



SOLUTION OVERVIEW

CISCO APPLICATION-ORIENTED NETWORKING FACILITATES INTELLIGENT RADIO FREQUENCY IDENTIFICATION PROCESSING AT THE EDGE

Cisco Application-Oriented Networking incorporates radio frequency identification (RFID) infrastructure functions into the network, lowering the cost and complexity of deploying RFID at the enterprise edge and optimizing RFID event capture, filtering, and routing.

CHALLENGE

Radio frequency identification is one of today's most rapidly proliferating technologies for enterprises. Based on the promise of lower operating costs combined with more accurate product and asset information, organizations are introducing RF technologies in the supply chain to improve asset tracking, optimize stock levels, enforce tighter security, and comply with new industry regulations.

As enterprises explore these potential benefits, many are realizing that scaling from a pilot program to a production scale deployment is no trivial exercise. Without careful planning, it is possible to destabilize business operations as huge volumes of RFID messages generated at the edge of the enterprise flood toward the data center. Over time, this problem could get magnified as RFID tagging at the item level becomes mandated by supply chain partners or market pressures.

Most existing application and network infrastructures were not designed with RFID in mind. At the edge, if RFID infrastructure is deployed on general-purpose servers that require installation and ongoing support, manageability problems alone might render RFID cost-prohibitive. In addition, without a unified deployment model of centralized control and distributed enforcement, disconnected areas of RFID infrastructure will grow, creating a familiar set of application and data integration challenges. On the network side, RFID implementations will generate large amounts of new data that will fan in from the edge of an enterprise toward its data center core, placing further demands upon the existing network.

To optimize the use of available network bandwidth and simplify the deployment of RFID technology, solutions are needed to collect and filter raw RFID tag data close to its source and subsequently to correlate, aggregate, and transform this data into meaningful business-level events. These events in turn should be acted upon locally, where appropriate, or securely routed and delivered to back-end inventory management, sales, and financial applications. It is this "intelligent information" that will enable RFID-ready applications to deliver on their promise of increased operational productivity.

SOLUTION: CISCO AON FOR RFID

Cisco® Application-Oriented Networking (AON) is the foundation for a new class of network-embedded products and solutions that help converge intelligent networks with application infrastructure based either on service-oriented or traditional architectures. With Cisco AON products and services, organizations can embed a new class of application message-level intelligence into the network to better meet the underlying needs of applications for real-time visibility, security, event-based messaging, optimized delivery, and other core integration and deployment services. Cisco AON technology can natively understand the content and context of application messages such as advanced shipping notices, stock allocations, or purchase orders and can conduct operations on those messages in transit according to business policies.

RFID is exactly the type of network-based application in which the policy-driven infrastructure services provided by Cisco AON meet the challenges encountered in deploying enterprise-class solutions. Cisco AON uniquely integrates RFID event capture and intelligent message routing into the pervasive network, centrally coordinating the wide distribution of RFID capabilities throughout the network. The Cisco AON for RFID

solution uniquely provides RFID tag data filtering, aggregation, and other services that manage, route, and secure RFID data all in the fabric of the network. As enterprise initiatives mature from early RFID pilots toward large-scale production deployments of RFID technology, the use of RFID tagging continues to proliferate. However, by filtering much of the tag data at the network edge, and by coordinating across disparate RFID deployments throughout the enterprise, data center applications avoid being flooded with unwanted information.

Cisco AON is designed to use existing investments in Cisco Systems® hardware. Enterprises that already own a Cisco integrated services router (ISR) or Cisco Catalyst® 6500 Series switch can upgrade their current networking equipment to an RFID-capable system simply by adding an additional blade or module. These provide core Cisco AON services integrated with RFID filtering and reader management capabilities provided by ConneCTerra, a leading supplier of enterprise software for RFID and device computing.

Why Cisco AON for RFID?

