Cross-Industry RFID-enabled Core Logistics Processes

The Cross-Industry RFID-enabled Core Logistics Processes ES bundle provides an initial set of RFID-enabled core logistics services, service-enabling both some SAP ERP and SAP Auto-ID Infrastructure (SAP AII) functions. This initial version of this ES bundle includes a basic set of AII services for interacting with SAP ERP as well as some pure ERP services.

SAP AII can support many kinds of standard and custom unique identifier schemes, not just electronic product codes. SAP AII is Auto-ID technology agnostic; it can be used for RFID as well as linear and 2-D barcode data capture.

Terminology

Here are some terms you’ll encounter as you read the description of this ES bundle.

- **AII stands for Auto-ID Infrastructure.** SAP Auto-ID Infrastructure enables integration of various Auto-ID write and read devices, including RFID readers and printers, as well as linear and 2-D bar-code devices and converts raw Auto-ID Capture Event data into the business context.

The Cross-Industry RFID-enabled Core Logistics Processes ES bundle leverages enterprise SOA through communications between SAP ERP and SAP Auto-ID Infrastructure using enterprise services.

- **ASN is an Advanced Shipping Notice.**

- **RFID stands for Radio Frequency Identification.** According to Wikipedia, RFID is "an automatic identification method that relies on storing and remotely retrieving data using devices called RFID tags or transponders."

- **AIDC stands for Automatic Identification and Data Capture.** Automatic Identification and Data Capture (AIDC) refers to the methods of automatically identifying objects, collecting data about them, and entering that data directly into computer systems (without human involvement). Technologies typically considered as part of AIDC include various forms of bar codes such as linear and 2-D barcodes and other new recent barcode technologies such as GS1-Data Bar, RFID, biometrics, magnetic stripes, Optical Character Recognition (OCR), smart cards, and voice recognition. AIDC is also commonly referred to as Automatic Identification, Auto-ID, and Automatic Data Capture.

- **RFID gate reader.** A gate reader is a fixed device that has sensors to read RFID tags as they pass the RFID gate reader, perhaps driven through by a forklift. A gate reader is one kind of RFID reader. (SAP AII also supports mobile RFID scanners.)

- **Observation or Observation Event.** An event associated with a particular RFID tag. To be recorded properly, the event must be provided with context before the tag passes by the RFID reader (through explicit or implicit assignment of a document type and ID and an activity such as commissioning, packing, loading or unloading as well as a read location).

- **EPC.** Electronic product code. An industry standard for an RFID identification scheme of products and assets developed by GS1/EPCglobal (www.epcglobalinc.org).

- **IUID.** Item Unique Identification (IUID) is an asset identification standard from the US Department of Defense. (For more information, see the related Item Unique Identification ES bundle and http://www.acq.osd.mil/dpap/pdi/iuid/about.html.)

Benefits of This ES Bundle
This ES bundle provides a number of important benefits:

- **Flexibility.** This bundle shows how SAP ERP enterprise services and SAP Auto-ID Infrastructure enterprise services can work together to bring Auto-ID observations into the ERP business context, thereby closing the divide between the physical and digital world. In that sense, what is provided here are example use and test cases for illustrative reference; you can think of many other ways to use ERP enterprise services with Auto-ID Infrastructure enterprise services and come up with your own additional use cases for application-to-application integration as well as custom user interface creation.

- **Cost savings.** It's cheaper to integrate SAP ERP and SAP AII using enterprise services than using older, more brittle integration methods.

- **Improved implementation efficiency.** Using services in this ES bundle, you can more easily create your custom implementation based on industry standards and flexible SOA.

- **Handles several types of unique identifiers for products and parts (Automatic Identification Labels).** As mentioned earlier, this bundle facilitates the use of instance serialization of product, parts, and logistics units according to the EPC or IUID schemes or indeed other schemes subject to your custom configuration in SAP AII. This allows you to generate, print, and scan products and parts according to multiple unique ID schemes.

**Audience**

This ES bundle is suitable for all industries interested in enabling core logistics processes using Automatic Identification Labels such as, but not limited to, EPC in the RFID domain. Some of the key industries that will benefit from using this bundle include consumer products, retail, aerospace and defense, life sciences, and governmental defense.

This ES bundle provides some initial service-based capabilities that allow customers to compose their own user interfaces and system integration to enable backend integrated Auto-ID enabled process execution.

Shop-floor execution workers and supervisors in these industries will be the main end users of the services in this bundle. The services provided in this bundle will help those users to tag, label, and log items in their shipping and receiving departments and move goods into and out of their RFID-enabled distribution center or warehouse environments.

