Oracle Fusion Cloud Transportation and Global Trade Management

Integrating with Oracle Internet of Things Fleet Monitoring Guide

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F91691-01

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2 Introduction

Integrating with the Internet of Things

Oracle Internet of Things (IoT) Intelligent Applications "Fleet Monitoring (FM)" and Oracle's Transportation Management (OTM) solution helps optimize your logistics operations with proactive detection of anomalies and deviations for private fleet and/or third party carrier movements. IoT FM can provide you with real-time visibility, in-transit insights and improve efficiencies by capturing sensor data from connected devices to track vehicles, monitor trips, track equipment or trailer and RTIs (Returnable Transport Items such as Chassis for container, Metallic Pallets, Medicinal containers, Automotive Racks, or more) and most importantly the condition of the cargo being transported. The standard integration increases the efficiency and provides a better customer experience because the location and condition of trips and related entities is always known.

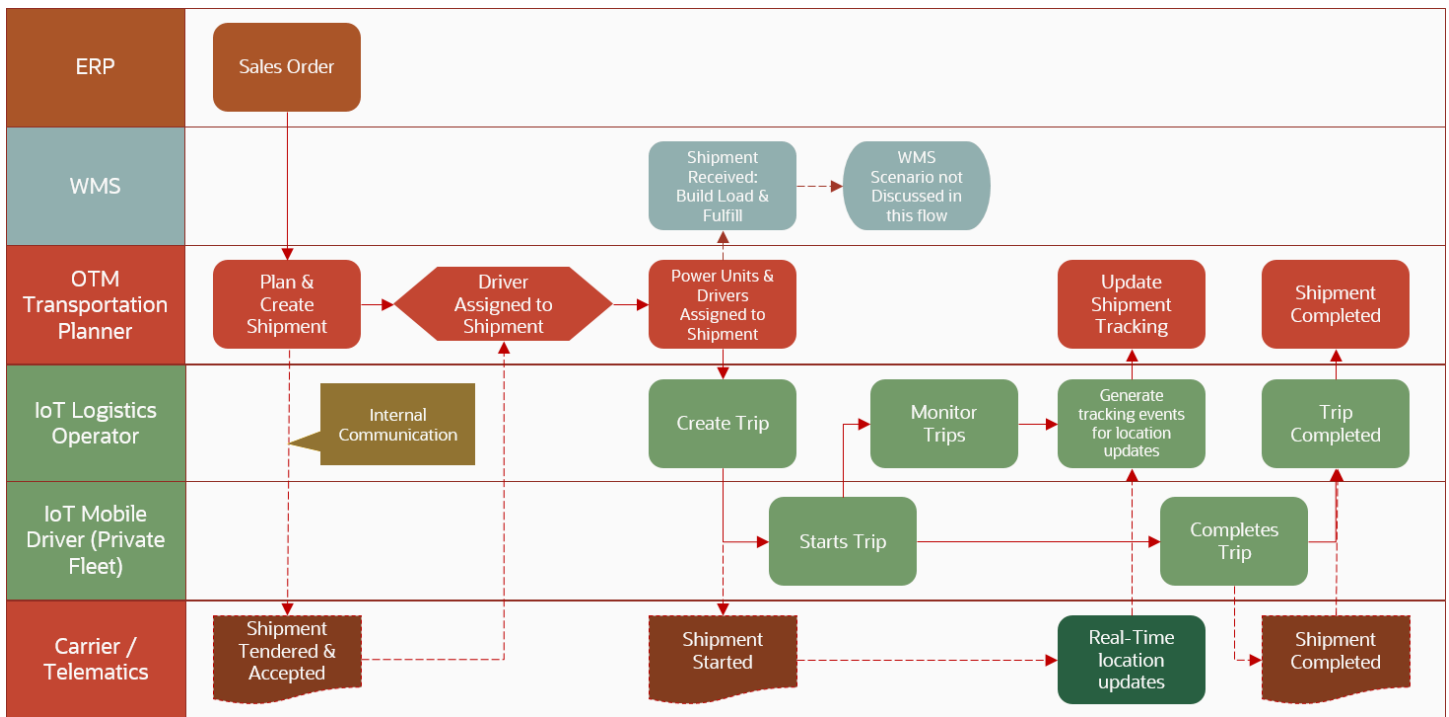Oracle's IoT enabled Transportation Management solution enables:

- Fleet and Driver Behavior Monitoring
    - Real-time visibility into fleet location
    - Monitor fleet for availability and utilization
    - Monitor driver behavior: Idle time, excessive speeding, unauthorized stops, route discipline, etc.