- **Lower cost**—Integrated network device means lower total cost of ownership
- **Increased visibility**—Single enterprisewide view into RFID events across widely distributed deployments
- **Localized response**—Responds to RFID events at the source
- **Flexible message routing**—Captures, filters, secures, transforms, and routes RFID-related application messages
- **Forward compatibility**—Designed to work other applications and sensor networks

Benefits of the Cisco AON for RFID Solution

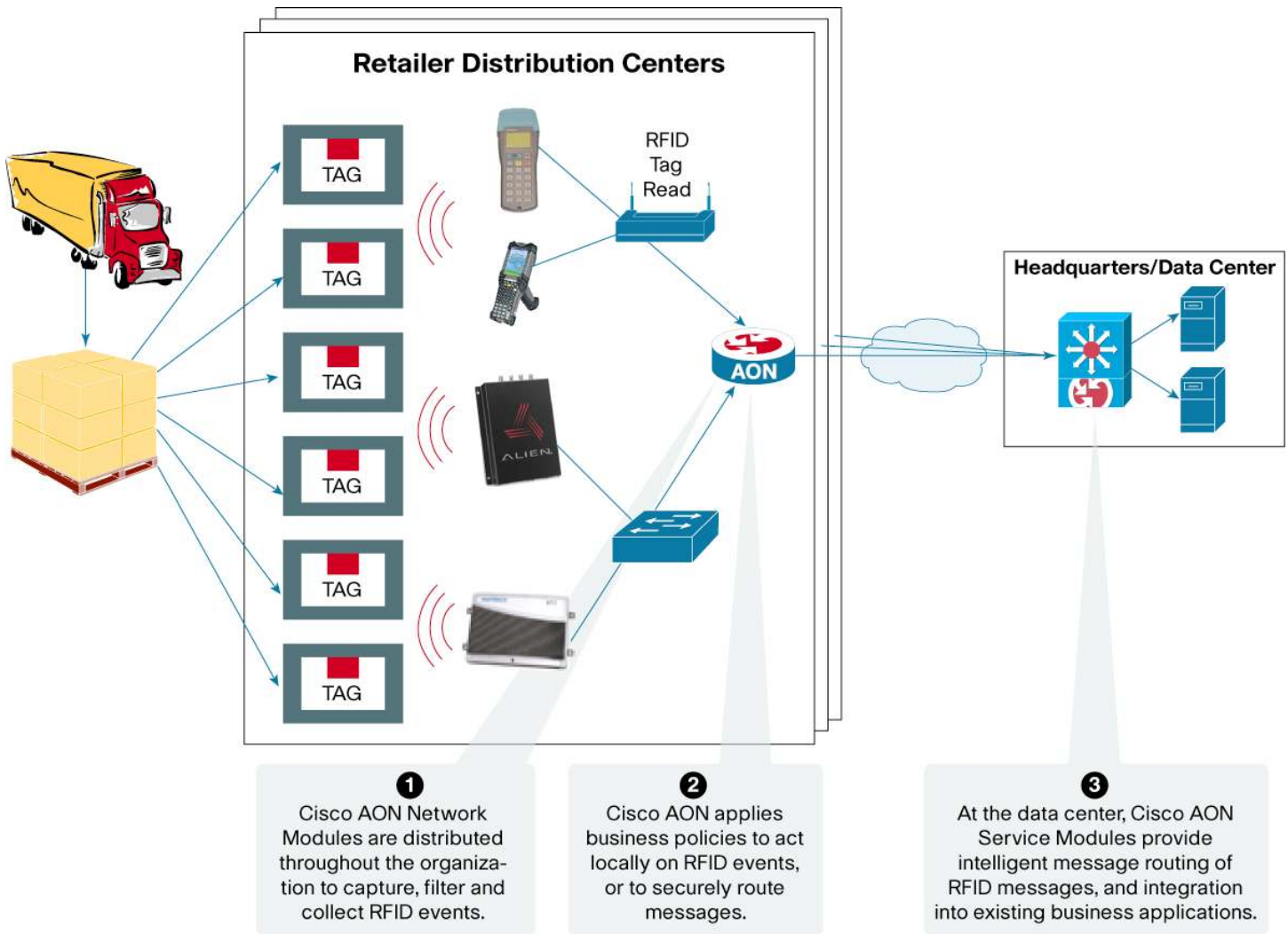
Through its unique approach of incorporating RFID infrastructure directly into the network, the Cisco AON for RFID solution provides powerful business benefits. Whether an organization is just beginning RFID trials, scaling out RFID deployments to multiple physical locations, or building a business-to-business RFID network, Cisco AON can help. Cisco AON for RFID provides these benefits:

- **Lowering the cost of RFID deployments**—Cisco AON significantly lowers the cost and complexity of deploying and managing RFID infrastructure at the edge. Cisco AON offers RFID-specific functions and value-added message-routing capabilities, all in an integrated edge device that includes packet-level routing and all designed for remote configuration and management. Cisco AON helps companies centrally define RFID-specific policies, which are automatically propagated to edge devices for enforcement. By doing so, Cisco AON eliminates the capital costs and need to deploy expensive IT personnel for installation and ongoing maintenance of general-purpose servers tasked with managing RFID traffic. In addition, by offering filtering and collection of RFID events at the edge, Cisco AON optimizes bandwidth usage between outlying enterprise locations (where most RFID events occur) and data centers (where RFID information can be used best). Cisco AON helps ensure that only relevant RFID events are passed back to the data center, which is critical because network bandwidth to edge collection points can often be limited.
- **Increasing flexibility in capturing, filtering, aggregating, transforming, securing, and routing RFID events**—Cisco AON not only captures a wide variety of RFID events but can also act upon those events, either locally at the source or at the data center, in conjunction with other enterprise systems. Once RFID events are captured, Cisco AON can route these events throughout the enterprise, providing message-level security and encryption, transforming the messages to different formats (such as stock-keeping unit, or SKU numbers), bridging to different protocols, and guaranteeing reliability. In addition, Cisco AON can respond locally to RFID events where appropriate (for example, when a light bar on a receiving floor needs to be set from red to green or a supervisor needs to be paged because of an exception). And with Cisco AON's powerful policy-based approach, all of this can be easily reconfigured without rewriting application code.
- **Providing a superior platform for growth**—By enabling RFID at the enterprise edge, Cisco AON introduces application infrastructure functions to remote locations for the first time. Once in place, the same Cisco AON platform can be used to support application security, business-to-business gateways, and Extensible Markup Language (XML) message processing.

SOLUTION OVERVIEW AND ARCHITECTURE

The Cisco AON for RFID solution—a package of Cisco AON software, hardware, and service offerings designed especially for RFID deployments—can be installed throughout an enterprise's network, at the edge for RFID event capture and filtering, and in the data center for data authentication, additional filtering and aggregation, and application protocol bridging (Figure 1). In addition, these same Cisco AON devices can perform tasks such as outbound encryption, digital signature, and content-based routing when sharing data with external business partners.

Figure 1. Cisco AON can be Deployed at the Enterprise Edge as well as in Data Centers



The Cisco AON for RFID solution provides the following core functions:

- **RFID filtering, collection, and notification**—Filtering application-level events (ALE) according to the ALE specification, and providing visibility into ALE messages and tag data for reporting and notification.
- **RFID reader virtualization**—Virtualizing readers and edge server instances on behalf of applications requesting RFID data.
- **RFID reader management**—Configuring the deployment of reader-specific settings and helping to ensure proper communications between Cisco AON and various makes and models of RFID readers, printers, stack lights, LED displays, electric eyes, and programmable logic controllers (PLCs). Many popular makes and models are supported out of box.
- **RFID message security**—Including data privacy, authentication, authorization, logging, signing, and validation of RFID and ALE requests.
- **RFID intelligent message routing**—Optimizing, compressing, and reliably routing RFID data traffic; providing local execution of RFID processes; and integrating RFID messages into back-end systems using protocol switching, transformation, and content-based routing.