**For details on Service Operations, Business Objects and Process Components, please check the ES Workplace.**

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Brief Tour of the Process Components, Business Objects, and Enterprise Services in This ES Bundle

You’ll find details on each process component, business object, and enterprise service in this ES bundle, along with relevant links to the ES Workplace, once this bundle is released with Enhancement Package 4. To help provide some information for interested developers before that time, here is some information about the elements of this ES bundle.

Process Component

The Automatic Identification Label Processing process component is used in SAP Auto-ID Infrastructure (SAP AII) to service-enable automated logistic processes by using labels that can be automatically identified by IDs. Events that involve objects that have an automatically identifiable label, such as an RFID tag or a barcode, can be observed and automatically reported.

Business Objects

The Automatic Identification Label Processing process component includes the following business objects, which manage the lifecycle of the label, the RFID device that is used to read the label, and observations recorded by the RFID device:

- **Automatic Identification Label**: The enterprise service operations related to this business object manage tag IDs.
- **Automatic Identification Label Device**: The enterprise service operations related to this business object create and modify master data for devices.
- **Automatic Identification Label Device Observation**: The enterprise service operations related to this business object to create and search for observations, that is, events that have occurred to objects identified by an automatically identifiable label.

Enterprise Service Operations

The following table summarizes the enterprise service operations in this ES bundle.

<table>
<thead>
<tr>
<th>Business Object</th>
<th>Service Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic Identification Label</td>
<td>Create Label as Collection: Creates (persists) multiple Auto-ID Labels in database Technical Name: AutomaticIdentificationLabelSCMCollectionCreateRequestConfirmation_In</td>
</tr>
<tr>
<td>Automatic Identification Label</td>
<td>Encode Label as Collection: Encodes multiple Auto-ID Labels in one step per the chosen encoding format Technical Name: AutomaticIdentificationLabelSCMCollectionEncodeRequestConfirmation_In</td>
</tr>
<tr>
<td>Automatic Identification Label</td>
<td>Decode Label as Collection: Decodes multiple Auto-ID Labels Technical Name: AutomaticIdentificationLabelSCMCollectionDecodeRequestConfirmation_In</td>
</tr>
<tr>
<td>Automatic Identification Label</td>
<td>Create Label: Creates (persists) a single Auto-ID Label in database Technical Name: AutomaticIdentificationLabelCreateRequestConfirmation_In</td>
</tr>
<tr>
<td>Automatic Identification Label</td>
<td>Encode Label: Encodes a single Auto-ID Label per the chosen encoding format Technical Name: AutomaticIdentificationLabelEncodeRequestConfirmation_In</td>
</tr>
<tr>
<td>Automatic Identification Label</td>
<td>Decode Label: Decodes a single Auto-ID Label Technical Name: AutomaticIdentificationLabelDecodeRequestConfirmation_In</td>
</tr>
<tr>
<td>Automatic Identification Label Device</td>
<td>Set Device Default Reference: Enables the assignment of a document to a read device. This service does not enable the assignment of a device to an action such as packing, loading, or unloading. Action types such as packing, loading, and unloading are used by this service based on the configuration of the device master record and the assignment of device IDs to configured action types. Technical Name: AutomaticIdentificationLabelDeviceSCMDefaultReferenceSetRequestConfirmation_In</td>
</tr>
</tbody>
</table>
### How To Use This ES Bundle

The introduction of the Cross-Industry RFID-enabled Core Logistics Processes ES bundle facilitates the implementation of RFID-enabled core logistics processes through cross-component (SAP AII and ERP) service implementations spanning business objects such as **Outbound Delivery**, **Inbound Delivery**, and **Handling Unit** from SAP ERP and **Automatic Identification Label**, **Automatic Identification Label Device**, and **Automatic Identification Label Device Observation** from SAP Auto-ID Infrastructure.

This section also facilitates the creation of composite applications that enable generating, scanning, printing, and gathering observations from unique identifiers for products and logistics units.

This section will explore a series of use cases for the Cross-Industry RFID-enabled Core Logistics Processes ES bundle. Each use case will show how different outcomes can be achieved by using the enterprise services in different combinations. These use cases are simply examples that illustrate a few of the ways that this ES bundle could be used. The intention is to show the flexibility and reusability of these business objects and enterprise service operations so that you will have a clearer understanding of how to best deploy them in your own environment. This wiki is also a space for you to share knowledge and collaborate with others who are implementing the Cross-Industry RFID-enabled Core Logistics Processes ES bundle.