- In-Transit Trip Monitoring
    - Real-time visibility into trip locations
    - Supports private fleets and 3rd party carrier trips
    - Monitor in-transit delays and updated ETA
    - Carrier route efficiency, theft prevention, customer satisfaction
    - Tracking Events sent to OTM for location as well as stop events

- Equipment or Trailer Asset Monitoring:
    - Track and monitor equipment or trailer location and condition for better utilization
    - Monitor the planned vs unplanned detachments while on active trip

- Returnable Transport Items (RTIs) Monitoring:
    - Track the location of RTIs
    - Monitor the usage conditions and mishandling, impacting the re-usage
    - Manage return movements for better utilization

- Cargo Condition Monitoring:
    - Track and monitor cargo condition while being delivered
    - Monitoring in-transit inventory within container for any condition deterioration
    - Alerts/notifications in case of an exception situation

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3 Sample Flows

OTM Shipment to IoT Fleet Monitoring: Fleet and Trip Monitoring Flow

This flow summarizes the following:

- Supports tracking and monitoring of Trip and Driver for Private Fleet or tracking and monitoring Trip for 3rd party carrier. This transaction is indicated by the dotted lines.

- A driver is assigned or a load is tendered and accepted for a Shipment and is sent to IoT FM for the trip to be tracked and monitored from its start, through its delivery stops, to its final destination. Trip status progress is reported back to OTM. This transaction is indicated by the solid lines.

- Optionally, shipments can be sent to WMS Cloud for outbound loads to be tracked and monitored through IoT FM. See the *WMS Integration Guide* for more details about the WMS part of this flow.

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This functional flow tracks information moving between an order management ERP, OTM, and IoT FM. The flows facilitates the monitoring of private fleets, the tracking of trips via 3rd party carriers, and the monitoring of trips.