The Cisco AON for RFID solution consists of the following software, hardware, and service offerings:

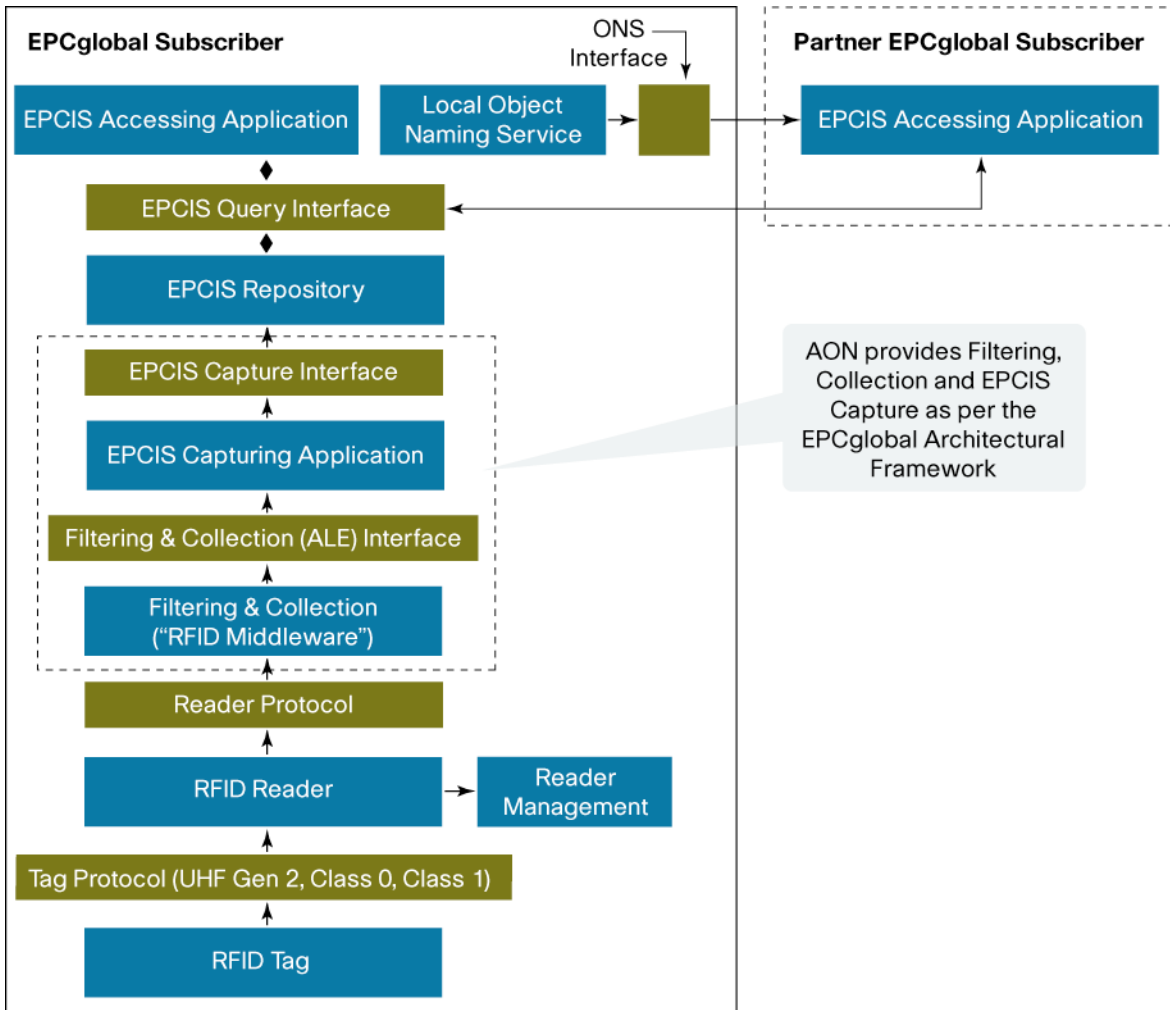
- **Cisco 2600/2800/3700/3800 Series AON Module**—A network module that can be installed in any Cisco 2600 or 3700 series router as well as the Cisco 2800 Series Integrated Services Router and the Cisco 3800 Series Integrated Services Router. The Cisco AON Network Module is a low-cost, integrated device that will primarily be deployed at the enterprise edge as the primary device for RFID filtering, collection, and capture.
- **Cisco Catalyst 6500 Series AON Module**—A service module that can be installed in any Cisco Catalyst 6500 Series switch to take full advantage of the switch's high availability, security, and traffic-management capabilities. The Cisco AON Service Module will be deployed in the data center, providing intelligent message routing of RFID messages, and integrating into existing business applications.
- **Cisco AON Management Console (AMC)**—A Linux-based Web application, Cisco AMC provides full role-based access control for centralized management of Cisco AON. The application helps ensure that the configurations across all Cisco AON devices (nodes) in a distributed infrastructure are consistent and up-to-date. Cisco AMC configures and manages Cisco AON nodes, defines and provisions application policies, manages keys and certificates, monitors Cisco AON node events and logs, and directly interfaces with the Cisco AON blade in a switch or router. Specifically for RFID, the Cisco AMC allows for the configuration and deployment of reader-specific settings to help ensure proper communications between various makes and models of RFID readers and the Cisco AON for RFID solution.
- **Cisco AON Development Studio (ADS)**—A Windows-based design-time tool, Cisco ADS allows developers to configure the run-time handling of application messages. Its features include an easy drag-and-drop GUI, a set of preconfigured functions (bladelets) that can be used to create message plans, and separate additional kits for creating custom bladelets and custom adapters. Specifically for RFID, the Cisco ADS allows application-level policies to be created to determine which use-case specific functions should be applied to RFID traffic once it has been successfully captured and filtered.