<table>
<thead>
<tr>
<th>Service Type</th>
<th>Description</th>
<th>Technical Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Automatic Identification Label Device</strong></td>
<td>Searches and finds available devices</td>
<td>AutomaticIdentificationLabelDevicebyElementsQueryResponse_In</td>
</tr>
<tr>
<td><strong>Automatic Identification Label Device Observation</strong></td>
<td>Counts the Auto-ID labels needed to provide the aggregated quantity-based inputs to ERP services.</td>
<td>AutomaticIdentificationLabelDeviceObservationSCMLabelCountByBusinessTransactionDocumentReferenceQueryResponse_In</td>
</tr>
<tr>
<td><strong>Automatic Identification Label Device Observation</strong></td>
<td>This service can be used to register a list of Auto-ID labels. Note that this service has restricted functionality in that it cannot communicate a hierarchy of Auto-ID labels (The Business Add-In BAdI: Auto-ID Label Device Observation Create Request/Confirmation (/AIN/BADI_AIL_DEV_OBS_CRE_RC) is available for this operation.)</td>
<td>AutomaticIdentificationLabelDeviceObservationCreateRequestConfirmation_In</td>
</tr>
<tr>
<td><strong>Automatic Identification Label Device Observation</strong></td>
<td>Finds Auto-ID Labels that are associated with a business document. This service is used to SAP AII for Auto-ID labels that are related, for example, to an outbound delivery as input for the delivery notification for Auto-ID Label List enriched for ASN purposes</td>
<td>AutomaticIdentificationLabelDeviceObservationSCMLabelByBusinessTransactionDocumentReferenceQueryResponse_In</td>
</tr>
<tr>
<td><strong>Goods Movement</strong></td>
<td>Creates a goods movement from the UI for goods receipt with reference to a purchase order</td>
<td>GoodsMovementERPCreateRequestConfirmation_In_V1</td>
</tr>
<tr>
<td><strong>Handling Unit</strong></td>
<td>This service is used within this bundle to propagate Auto-ID Label create, pack, and unpack event notifications to ERP Handling Unit Management and to create, pack, or unpack commensurate handling units and handling unit hierarchies in ERP</td>
<td>HandlingUnitERPRequestConfirmation_In</td>
</tr>
<tr>
<td><strong>Inbound Delivery</strong></td>
<td>Finds and reads inbound deliveries</td>
<td>InboundDeliveryByElementsQueryResponse_In</td>
</tr>
<tr>
<td><strong>Inbound Delivery</strong></td>
<td>Updates delivery with goods receipts</td>
<td>InboundDeliveryERPChangeRequestConfirmation_In</td>
</tr>
<tr>
<td><strong>Outbound Delivery</strong></td>
<td>Finds and reads outbound deliveries</td>
<td>OutboundDeliveryByElementsQueryResponse_In</td>
</tr>
<tr>
<td><strong>Outbound Delivery</strong></td>
<td>Maintains outbound delivery based on received delivery notification: Enriches outbound delivery with Auto-ID Labels</td>
<td>ReceivedDeliveryNotification_In</td>
</tr>
<tr>
<td><strong>Outbound Delivery / Inbound Delivery</strong></td>
<td>Queries SAP AII to find out which auto-ID labels are associated with a given delivery.</td>
<td>AutomaticIdentificationLabelSCMByBusinessDocumentQueryResponse_Out</td>
</tr>
<tr>
<td><strong>Outbound Delivery</strong></td>
<td>Populates ASN message with standard ERP outbound delivery data.</td>
<td>DespatchedDeliveryNotification_Out</td>
</tr>
<tr>
<td><strong>Outbound Delivery</strong></td>
<td>A service that uses a message from SAP AII to trigger delivery status changes such as pick status, pack status, and goods movement/goods issue status.</td>
<td>OutboundDeliveryERPChangeRequestConfirmation_In</td>
</tr>
</tbody>
</table>
Use Case 1: Mass Tag (Auto-ID Label) Commissioning for Homogenous Product Pallets to Stock

Note: This use case illustrates both how you can tag pallets of products to put them into the warehouse. You can use the same sequence of services for RFID-enabled free packing, in which you tag products and pack them for later shipment.

A company has a large warehouse full of existing stock. A new product, product A, has been introduced and the company has decided that it will proactively tag these items at the case level before putting them into the warehouse. Taking this step right now will speed up both inventory processes and shipping processes later on. The rest of the stock in the warehouse hasn't been tagged, so orders that include those items will need that extra step at ship time. (There's a plan to use any quiet periods in the warehouse to tag the existing stock in a similar way.)