1. An order management ERP system sends sales orders to OTM.
2. Based on the orders received, shipments are created and planned in OTM. This can happen in the following ways:
   o For private fleets, a shipment is planned, and a driver is assigned to the shipment.
   o For 3rd party carriers, a shipment is planned, sent to a carrier, and is accepted and tendered.
3. Upon committing a shipment, OTM changes the shipment status to "Secure Resources – Accepted".
4. When a shipment's status changes to "Secure Resources - Accepted" or "Secure Resources - Pickup Notification", OTM triggers an Agent to send the shipment information to IoT FM. A pre-seeded agent *IOT SEND SHIPMENT* will:
   a. Send the shipment to the IoT FM instance as configured in an External System. As part of this step, OTM will automatically push a SOAP XML message with the shipment information to IOT FM's REST API.
   b. Set the external status of the shipment to IOT_FM_SENT.
   c. Add a Reference Number to the shipment with a reference number qualifier IOT_FM_ID.
5. The shipment sent from OTM automatically shows up as a **trip** in IoT FM.
6. A link is created in IoT FM, to associate the IoT FM trip and the corresponding OTM shipment.
7. Once the trip starts, event data, in the form of transmission codes, are reported back and updated within IoT FM.
8. Based on the transmission codes received, such as arrival event codes, departure event codes, en-route position event codes, IoT FM will send back to OTM in real time, details of the fleet, and event information using OTM's tracking events.
9. As tracking events are received, OTM will update the status of the corresponding shipment.
   o In order for the tracking event to get processed in OTM, a matching agent along with a corresponding workflow agent is needed. This can be the LEGACY SHIPMENT MATCHING agent along with the PUBLIC agent SHIPMENT EVENT TRACKER or the MATCH SHIPMENT agent action, and a tracking event based agent for workflow processing.
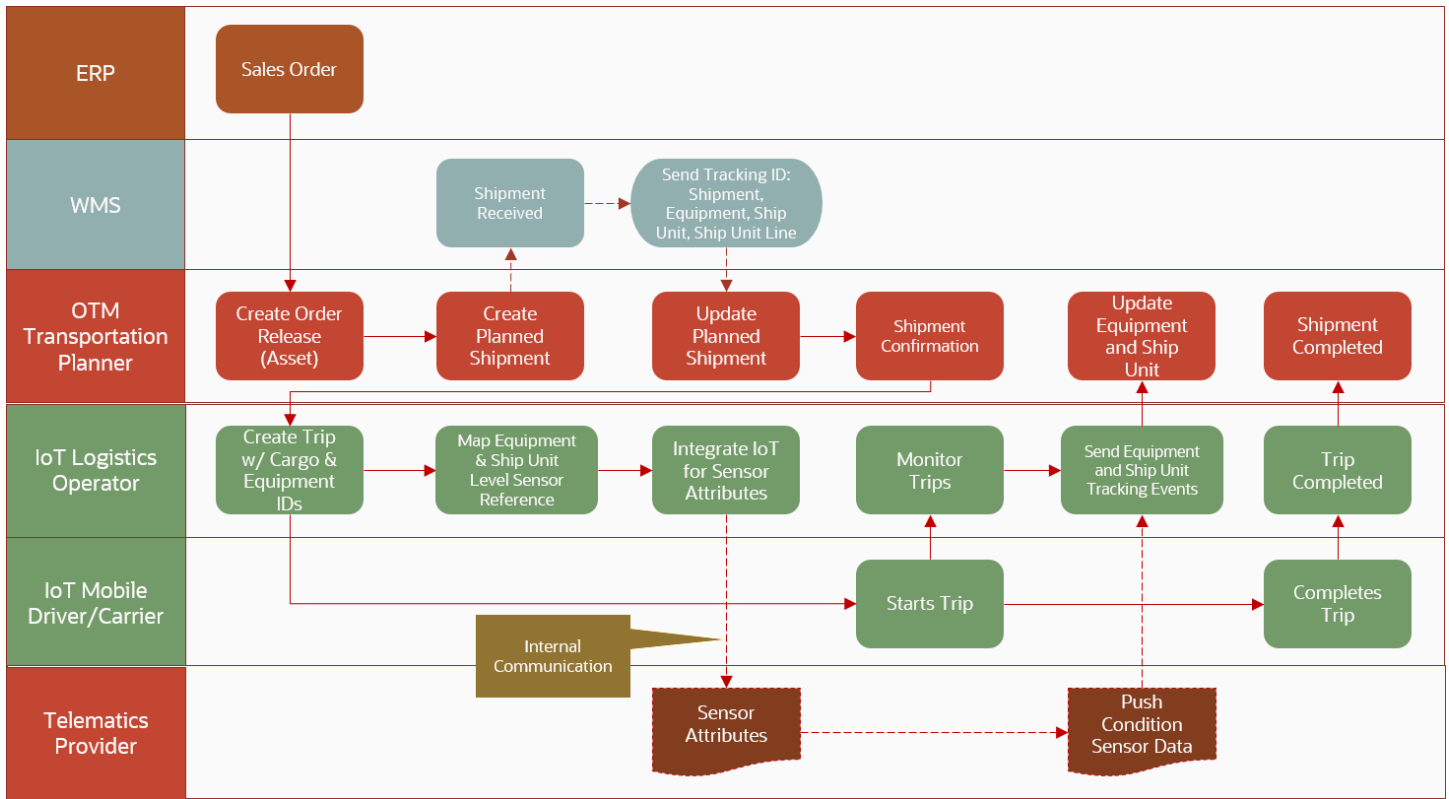
The *IOT SEND SHIPMENT* Agent creates the initial link between an OTM shipment and an IoT FM trip. Any subsequent changes to the OTM shipment can be propagated to IoT FM via a second agent *IOT SEND SHIPMENT UPDATE*.

The complete list of *Shipment Reference Number Qualifiers* that are seeded in OTM to support the fleet monitoring flows can be found in the *Seeded Data chapter*.

OTM Shipment to IoT Fleet Monitoring: Cargo Condition and Equipment Monitoring

This flow summarizes the following:

- Order level tracking data can be sent from an ERP Sales Order into OTM and can be passed from the Order Release to the Shipment.

- OTM sends planned Shipment to WMS. WMS sends back into OTM, a Tracking ID attached to the Shipment, Equipment, Ship Unit, and Ship Unit Line.

- The Tracking ID, attached to the Shipment, Equipment, Ship Unit, and Ship Unit Line, is passed out to IoT FM in the Planned Shipment as part of the Shipment Confirmation. Subsequent Tracking Events against the Shipment are sent back to OTM from IoT FM.

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This section describes the functional flow of information between an order management ERP, OTM and IoT FM to monitor cargo conditions, equipment conditions and track equipment locations.

