliminates the dependence on stand-alone third party repositories, thereby providing **the foundation for a scalable architecture**.

The following examples of a CPG organization using different WMS systems for inbound and outbound processes illustrate how SAP OER can be used in an RFID-enabled supply chain. A similar architecture can be used by the other players as well.

Integration of SAP-based WMS for Inbound Receiving

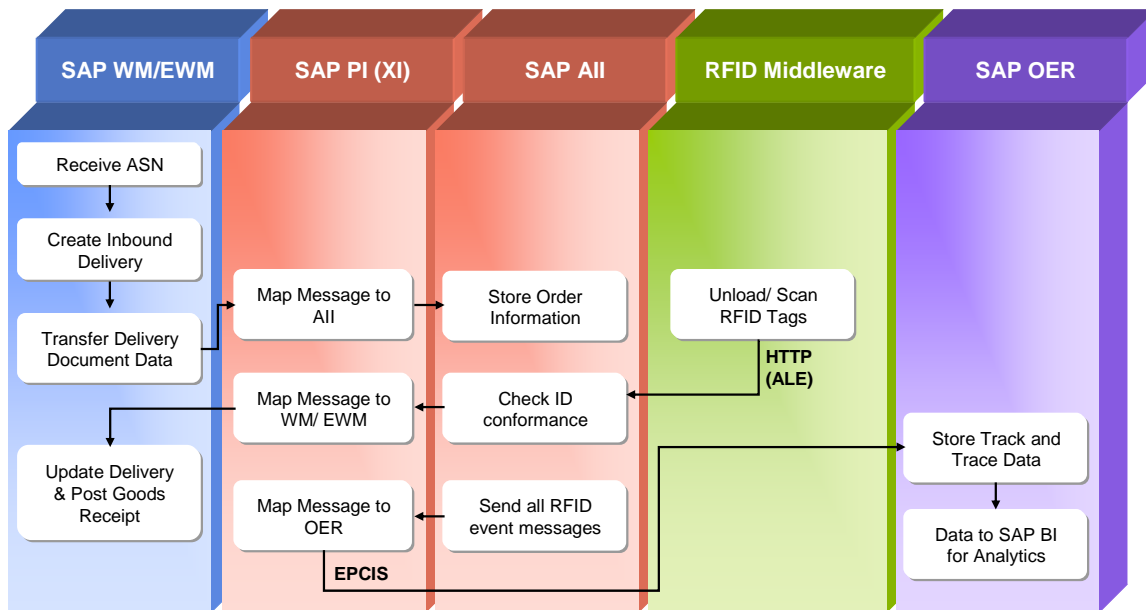
The following diagrams depict how an SAP OER central repository can provide traceability when raw materials are being received from suppliers, assuming that an SAP-based WMS is used for the inbound process by the CPG organization:

Figure 3: Shipment of Raw Materials by Suppliers and Notification to CPG Player



The supplier posts the relevant RFID business events occurring within its environment to the CPG organization using the **“Event-capture” interface** of the latter’s SAP OER via SAP PI. A serialized, EPC-enriched Advanced Shipment Notice (ASN) is also sent to the CPG player when the “goods-issue” process occurs at the supplier’s premises. This ASN can be used by the CPG organization to reconcile receipts and immediately alert any discrepancies, which streamlines the entire receiving process and reduces FTEs. Therefore, the events captured and shared by the various players can be used to efficiently plan and execute their respective processes. An equivalent architecture could also be used by retailers to receive shipments from CPG companies.