- **Cisco AON for RFID Advanced Services Offerings**—The Cisco advanced services group offers a set of packaged service offerings designed to help clients design, build, and deploy RFID solutions using Cisco AON. Specific services offerings are available in the following:
 - **RFID Pilot Service Offering**—Cisco network and application experts assist and advise on framing RFID integration use cases and integration of Cisco AON for RFID solutions with reader and system infrastructures. The RFID Pilot Service Offering specifically provides:
 - A tested and working Cisco AON for RFID solution implementation in a key lab or limited production
 - A requirements and use case scope and analysis
 - A system test plan
 - A network deployment plan for this pilot implementation
 - **Specialized Cisco AON for RFID Solution Integration Services**—A set of specialized services designed to help customers and partners solve specific architecture, design, integration, and deployment issues they will face when typically applying the Cisco AON for RFID solution in their environment:
 - **Cisco AON for RFID Solution Architecture and Design**—Using both the EPCglobal architectural framework and Cisco AON for RFID solution.
 - **RFID Middleware and Network Deployment Planning**—Planning to help install and deploy Cisco AON for RFID middleware solutions in the network.
 - **RFID Message Infrastructure Services**—Integration services to connect the Cisco AON for RFID solution with enterprise resource planning (ERP), Warehouse Management Systems (WMS), Object Naming Service (ONS) and Global Data Storage Network (GDSN) systems.
 - **Cisco AON for RFID Solution Training**—Training to introduce the Cisco AON for RFID solution to architects, developers, and network engineers. The training includes hands-on labs to allow trainees to be able to configure and extend the solution.
 - **Cisco AON for RFID Solution Support**—Specialized support services to support the Cisco AON RFID solution, once it is deployed in production, designed to offer the customer or partner a single point of contact for the solution.