To tag this new product, the warehouse workers will create homogenous pallets (that is, pallets of product A and then put the pallets in the warehouse. The workers will label the products at the case level and at the pallet level and read all the tags - thereby creating the case-to-pallet hierarchy aggregation before putting them into the warehouse.

The worker starts with a pallet of product A. The cases on the pallet need to be tagged with labels, so the worker removes the shrink-wrap of the untagged pallet and counts the cases on the pallet. Let's say the worker counts 20 cases.

Using a composite application, the worker requests the encoding of 20 Automatic Identification Labels for product A (or its GTIN) selecting the desired encoding scheme (e.g., EPC SGTIN-96). The numbers are then issued by SAP AII. The worker confirms the issue of the Automatic Identification Labels, which persists the created Automatic Identification Labels in AII. In the next step, the worker requests the printing of the labels. Next, the worker physically affixes the Automatic Identification Labels (in form of RFID tags) to the cases.

The worker puts the cases back on the pallet and shrink-wraps the pallet again. The worker then prints a pallet-level label and then tags the pallet with the pallet-level label.

To read in all these tags, the worker will drive the pallet past an RFID gate reader, which will read all the case-level tags as well as the pallet-level tag.

Alternatively the worker may use a mobile RFID reader for scanning the case labels and subsequently the association with the pallet-level RFID label tag.

With this overview in mind, let's look at the use case in terms of the sequence of enterprise services.

Specifying a Device and Observation

Before the worker commissions RFID tags (or more generally speaking Automatic Identification Labels), she must first specify what devices are available for label printing. Alternatively, the composite application can set a device default assignment to an activity such as tag commissioning, packing, or loading. If the worker needs to specify a different device, the composite can invoke the enterprise service.

Labeling the Cases

The warehouse worker unwraps the shrink-wrap of a pallet containing cases of product A, counts the cases, and enters the case-level product ID or its GTIN into the composite application. He then enters the number of cases on the pallet, which triggers the Encode Label as Collection enterprise service. This service encodes multiple tags in one step according to the chosen encoding format, whether EPC or IUID, for example. Following encoding, the next step is to store the encoded tag identifiers in SAP Auto-ID Infrastructure by invoking the Create Label by Collection enterprise service operation.

The warehouse worker prints the RFID tags for the cases. The warehouse worker then applies the tags to the cases and shrink-wraps the pallet of cases.

Labeling the Pallet

In this step, the warehouse worker selects the EPC Serial Shipping Container Code (SSCC) encoding for pallet Auto-ID label commissioning and triggers the Encode Label enterprise service. This service encodes a single Auto-ID Label with the chosen encoding format. Next, the Create Label enterprise service is triggered, which creates a single Auto-ID Label in the database.

At this point, the warehouse worker prints the RFID tag for the pallet by invoking the Print Automatic Identification Label enterprise service and affixes it to the pallet.

Scanning the Cases to the Pallet to Create the Packing Hierarchy

Next, the warehouse worker drives the forklift with the pallet past the RFID gate reader. The reader scans the pallet, which triggers the Create Observation enterprise service. This service creates observations for all of the cases and for the pallet as a whole, storing these observations, which specify that these items have been moved into the warehouse.

Creating Handling Units in SAP ERP
The composite application then triggers one final enterprise service in the background: **Maintain Handling Unit**. This enterprise service creates handling units and a handling unit hierarchy in SAP ERP, reflecting the tagging at the case and pallet level that was stored in the Auto-ID Infrastructure.

The following table summarizes these steps and the related enterprise services:

<table>
<thead>
<tr>
<th>Step</th>
<th>Enterprise Service Invoked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1: If the device does not default, the worker searches for and</td>
<td>Find Device by Elements</td>
</tr>
<tr>
<td>finds a device to use</td>
<td></td>
</tr>
<tr>
<td>Step 2: The worker unwraps the pallet, counts the cases, and enters</td>
<td>Encode Label as Collection</td>
</tr>
<tr>
<td>the number of cases on the pallet in the composite application</td>
<td></td>
</tr>
<tr>
<td>Step 3: The composite app stores the encoded tag identifiers in SAP</td>
<td>Create Label by Collection</td>
</tr>
<tr>
<td>All</td>
<td></td>
</tr>
<tr>
<td>Step 4: The worker prints RFID tags for the cases</td>
<td>(no enterprise service is invoked during this step)</td>
</tr>
<tr>
<td>Step 5: The worker affixes the tags to the cases and shrink-wraps</td>
<td>(no enterprise service is invoked during this step)</td>
</tr>
<tr>
<td>the pallet</td>
<td></td>
</tr>
<tr>
<td>Step 6: The worker encodes a label for the pallet</td>
<td>Encode Label</td>
</tr>
<tr>
<td>Step 7: The composite application persists the label in SAP All</td>
<td>Create Label</td>
</tr>
<tr>
<td>Step 8: The worker prints a label for the pallet</td>
<td>Print Automatic Identification Label</td>
</tr>
<tr>
<td>Step 9: The worker affixes the label to the pallet</td>
<td>(no enterprise service is invoked during this step)</td>
</tr>
<tr>
<td>Step 10: The worker drives the pallet by the reader</td>
<td>Create Observation</td>
</tr>
<tr>
<td>Step 11: The composite application tells SAP ERP to create a</td>
<td>Maintain Handling Unit</td>
</tr>
<tr>
<td>handling unit and handling unit hierarchy in SAP ERP</td>
<td></td>
</tr>
</tbody>
</table>

**Use Case 2: RFID-enabled Outbound Processing for Delivery Fulfillment**

As mentioned earlier, the company has a large warehouse of existing stock that is still in high demand. Since this stock hasn't been tagged, orders that include older stock are tagged at the time goods are picked for delivery.

The worker pulls all the items needed to fill the order: a case of product B, 3 cases of product C, and 17 cases of product A. The worker is relieved that at least the largest part of the order was tagged last week. She didn't enjoy the big weekend push to do the tagging, but now she sees the benefits of doing it that way. She feels relieved to have just 4 cases to tag instead of 21.

Since there is a delivery to fill, the warehouse worker would first enter the selection criteria to find and select the delivery, which triggers the **Find Outbound Delivery by Elements** enterprise service.

**Tagging the Cases**

The warehouse worker would enter the item ID for product B and specify the quantity of the item in the composite application. The composite would then trigger the **Encode Label as Collection** enterprise service, followed by the **Create Label as Collection** enterprise service. As the final step in tag commissioning, the worker prints the Auto-ID labels and affixes them to the cases. She repeats this step for product C as well.

**Setting the Pick Status for the Outbound Delivery**

After tagging the goods, the warehouse worker would use the composite application to set the status of the outbound delivery to "picked" by invoking the **Change Outbound Delivery** enterprise service. In this way, she can change the pick status for the order.

**RFID-enabled Packing**

Now we come to the stage where the items that have been picked need to be packed. Before packing the delivery, the composite performs the RFID setup steps described in use case 1: specifying the device and the associated observation by invoking **Find Device by Elements**, followed by **Set Device Default Reference**. Driving the forklift past the gate reader invokes the **Create Observation** enterprise service. The observation this time is related to the delivery, recording that these particular cases are associated with this outbound delivery.
Now the warehouse worker can finish the packing. When that happens, she triggers the Change Outbound Delivery enterprise service again, changing the pack status associated with the outbound delivery.

**RFID-enabled Loading**

After the packing has taken place, it is time to load the delivery. Now, it could be that the loading will take place at some point later, in some cases even hours after the packing has been done. This is often the case in shipping scenarios. The loading activity will have to be scanned as the delivery is loaded onto the truck.

The warehouse worker may not have access to the same device that she did for scanning at the packing stage, so the steps in the packing stage will have to be repeated with a different device. First the Find Device by Elements service is invoked, followed by Set Device Default Reference to specify that the following observation relates to loading, followed by Create Observation when the goods are driven past the gate reader.

**Goods Issue Posting for Outbound Delivery**

After the truck is scanned and loaded, the composite application invokes one more service to create a posting in the backend system. To set the goods issue status in SAP ERP, it triggers the Change Outbound Delivery enterprise service.

**Auto-ID Label List Enriched ASN**

The ASN is enriched with Auto-ID Labels using ccBPM functionality.