Figure 4: Inbound receiving using SAP-based WMS with SAP OER

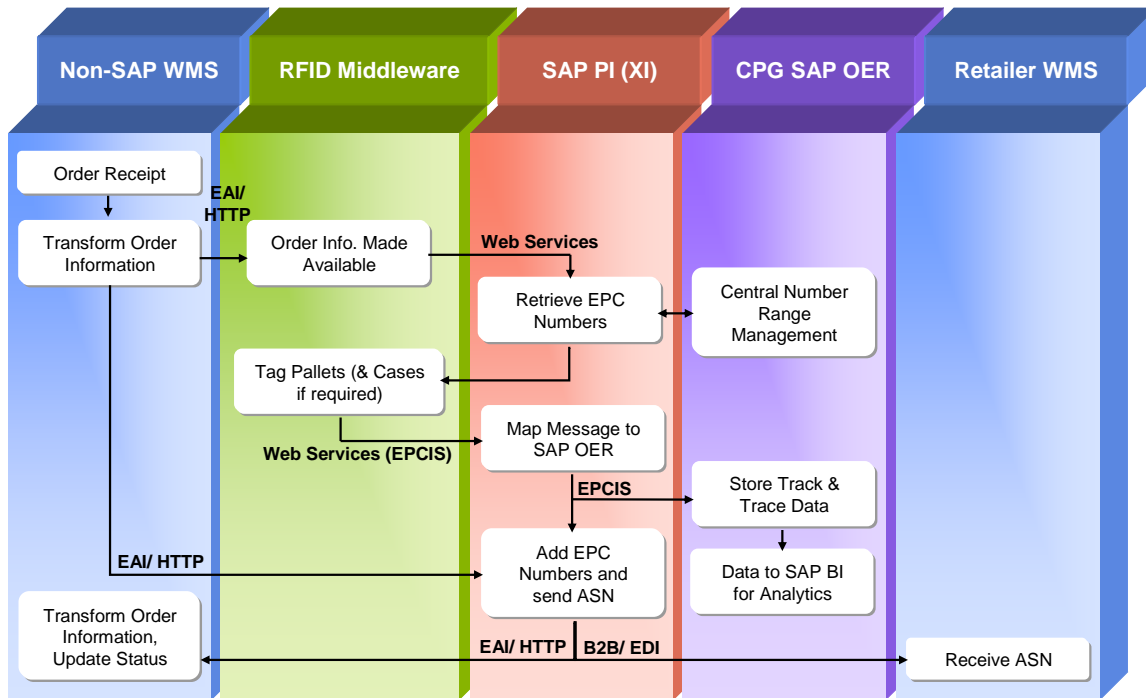


Integration of non-SAP-based WMS for Outbound Shipping

The next diagram depicts how SAP OER can be used as a central repository by a CPG organization for traceability and commissioning while shipping finished goods to retailers, assuming that a non-SAP WMS is used by the CPG player for the outbound process.

The CPG organization can maintain a central SAP OER instance to handle and ensure unique serial numbers across geographies. After loading shipments, the CPG player can create an EPC-enabled ASN and send it to the retailer, which can be used for reconciliation at the latter's end. EPC-enabled ASNs improve the efficiency of retailers' inbound receiving processes, enabling them to share the benefits with the CPG organizations in the eco system. Thus, the data captured in SAP OER during the inbound and outbound processes aids product visibility, KPIs, demand forecasting and inventory management, and rationalizes the RFID investment. Likewise, other players in the supply chain can also reap the benefits of RFID-enabled business-event sharing and enhance relationships between the organizations.

Figure 5: Outbound shipping using non-SAP-based WMS with SAP OER

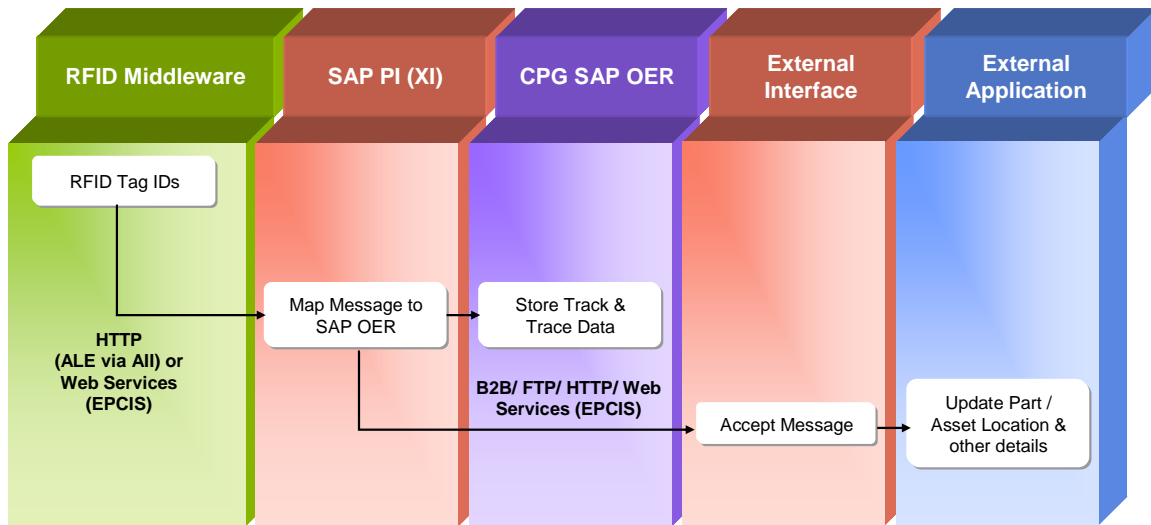


Notification to Trading-partners

Besides the supplier, CPG player and retailer, several other parties are involved in the supply chain, such as shipping agents, receiving agents and third party logistics companies like distributors or container-pooling organizations. In an RFID-enabled world, these trading partners would also be interested in certain RFID events. For instance, the container-pooling organization would be interested in knowing when its pallets have left the distribution-center and are en-route to the retailer's location. Organizations lose millions of dollars every year on account of misplaced DSD carts and other assets. This can be prevented by providing trading partners real-time information about the locations of assets.