The following steps out line the functional flow:

1. Order level tracking data for assets is passed into OTM from an order management ERP system. This asset level tracking data is stored in OTM on the order release line as *Reference Numbers*.
2. In OTM a shipment is created and planned.
3. In OTM set up an agent to copy the tracking data from the order level to reference numbers on the shipment level. See the sample agent to copy reference numbers from order release line to shipment ship unit line in the *Seeded Data* chapter.
4. OTM sends the planned shipment to the warehouse management system (WMS).
5. A WMS assigns a Tracker ID, which flows in via integration and is then attached to the shipment, equipment, ship unit, and ship unit line.
6. When the shipment is committed, OTM triggers an agent *IOT SEND SHIPMENT* to send the shipment, which has the Tracker ID attached, to IoT FM.
7. The Tracker ID is stored as part of the IoT Trip.
8. Once the Trip starts, trip event data, in the form of transmission codes, are reported back and updated within IoT FM.

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9. Based on the transmission codes received, IoT FM will send back to OTM in real time, details of the fleet, and event information using OTM's tracking events.

In order for the tracking event to get processed in OTM, a matching agent along with a corresponding workflow agent is needed. This can be the LEGACY SHIPMENT MATCHING agent along with the PUBLIC agent SHIPMENT EVENT TRACKER or the MATCH SHIPMENT agent action, and a tracking event based agent for workflow processing.

The *IOT SEND SHIPMENT* agent creates the initial link between an OTM shipment and an IoT FM trip. Any subsequent changes to the OTM shipment can be propagated to IoT FM via a second agent *IOT SEND SHIPMENT UPDATE*.

The complete list of reference number qualifiers and attributes that are seeded in OTM to support the cargo monitoring flows can be found in the *Seeded Data chapter*.

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Chapter 4
Integration Setup

4 Integration Setup

IoT Configuration

To integrate OTM with IoT FM, the following tasks need to be completed in IoT FM:

- Map Oracle Transportation Management Users to IoT FM Drivers.

- Connect to an Oracle Transportation Management Cloud Service Instance

- Customize Oracle Transportation Management Cloud Service Transmission Codes

- Set the Oracle Transportation Management Security Settings

Detailed information on how to complete these tasks can be found in the *Integrate with Oracle Transportation Management* section of the Using Oracle IoT Fleet Monitoring Cloud Service Guide.

OTM Configuration

IoT Connectivity Configuration

An external system IOT_FM is staged, that can be used to integrate with IoT FM. The external system needs to be configured with the appropriate credentials and a URL to connect to a specific IoT FM Cloud Service instance. See *Connect to an Oracle IoT Fleet Monitoring Cloud Service Instance* for detailed information on how to configure the external system.

- When specifying the user name and password in the external system, use the credentials associated with that IoT FM instance's *Integrator* or *Administrator* role.

- When specifying the URL to the IoT FM Cloud Service instance, the URL should be formatted as
    - `https://<IOT_instance>/iotapps/serviceapi/v1/transportation?defaultNS=true`

Staged Data

Data is staged in the FA (Fusion Applications) domain in OTM. This is the sample data and agents that are used by the integration flows with the Fusion Applications. In the FA domain, reference number qualifiers, remark qualifiers, equipment attributes, agents, saved queries, external systems and external status types are staged.

Reference number qualifiers can be copied to the PUBLIC domain prior to using IoT flows if you want to use them without a domain preference. This data content can also be copied into the customer domains and extended as needed.

A complete list of staged data is documented in the *Seeded Data chapter*.

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Exception Event Handling

IoT FM can notify OTM when there is a an exception event, such as deterioration in the cargo condition or violation of the rule predicates set up in IoT FM; these include situations such as temperatures inside the container falling out of set thresholds, violating a geo-fence, truck speeds exceeding acceptable limits, etc. These exception events are sent to OTM as tracking events.

To support exception event handling in OTM, clients should create custom status codes which IoT FM will use when sending the tracking events. These custom status codes should be created in the PUBLIC domain in OTM.

You should also create custom reference number qualifiers in OTM that match exception attributes or rule predicates such as sensor attributes or metric name in IoT FM.

When exception events flow in, clients can set up agents in OTM to copy over relevant event details to the appropriate OTM objects such as shipment, equipment, or driver. Depending on the type of the exception event such as cargo temperature conditions or vehicle breakdown, agents can set different indicators that are easily visualized on a workbench. For higher severity exceptions, agents can send critical alert notifications for intervention services or drive additional workflows such as re-planning with another vehicle.