CISCO AON AND THE EPCglobal REFERENCE ARCHITECTURE

The EPCglobal Framework is a collection of interrelated standards for hardware, software, and data interfaces, together with core services that are operated by EPCglobal and its delegates, all toward a common goal of enhancing the supply chain through the use of Electronic Product Codes (EPCs). The Cisco AON for RFID solution provides an implementation of the Filtering and Collection Interface through the Cisco partnership with ConnecTerra. Given the inherent extensibility of the Cisco AON platform, the solution also provides the ability to implement the EPC Information Services (EPCIS) capture interface as needed to address varying customer use cases.

Cisco is taking a leadership role in the industry by becoming a member of EPCglobal and actively working with this standards body to shape RFID standards. Mohsen Moazami, vice president of the Internet Business Solutions Group at Cisco, was selected to serve on the board of governors for EPCglobal; in addition, Cisco has employees participating in various EPCglobal hardware and software action groups.

Figure 2. EPCglobal “Network” Layers implemented in Cisco AON



ALE = application level events

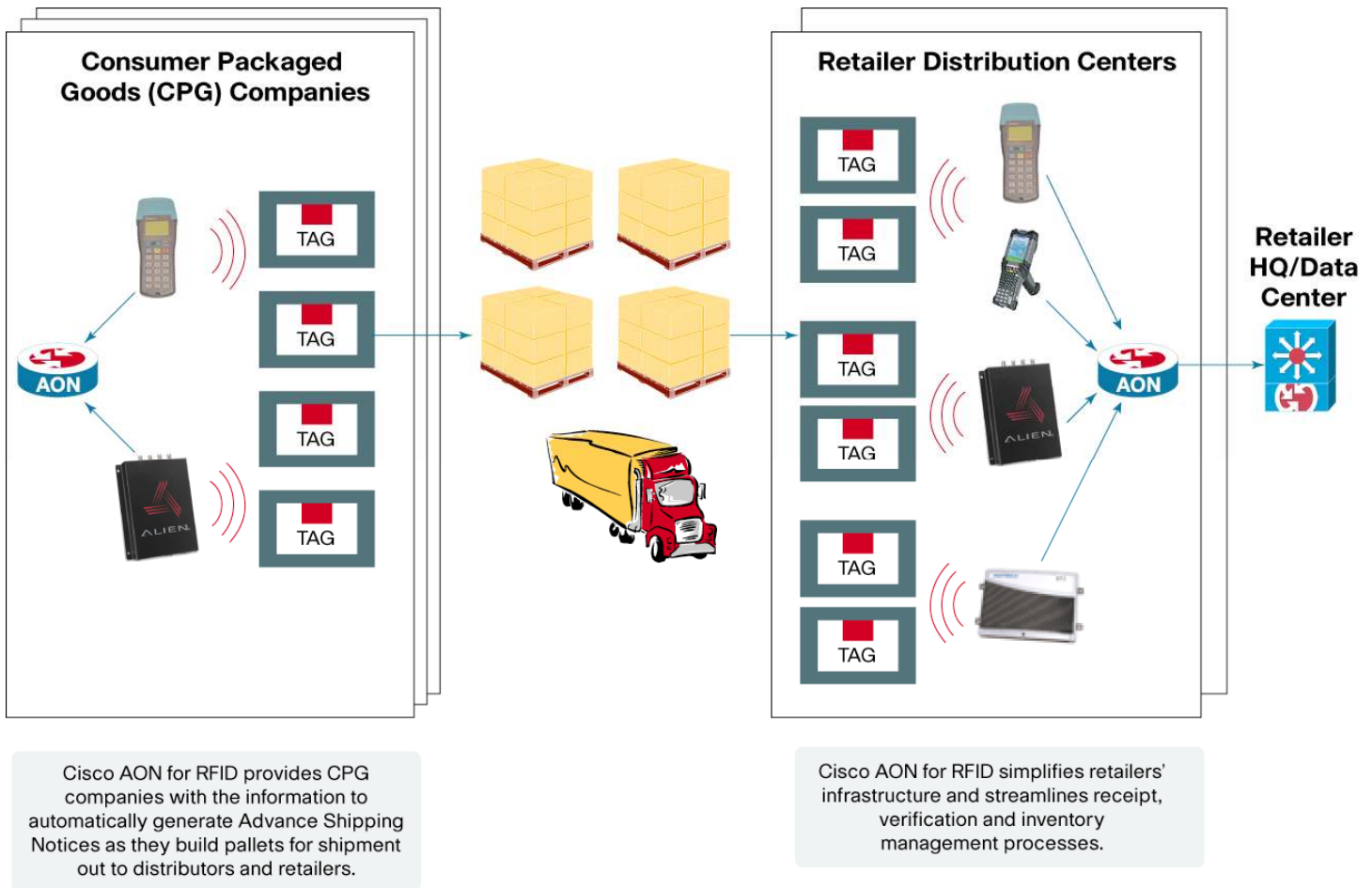
EPCIS = electronic product code information system

CISCO AON IN THE EXTENDED VALUE CHAIN

One of the promises of RFID technology is improving the coordination across the extended business-to-business value chain. Cisco AON for RFID can directly benefit all the players in the value chain. For instance, in this simple scenario (Figure 3), Cisco AON helps consumer packaged goods companies streamline their distribution processes and helps retailers better manage their inventory.

