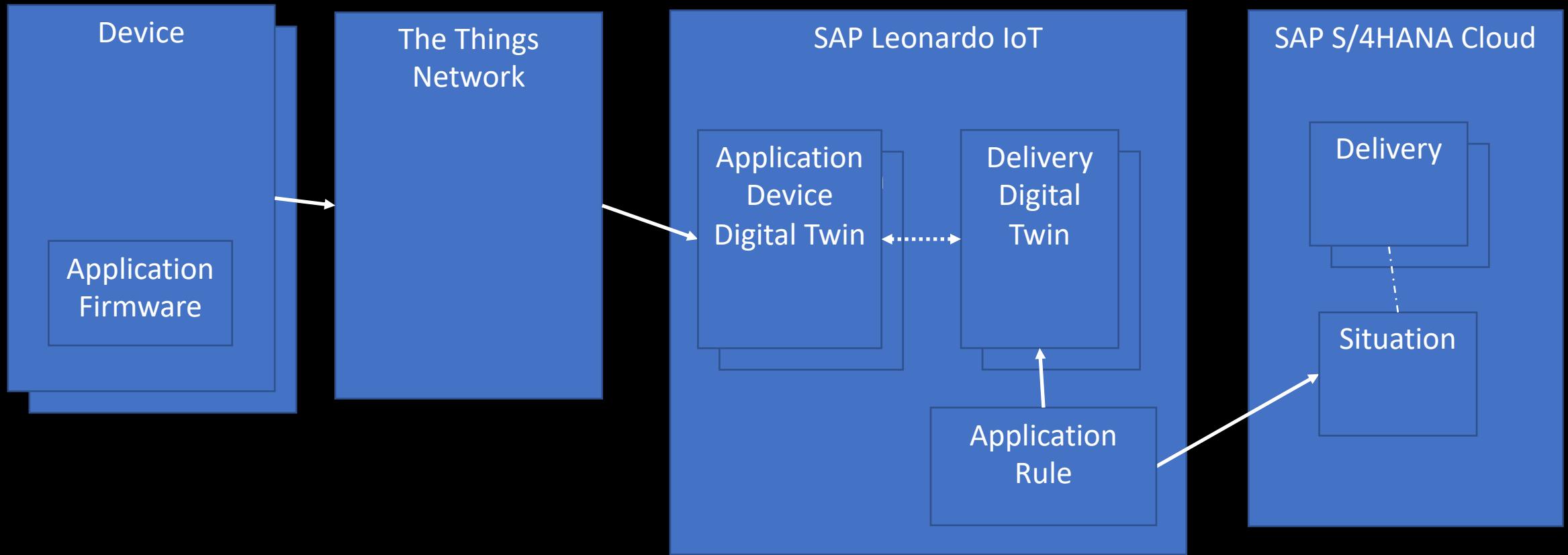


Possible Integration Scenario of The Things Network & SAP ERP to support Delivery Tracking