Example agent setup for exception event handling is listed in the *Seeded Data chapter*.

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Chapter 5
Seeded Data

5 Seeded Data

Qualifiers

Shipment Reference Number Qualifiers for Fleet Monitoring

OTM Reference Number Qualifier	IoT Field Name	Description
CAPACITYPROVIDERACCOUNTCODE	capacityProviderAccountCode	The code for the requested capacity provider account that was used for authentication with the capacity provider's API.
DOT_NUMBER		Carrier's Department of Transportation Number
INVOICE	InvoiceNumber	Invoice Number
IOT_BILL_OF_LADING	billOfLading	IOT Bill of Lading
IOT_FM_ID		Shipment ID to link OTM Shipment to IOT Trip.
MC_NUMBER		Carrier's Operating Authority(MC Number
PORTABLETRACKERID	portableTrackerId	Portable Trackers ID, if location source is "Portable".
PRIMARYDRIVERALTERNATEMOBILENUMBER		Alternate mobile phone number of the driver executing the shipment.
PRIMARYDRIVERMOBILENUMBER	driverMobileNumber	Mobile phone number of the driver executing the shipment. This field is mandatory for tracking Shipment through Data Aggregator integration.
SECONDARYDRIVERALTERNATEMOBILENUMBE		Alternate mobile phone number of the second driver executing the shipment.
SECONDARYDRIVERMOBILENUMBER		Mobile phone number of the second driver executing the shipment.
SYSTEM		
VEHICLEELDID	vehicleELDID	Vehicle Identifier is an ELD registration number for a vehicle in North America. This ID is used to fetch vehicle information (position, other parameters) from data providers. This is critical for tracking vehicles of certain carriers in North America.

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OTM Reference Number Qualifier	IoT Field Name	Description
VEHICLELICENSEPLATE	vehicleLicensePlate or (vehicleRegNumber)	License Plate info of Truck carrying the shipment. This field is needed for tracking Shipment through Data Aggregator integration.

Shipment Reference Number Qualifiers for Cargo Monitoring

OTM Reference Number Qualifier	IoT Field Name	Description
IOT_CARRIER_TRACKINGNUM	Trip.carrierRefNum	IOT Carrier Tracking Number
IOT_DEVICE_HARDWARE_ID_1	Trip.trackers	IOT Cargo Monitoring Device 1
IOT_DEVICE_HARDWARE_ID_2	Trip.trackers	IOT Cargo Monitoring Device 2
IOT_DEVICE_NAME_1	Trip.trackers	IOT Cargo Monitoring Device 1
IOT_DEVICE_NAME_2	Trip.trackers	IOT Cargo Monitoring Device 2

Shipment Ship Unit Reference Number Qualifiers for Cargo Monitoring

OTM Reference Number Qualifier	IoT Field Name	Description
IOT_ASSET_NAME	Trip.ShipUnit.assetRef	IOT Asset Name
IOT_DEVICE_HARDWARE_ID_1	Trip.ShipUnit.trackers	IOT Cargo Monitoring Device 1
IOT_DEVICE_HARDWARE_ID_2	Trip.ShipUnit.trackers	IOT Cargo Monitoring Device 2
IOT_DEVICE_NAME_1	Trip.ShipUnit.trackers	IOT Cargo Monitoring Device 1
IOT_DEVICE_NAME_2	Trip.ShipUnit.trackers	IOT Cargo Monitoring Device 2

Shipment Ship Unit Line Item Reference Number Qualifiers for Cargo Monitoring

OTM Reference Number Qualifier	IoT Field Name	Description
IOT_ASSET_NAME	Trip.ShipItem	IOT Asset Name
IOT_DEVICE_HARDWARE_ID_1	Trip.ShipItem.trackers	IOT Cargo Monitoring Device 1
IOT_DEVICE_HARDWARE_ID_2	Trip.ShipItem.trackers	IOT Cargo Monitoring Device 2
IOT_DEVICE_NAME_1	Trip.ShipItem.trackers	IOT Cargo Monitoring Device 1
IOT_DEVICE_NAME_2	Trip.ShipItem.trackers	IOT Cargo Monitoring Device 2

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Order Release Line Reference Number Qualifiers for Cargo Monitoring