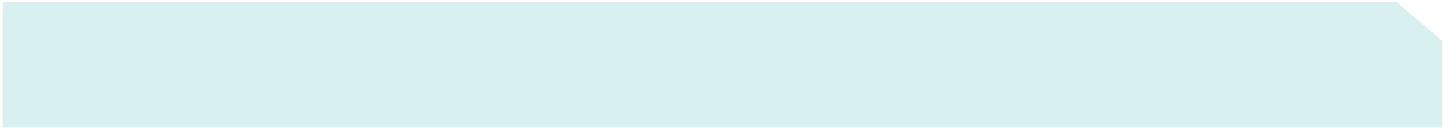
- **Consumer packaged goods** companies use RFID as they build pallets for shipment to distributors and retailers. As pallets leave distribution centers, Cisco AON collects and filters RFID events, updates inventory management systems, and helps enable supply chain management systems to generate advanced shipping notices (ASNs).
- **Retailers** use Cisco AON as they first capture RFID events from incoming product shipments. Cisco AON simplifies the RFID infrastructure and the receipt, verification, and inventory management processes.

Figure 3. Cisco AON in the Extended Value Chain



SUPPORTING SOLUTIONS, PRODUCTS, PARTNERS, OR SERVICE OFFERINGS

Cisco AON is the cornerstone of the company's efforts to deliver an intelligent foundation for RFID and sensor networks. The solution encompasses multiple solutions and service offerings. Designed to work together transparently, the offerings include Cisco RF sensor solutions—based on the Cisco Wireless Location Appliance—which uses RF fingerprinting to simultaneously track up to 1500 Wi-Fi-enabled active RFID tags from within the 802.11 WLAN infrastructure.



In the context of the Cisco AON for RFID solution, Cisco has partnered with ConneCTerra, a leading provider of enterprise infrastructure software for RFID and device computing and a Cisco AON Advanced Technology Partner. As an integrated component of the Cisco AON for RFID solution, ConneCTerra RFTagAware Edge Server RFID infrastructure software provides specialized technology that addresses the following challenges of enterprise-scale RFID deployment:

- **Data filtering and aggregation**—To generate real value from the continuous stream of low-level raw data generated by RFID readers, the RFTagAware ALE API helps Cisco AON for RFID define the level of information desired, then controls, filters, and aggregates incoming RFID data. The resulting data becomes a reliable and valuable asset to improve business processes across all areas of an RFID-enabled enterprise.
- **Monitoring and managing an RFID infrastructure**—Included as an integrated component of the Cisco AON for RFID solution, the RFTagAware Administration Console provides advanced device monitoring and management capabilities. RFTagAware delivers confidence in the data produced by large numbers of devices implemented across a distributed enterprise environment. RFTagAware supports a broad range of devices including RFID readers and printers, as well as a variety of barcode readers, stack-lights, LED displays, electric eyes, and programmable logic controllers (PLCs). As RFID deployments expand, RFTagAware provides centralized monitoring and management of the entire RFID infrastructure, facilitating efficient and optimal enterprise operation.

WHY CISCO

Cisco RFID solutions are developed to meet the specific needs of today's enterprise. Providing the ability to optimize network performance as well as maximize network value, Cisco supports your enterprise with the expertise to promote faster deployments and a powerful knowledge of RFID best practices. Cisco combines end-to-end security, scalability, interoperability, traffic management, and a forward-looking networking infrastructure that allows you to deploy current and future RFID applications to trim operating costs, improve productivity, and increase customer satisfaction across the enterprise.

Central to Cisco RFID solutions is Cisco Application-Oriented Networking (AON). It is unique in the market because it embeds RFID middleware functions into the network—onto Cisco devices—leading to breakthroughs in scalability, deployment cost, and simplicity. Cisco AON technology delivers this breakthrough level of intelligence to extend the Cisco vision for a more intelligent network for application services technologies and offers an unsurpassed level of insight for real-time business decision making.

FOR MORE INFORMATION

For more information about the Cisco AON for RFID solution, visit <http://www.cisco.com/go/aon> or contact your local account representative.

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