The following table summarizes these steps and the related enterprise services:

<table>
<thead>
<tr>
<th>Step</th>
<th>Enterprise Service Invoked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1: The warehouse worker searches for the delivery document</td>
<td>Find Outbound Delivery by Elements</td>
</tr>
<tr>
<td>Step 2: The worker enters the item ID for the items being shipped and the quantity</td>
<td>Encode Label as Collection</td>
</tr>
<tr>
<td>Step 3: The composite app stores the encoded tag identifiers in SAP All</td>
<td>Create Label as Collection</td>
</tr>
<tr>
<td>Step 4: The worker prints RFID tags for the items</td>
<td>(no enterprise service is invoked during this step)</td>
</tr>
<tr>
<td>Step 5: The worker affixes the tags to the items</td>
<td>(no enterprise service is invoked during this step)</td>
</tr>
<tr>
<td>Step 6: The worker updates the status of the outbound delivery to &quot;picked&quot;</td>
<td>Change Outbound Delivery</td>
</tr>
<tr>
<td>Step 7: The worker prepares to pack the order. If no device has been specified, the worker finds the device to use.</td>
<td>Find Device by Elements</td>
</tr>
<tr>
<td>Step 8: The worker specifies that the observation to be used is packing.</td>
<td>Set Device Default Reference Create Observation</td>
</tr>
</tbody>
</table>
Step 8: The worker finishes the packing, scanning the goods in the process
(no enterprise service is invoked during this step)

Step 9: The composite updates the outbound delivery to reflect that the order has been packed
Change Outbound Delivery

Step 10: The worker (or other workers at a later time) load the goods
(no enterprise service is invoked during this step)

Step 11: If the loading device has not been specified, the worker specifies one.
Find Device by Elements

Step 12: The worker sets the observation to be used. (Note: Set Device Default Reference enables the assignment of a document to a read device. This service does not enable the assignment of a device to an action such as packing, loading, or unloading. Action types such as packing, loading, and unloading are used by this service based on the configuration of the device master record and the assignment of device IDs to configured action types.)
Set Device Default Reference

Step 12: The driver loads the goods, passing them by the reader
Create Observation

Step 13: The composite application updates the outbound delivery to set the goods issue status
Change Outbound Delivery

Step 14: The composite application tells ERP to create an ASN
Notify of Outbound Delivery

Step 15: The association of the ASN with the AutoID labels is handled using ccBPM functionality
(no enterprise service is invoked during this step)

Use Case 3: RFID-enabled Inbound Delivery Processing

In use case 3, the order has now been delivered to the retail sales outlet center and needs to be checked in. There are two approaches to this process. The simplest method uses no enterprise services at all, simply the functionality of SAP AII and SAP ERP. Alternatively, if desired, this process can be performed using enterprise services.

Standard (not enterprise service enabled) Automated ERP/ SAP All Functionality: Automatic Receipt of ASN and Creation of Inbound Delivery

As is standard today, the receipt of the Auto-ID Labels enriched ASN can trigger the automatic creation of the inbound delivery in the receiving ERP system which in turn is then automatically replicated enriched with the expected Auto-ID Label List to the SAP Auto-ID Infrastructure.

The following table summarizes this process:

<table>
<thead>
<tr>
<th>Step</th>
<th>Enterprise Service Invoked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1: Receiving an auto-ID label enriched ASN triggers automatic creation of an inbound delivery in ERP</td>
<td>(no enterprise service is invoked during this step)</td>
</tr>
</tbody>
</table>

Using Enterprise Services for Inbound Delivery Processing

If desired, you can do the same thing using enterprise services, as described next.

Finding and Creating the Inbound Delivery
To use enterprise services for this process, the first step is for the warehouse worker to search for the business partner (supplier) in order to find a particular delivery. When he does this, the Find Inbound Delivery by Elements enterprise service is triggered. Alternatively, if no inbound delivery exists, the warehouse worker may create a new inbound delivery on the fly using the Create Inbound Delivery service.

**Querying for and Assigning the Inbound Delivery to a Device**

Similar to use cases 1 and 2, it is now time to assign the delivery to an available device for scanning so that the delivery can be logged into the user's system. The Find Device by Elements service is triggered when the warehouse worker searches for the device. The warehouse worker then assigns the delivery to the device he has selected for the scan using the Set Device Default Reference enterprise service. Next, the Query Labels by Delivery enterprise service is triggered, since now that the delivery has been found, Auto-ID Infrastructure needs to know which Auto-ID Labels are expected for the delivery.

**Unloading the Pallet**

It is now time to unload the pallet containing the delivery referred to in the above steps. As the unloading begins, the items on the pallet are scanned. This triggers the Create Observation enterprise service.

**Translating Auto-ID Observed Delivery Item Instances into Delivery Item Quantity for ERP Processing**

In this next step, the warehouse worker invokes an enterprise service to compare the Auto-ID list against the items that have been unloaded from the pallet and convert the list into a quantity required for inbound delivery item posting. This triggers the Find Observation Label Count by BTD Reference enterprise service. This service is used to query the Auto-ID Infrastructure for Auto-ID labels that are related.