OTM Reference Number Qualifier	IoT Field Name	Description
IOT_ASSET_NAME	assetRef	IOT Asset Name
IOT_DEVICE_HARDWARE_ID_1	trackers	IOT Cargo Monitoring Device 1
IOT_DEVICE_HARDWARE_ID_2	trackers	IOT Cargo Monitoring Device 2
IOT_DEVICE_NAME_1	trackers	IOT Cargo Monitoring Device 1
IOT_DEVICE_NAME_2	trackers	IOT Cargo Monitoring Device 2

Order Release Ship Unit Reference Number Qualifiers for Cargo Monitoring

OTM Reference Number Qualifier	IoT Field Name	Description
IOT_ASSET_NAME	assetRef	IOT Asset Name
IOT_DEVICE_HARDWARE_ID_1	trackers	IOT Cargo Monitoring Device 1
IOT_DEVICE_HARDWARE_ID_2	trackers	IOT Cargo Monitoring Device 2
IOT_DEVICE_NAME_1	trackers	IOT Cargo Monitoring Device 1
IOT_DEVICE_NAME_2	trackers	IOT Cargo Monitoring Device 2

Equipment Attributes for Cargo Monitoring

OTM Equipment Attribute Qualifier	IoT Field Name	Description
IOT_ASSET_NAME	Trip.TripEquipmentInfo.assetRef	IOT Asset Name
IOT_DEVICE_HARDWARE_ID_1	Trip.TripEquipmentInfo.trackers	IOT Cargo Monitoring Device 1
IOT_DEVICE_HARDWARE_ID_2	Trip.TripEquipmentInfo.trackers	IOT Cargo Monitoring Device 2
IOT_DEVICE_NAME_1	Trip.TripEquipmentInfo.trackers	IOT Cargo Monitoring Device 1
IOT_DEVICE_NAME_2	Trip.TripEquipmentInfo.trackers	IOT Cargo Monitoring Device 2
IOT_EQUIPMENT_TYPE	Trip.Equipment.equipmentType	IOT Equipment Type
IOT_EQUIPMENT_LENGTH_UOM	Trip.Equipment.equipmentLength.unitOfMeasur	IOT Equipment Length UOM
IOT_EQUIPMENT_LENGTH_VALUE	Trip.Equipment.equipmentLength.value	IOT Equipment Length Value
IOT_EQUIPMENT_MAX_VOLUME_UOM	Trip.Equipment.equipmentMaxVolume.unitOfMe	IOT Equipment Max Volume UOM
IOT_EQUIPMENT_MAX_VOLUME_VALUE	Trip.Equipment.equipmentMaxVolume.value	IOT Equipment Max Volume Value
IOT_EQUIPMENT_MAX_WEIGHT_UOM	Trip.Equipment.equipmentMaxWeight.unitOfMe	IOT Equipment Max Weight UOM
IOT_EQUIPMENT_MAX_WEIGHT_VALUE	Trip.Equipment.equipmentMaxWeight.value	IOT Equipment Max Weight Value

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Remark Qualifiers

OTM Remark Qualifier	IoT Field Name	Description
IOT_SPECIAL_INSTRUCTION		IOT Cargo Monitoring Special Instruction
IOT_FM_LINK		IOT Fleet Monitoring Trip Link
IOT_DELIVERY_NOTE		Delivery Note that Drivers can post on to IoT and sent back to OTM as part of a Tracking Event.
IOT_DRIVER_EVENT		Driver Event that is recorded on the IoT side and sent to OTM as part of a Tracking Event.

Agents

Agent to Send a New Shipment to IoT FM

- **Agent ID**: IOT SEND SHIPMENT
- **Agent Type**: SHIPMENT
- **Triggered on**: "Secure Resources – Accepted" or "Secure Resources - Pickup Notification"
- **Saved Condition**: <blank>
- **Actions**:
    - Sends OTM Shipment to the External System "IOT_FM".
    - Sets IoT FM SENT status = IOT_FM_SENT.
    - Sets the shipment GID as a reference number on the shipment with the Reference Number Qualifier "IOT_FM_ID".

Note: You must configure the Out XML Profile on the external system to include the following relative xpath: ShipmentStop/StopType.

Agent to Send Modified Shipment to IoT FM

- **Agent ID**: IOT SEND SHIPMENT UPDATE
- **Agent Type**: SHIPMENT
- **Triggered on**: "SHIPMENT - DATES MODIFIED" or "SHIPMENT - LOCATION MODIFIED"
- **Saved Condition**: IOT SENT SHIPMENTS (for shipments already sent to IoT FM)
- **Actions**:
    - Sends OTM Shipment to the External System "IOT_FM".