There are various ways of notifying the trading partners. The RFID middleware could send a message to an external application maintained by the trading partner; however, this might not be feasible when the RFID middleware is placed in edge locations behind firewalls with no Internet connectivity – for example, a PLC network on the production line of a manufacturing plant. Should the connectivity credentials of the trading partner change, it would be tough to maintain different copies of that configuration across all the deployed middleware instances. Another approach could be one in which the external application queries the central SAP OER repository periodically using the EPCIS-based **“Synchronous-poll query” interface**. This might result in high usage of network bandwidth due to excessive polling. Trading partners can also subscribe to the CPG OER for latest RFID-events. This relevant feature establishes a periodic schedule for running a query, each time providing only the latest event. Trading partners may also unsubscribe from the query as and when desired. However, these are not real-time options.

Figure 6: Notifying trading-partners on real-time



Another option is to use SAP PI, which has in-built capabilities to integrate with external applications using industry-standard protocols, for sending messages to trading partner(s), as shown above. Whenever SAP PI receives data from the middleware for posting to the SAP OER, it can also post the same to external parties. This approach is fairly real-time. It is the prerogative of trading partners to decide the best approach for information sharing.

Conclusion

It is essential for organizations to understand the best strategy to own and maintain information pertaining to their assets and processes, if they expect to make rather than spend money on it. While third party vendor-hosted solutions might have jump-started the adoption of RFID, their use is not viable in the long run, since they lack standards, impose dependency and reduce trading-partner collaboration. When real-time, end-to-end traceability is the need of the hour, a central EPC repository which integrates enterprise systems with RFID infrastructure provides organizations with a cost effective way to attain **“visibility when it matters the most”**.

References

SAP Best Practice for RFID enabled Inbound and Outbound delivery execution
http://help.sap.com/saphelp_autoid70/helpdata/en/cf/8d95a065394e17a262758af17f10a6/frameset.htm

Appendix – Abbreviations Used

AII – AUTO IDENTIFICATION INFRASTRUCTURE, **ALE** – APPLICATION LEVEL EVENTS, **ASN** – ADVANCED SHIPMENT NOTICE, **B2B** – BUSINESS TO BUSINESS, **BI** – BUSINESS INTELLIGENCE, **CPG** – CONSUMER PACKAGED GOODS, **DSD** – DIRECT STORE DELIVERY, **EAI** – ENTERPRISE APPLICATION INTEGRATION, **EDI** – ELECTRONIC DATA INTERCHANGE, **EPC** – ELECTRONIC PRODUCT CODE, **EPCIS** – EPC INFORMATION SERVICE, **ERP** – ENTERPRISE RESOURCE PLANNING, **FTE** – FULL TIME EQUIVALENT, **FTP** – FILE TRANSFER PROTOCOL, **HTTP** – HYPER TEXT TRANSFER PROTOCOL, **KPI** – KEY PERFORMANCE INDICATOR, **OER** – OBJECT EVENT REPOSITORY, **PI** – PROCESS INTEGRATION, **PLC** – PROGRAMMABLE LOGICAL CIRCUIT, **ROI** – RETURN ON INVESTMENT, **USP** – UNIQUE SELLING PROPOSITION, **WMS** – WAREHOUSE MANAGEMENT SYSTEM, **XI** – EXCHANGE INFRASTRUCTURE.

Intended Audience

This paper is intended for VPs, Directors, Technology Strategists and Business Process Leads who have invested in RFID and are seeking to formulate strategies to realize traceability in the supply chain.

About the Authors

Mayank Shridhar is a Technology Lead in the Retail, CPG and Logistics Unit at Infosys Technologies Limited. He is a founder member of the Infosys RFID & Pervasive Solutions Practice and was also actively involved in the creation of the Infosys **ShoppingTrip360™** solution. He has over 6 years of software-architecture and technology-consulting experience in RFID & Pervasive Computing across industries like Retail/ CPG/ Logistics, Aerospace and Pharmaceuticals. He has engaged with clients to define architecture-strategy & roadmap, lead RFID consulting assignments, define enterprise-level functions, recommend or defend technology, carry-out product-evaluations from leading RFID vendors and to design/ develop high performance RFID & wireless applications. He has spoken and conducted workshops at conferences such as TED India 2009, and showcased Infosys innovation at EAN India 2004, EPC Global 2006 and Infosys Confluence 2006.

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