**Goods Receipt Posting**

The final step in this use case is a fairly simple one. After the Auto-ID list is converted into a quantity for posting, the warehouse worker does a goods receipt posting with reference to the inbound delivery. This triggers the Change Inbound Delivery enterprise service. This service updates a delivery as related to the receipt of goods. Now all of the information about the delivery is stored in the warehouse worker's ERP and AII system. The following table summarizes these steps and the related enterprise services:

<table>
<thead>
<tr>
<th>Step</th>
<th>Enterprise Service Invoked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1: The worker at the retail outlet receives an ASN</td>
<td>(no enterprise service is invoked during this step)</td>
</tr>
<tr>
<td>Step 2: The worker looks for a particular delivery</td>
<td>Find Inbound Delivery by Elements</td>
</tr>
<tr>
<td>Step 3: If there is no delivery in the system, if it is permitted, the worker can create one</td>
<td><em>Create Inbound Delivery</em></td>
</tr>
<tr>
<td>Step 4: If no device has been specified, the worker searches for a device</td>
<td><em>Find Device by Elements</em></td>
</tr>
<tr>
<td>Step 5: The worker sets the device default reference for receiving the goods. (Note: Set Device Default Reference enables the assignment of a document to a read device. This service does not enable the assignment of a device to an action such as packing, loading, or unloading. Action types such as packing, loading, and unloading are used by this service based on the configuration of the device master record and the assignment of device IDs to configured action types.)</td>
<td>Set Device Default Reference</td>
</tr>
<tr>
<td>Step 6: The worker queries the Auto-ID Infrastructure to find out which auto-ID labels are expected in this delivery</td>
<td>Query Labels by Delivery</td>
</tr>
<tr>
<td>Step 7: The worker scans the pallet</td>
<td>Create Observation</td>
</tr>
<tr>
<td>Step 8: The worker counts the items on the auto-ID list and counts the number of items unloaded from the pallet and compares the two</td>
<td>(no enterprise service is invoked during this step)</td>
</tr>
</tbody>
</table>
Step 9: The worker enters the quantity of items received

Step 10: The composite application queries the SAP All for related auto-ID labels

Step 11: The worker does a goods receipt posting with reference to the inbound delivery

Use Case 4: RFID-enabled Goods Receiving with Reference to a Purchase Order

In this use case, a shipment comes in with an extra pallet that is not on the inbound delivery list for the rest of the shipment. In this case, the warehouse worker can receive the goods by searching for an existing PO or by creating a new PO for it on the loading dock. This way, the goods can be received and a record of them can be automatically added in the system.

Finding the Purchase Order (Preparing to Unload)

Here the warehouse worker can search for an existing purchase order in ERP. Doing so triggers the Find Purchase Order by Seller and Product and Organisational Data enterprise service. This service enables the buyer to search for purchase orders by vendor, material, and organization. The warehouse worker first verifies that the purchase order does not already exist, so he creates it in accordance with warehouse policy for such cases.

Creating the Purchase Order

Alternatively a user may create a purchase order on the fly in ERP, by triggering the Create Purchase Order enterprise service. (This process could also take the form of a workflow triggered by the shop floor staff.)

Unloading the Pallet (RFID-enabled Unload)

To prepare to unload the pallet, the warehouse worker starts up the composite application, which specifies a default device to do the scan by invoking the Set Device Default Reference enterprise service. (If the worker needs to specify a different enterprise service, the composite would trigger the Find Device by Elements service. The composite then invokes the Set Device Default Reference enterprise service to associate the following observation with the purchase order. Finally, the warehouse worker will scan and unload the pallet, which triggers the Create Observation enterprise service.

The Find Observation Label Count by BTD Reference enterprise service now counts the Auto-ID labels to provide the needed aggregated quantity count as input to the ERP goods movement with reference to a purchase order.

Posting the Goods Receipt with Reference to the Purchase Order

The final step in this use case involves having the warehouse worker review and verify the quantities received against the purchase order line items and confirm the goods receipt with reference using the Create Goods Movement_V1 service. Now all of the information about the goods receipt is stored in SAP All and in SAP ERP.

The following table summarizes these steps and the related enterprise services:

<table>
<thead>
<tr>
<th>Step</th>
<th>Enterprise Service Invoked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1: The warehouse worker searches for an existing purchase order</td>
<td>Find Purchase Order by Seller and Product and Organisational Data</td>
</tr>
</tbody>
</table>
Use Case 5: RFID Enabled Aggregation Event

Note: This use case shows how the same enterprise services can be used in different contexts (for example, when you combine auto-ID packing and observing with creating part hierarchies, you can generate observations that create a new assembly).