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> **Note:** You must configure the Out XML Profile on the external system to include the following relative xpath: ShipmentStop/StopType.

Agent to Send Delete Shipment Transmission

- **Agent ID**: IOT DELETE SHIPMENT
- **Agent Type**: SHIPMENT
- **Triggered on**: Shipment status changes to SECURE RESOURCES_WITHDRAWN
- **Saved Condition**: IOT SENT SHIPMENTS (for shipments already sent to IoT FM)
- **Actions**:
    - Sends OTM Shipment to the External System "IOT_FM" with a remark "DELETE SHIPMENT".
    - Sets IoT FM SENT status = IOT_FM_NOT_SENT.
    - Sets the IOT_FM_ID Reference Number on the shipment to the value "DELETED".

> **Note:** You must configure the Out XML Profile on the external system to include the following relative xpath: ShipmentStop/StopType.

> **Note:** Trips in IoT FM can only be deleted if the Trips are in the PLANNED state.

Agent to Copy Reference Numbers from Order Release Line To Shipment Ship Unit Line

- **Agent ID**: <EXAMPLE - NOT STAGED>
- **Agent Type**: ORDER RELEASE
- **Triggered on**: ORDER - STATUS CHANGED
- **Saved Condition**: <blank>
- **Actions**:
    - Select the **Data Type Association** ORDER RELEASE TO ORDER RELEASE LINE.
    - Copy **Refnums** from the order release line to the shipment ship unit line.
        - Use the **Agent Action** COPY REFNUMS FROM ORDER RELEASE LINE.
        - Set the **Associated Object** to ORDER RELEASE LINE TO SHIPMENT SHIP UNIT LINE.
        - Select the **Reference Number Qualifiers** that should be copied such as IOT_ASSET_NAME, IOT_DEVICE_HARDWARE_ID_1, and IOT_DEVICE_NAME_1.

Agent to Send Shipment Tracking Number to Carrier

- **Agent ID**: <EXAMPLE – NOT STAGED>
- **Agent Type**: TRACKING EVENT
- **Triggered on**: TRACKING EVENT - CREATED
- **Saved Condition**: <blank>

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- **Actions**:
    - Associate the tracking event to the shipment using the TRACKING_NUMBER **Shipment Reference Number Qualifier**.
        - Use the **Agent Action** MATCH OBJECT BY TRACKING NUMBER
    - Copy remarks from the tracking event to the shipment.
        - Use the **Agent Action** COPY REMARKS FROM TRACKING EVENT
        - Select the **Associated Object** to TRACKING EVENT TO SHIPMENT
    - Send updated shipment information to the carrier :
        - Change the **Data Type Association** to TRACKING EVENT TO SHIPMENT.
        - Use the **Agent Action** MODIFY TENDER.

Agent to Handle Exception Events

- **Agent ID**: <EXAMPLE – NOT STAGED>

- **Agent Type**: TRACKING EVENT

- **Triggered on**: TRACKING EVENT – PROCESSING REQUEST
    - Can be further constrained to specific exception events by selecting the corresponding *Status Code* in the **Restrictions** field.

- **Saved Condition**: <blank>

- **Actions**:
    - **IF <Status Code>** indicates a violation of the temperature thresholds.
        - Flag for higher visibility on Workbench by using the **Agent Action SET INDICATOR** to ORANGE.
    - END IF
    - **IF <Status Code>** indicates theft or tampering and needs intervention services.
        - Send critical alert using the **Agent Action** NOTIFY CONTACT.
    - **END IF**

External Status Types

A Shipment External Status Type is defined with two status values to manage the state of the shipment processing signifying whether the OTM Shipment has been sent to the IoT External System.

- **Status Type ID**: IOT FM SENT

- **Object Type**: SHIPMENT

- **Description**: IOT Fleet Monitoring Sent Status

- Status Values:
    - IOT_FM_NOT_SENT
    - IOT_FM_SENT

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Saved Condition

A Saved Condition and its associated Saved Query are staged to help identify and query only Shipments that have previously been sent to IoT FM.

- **Saved Condition ID**: IOT SENT SHIPMENTS
- **Saved Query**: IOT SENT SHIPMENTS

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