In many instances, there are products with components that have to be grouped together before they are loaded into cases, and then onto pallets. So this use case considers the packing use case as an aggregation event that in fact creates a hierarchy of parts into an assembly using an identification scheme such as UIIs.

Let's take the example of a computer that comes with a monitor, keyboard, and mouse. The warehouse worker will tag or 2-D bar code each part separately and then scan various assembly constituent parts into a higher level assembly ID that may in turn be marked with a 2-D barcode with a UII encoding label. You may wish to consider notifying the completed Auto-ID labeled assembly with its constituent parts to other systems holding a record of assembly bill of materials. You may wish to further consider packing the completed assembly into an RFID tagged shipping box that is then in turn packed onto an RFID tagged pallet. These items can be aggregated into a bill of materials for the assembled product, and the assembled product tagged separately.

Here are the steps that take place in this use case.

Finding an Available RFID Device

In this use case (as in all the use cases), the first thing the composite application will have to do is specify a device to scan the items. This device can default, and then if it needs to be changed, the user can search for an alternate device using the Find Device by Elements enterprise service. In AII, the user will associate the activity for the device (an enterprise service to handle this task is planned for a future enhancement package).

Scanning the Auto-ID List per Hierarchy

The worker will then scan the Auto-ID list for the hierarchy of items to be assembled. This will trigger the Create Observation service.

Using Auto-ID Filter Values to Create Hierarchy

In this next step, the worker may set up Auto-ID filter values to create the proper hierarchy based on the items to be assembled. This action does not trigger an enterprise service.

The following table summarizes these steps and the related enterprise services:

<table>
<thead>
<tr>
<th>Step</th>
<th>Enterprise Service Invoked</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Create Observation</td>
</tr>
<tr>
<td></td>
<td>Find Device by Elements</td>
</tr>
<tr>
<td></td>
<td>Set Device Default Reference</td>
</tr>
<tr>
<td></td>
<td>Find Observation Label Countby BTD Reference</td>
</tr>
<tr>
<td></td>
<td>Create Observation</td>
</tr>
<tr>
<td></td>
<td>Find Observation Label Countby BTD Reference</td>
</tr>
<tr>
<td></td>
<td>(no enterprise service is invoked during this step)</td>
</tr>
<tr>
<td></td>
<td>Create Goods Movement_V1</td>
</tr>
</tbody>
</table>
Step 1: The user specifies a device to scan the items.

Step 2: The user selects a device that is configured for a logical packing activity (Hierarchy creation)
(Note: The Set Device Default Reference enterprise service enables the assignment of a document to a read device. This service does not enable the assignment of a device to an action such as packing, loading, or unloading. Action types such as packing, loading, and unloading are used by this service based on the configuration of the device master record and the assignment of device IDs to configured action types.)

Step 3: The worker successively calls scans the Auto-ID list that then invokes the creation of commensurate hierarchies for the hierarchy of items to be assembled. The Business Add-In BAdI: Auto-ID Label Device Observation Create Request/Confirmation (/AIN/BADI_ALL_DEV_OBS_CRE_RC) is available for this operation.

Step 4: The worker sets up auto-ID filter values to create a hierarchy based on the items to be assembled (no enterprise service is invoked during this step)

Future Directions

As previously mentioned, this bundle provides only an initial set of enterprise services for RFID-enabled core logistics processes. This delivery is part of a roadmap to incrementally deliver enterprise services for RFID-enabled core logistics processes as well as business-to-business data integration and data discovery services.

The SAP Real World Awareness program strategy is to have future RFID solutions and infrastructure enterprise service-enabled.

SAP would like to invite partners to complement these services with their own services including, for example, services relating to device controller and device management integration.

System Requirements

- SAP ERP 6.0
- SAP Enhancement Package 4 for SAP ERP 6.0
- SAP Auto-ID Infrastructure
- SAP NetWeaver Process Integration (formerly XI)

Related ES Bundles

- Item Unique Identification
- Inventory Management

End-to-end Processes Where This ES Bundle Is Used

- Logistics and Fulfillment Management

Links

SDN and SAP Links

- SOA Homepage on SDN
- SAP Help Portal SAP Solution for RFID
- SAP Service marketplace Select RFID (login required)
- SAP Auto-ID Infrastructure

External Links

- Wikipedia's page on RFID
- EPCglobal