Marcus Behrens, Director Product Management, SAP SE

Architecture



Demo

The Things Network Console

console.thethingsnetwork.org/applications/com_sap_delivery_insights/data

THE THINGS CONSOLE
COMMUNITY EDITION

Applications Gateways Support marcusbehrens

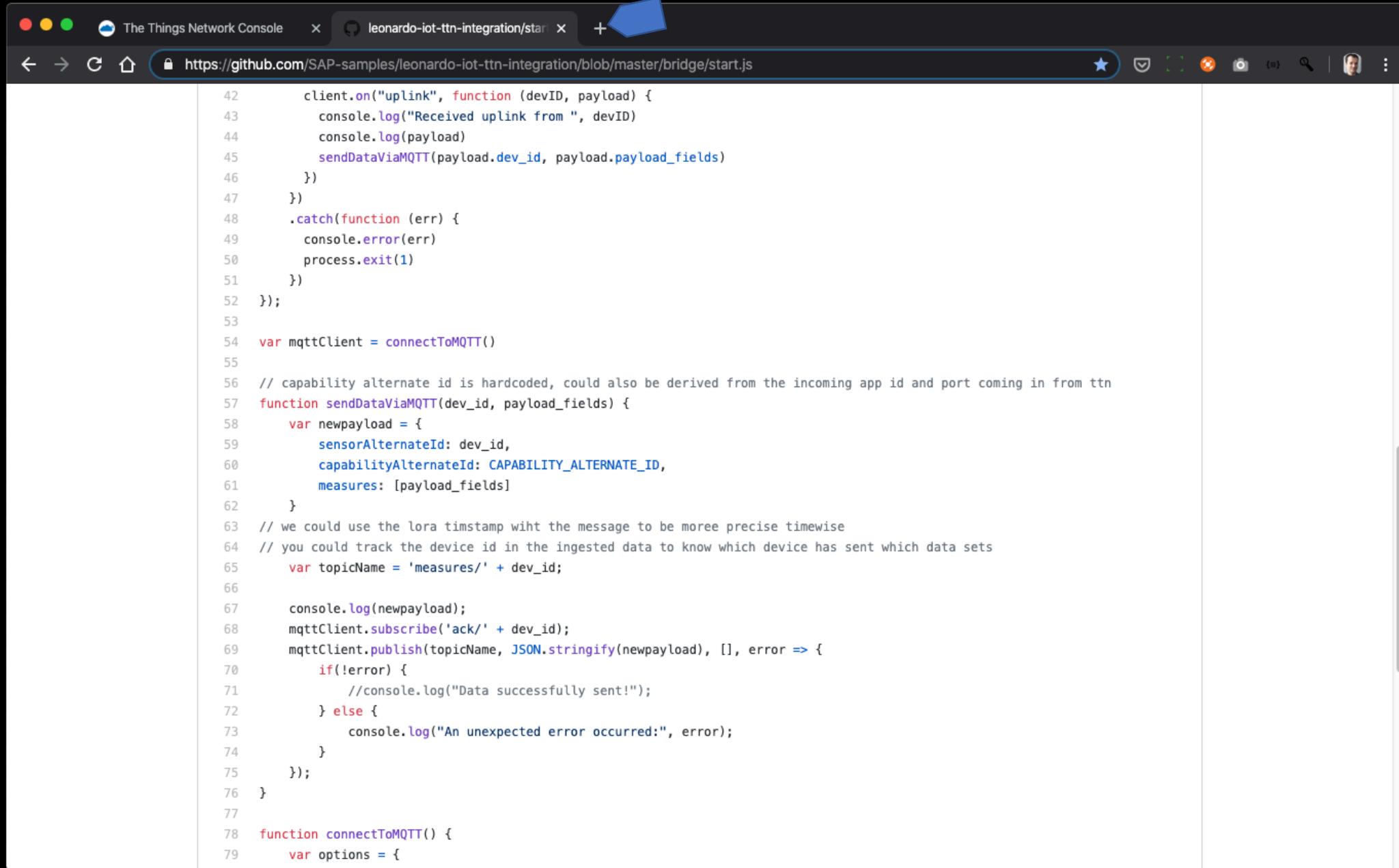
Applications > com_sap_delivery_insights > Data

Overview Devices Payload Formats Integrations **Data** Settings

APPLICATION DATA

Filters uplink downlink activation ack error

time	counter	port	dev id	payload	analog_in_4	luminosity_6	temp
▲ 11:09:09	6	2	eq007648	04 02 01 88 05 67 00 F8 06 65 00 3D	3.92	61	
▲ 11:03:39	5	2	eq007648	04 02 01 88 05 67 00 F8 06 65 00 3D	3.92	61	



The screenshot shows a web browser window with the title "The Things Network Console". The address bar displays the URL <https://github.com/SAP-samples/leonardo-iot-ttn-integration/blob/master/bridge/start.js>. A blue arrow icon is positioned in the top right corner of the browser window.

```
42     client.on("uplink", function (devID, payload) {
43         console.log("Received uplink from ", devID)
44         console.log(payload)
45         sendDataViaMQTT(payload.dev_id, payload.payload_fields)
46     })
47     .catch(function (err) {
48         console.error(err)
49         process.exit(1)
50     })
51 });
52 );
53
54 var mqttClient = connectToMQTT()
55
56 // capability alternate id is hardcoded, could also be derived from the incoming app id and port coming in from ttn
57 function sendDataViaMQTT(dev_id, payload_fields) {
58     var newpayload = {
59         sensorAlternateId: dev_id,
60         capabilityAlternateId: CAPABILITY_ALTERNATE_ID,
61         measures: [payload_fields]
62     }
63 // we could use the lora timestamp with the message to be more precise timewise
64 // you could track the device id in the ingested data to know which device has sent which data sets
65     var topicName = 'measures/' + dev_id;
66
67     console.log(newpayload);
68     mqttClient.subscribe('ack/' + dev_id);
69     mqttClient.publish(topicName, JSON.stringify(newpayload), [], error => {
70         if(!error) {
71             //console.log("Data successfully sent!");
72         } else {
73             console.log("An unexpected error occurred:", error);
74         }
75     });
76 }
77
78 function connectToMQTT() {
79     var options = {
```

The Things Network Console X | leonardo-iot-ttn-integration/start X | Home [Europe (Rot)] > iot-sand... X | Thing Modeler X | +

← → C ⌘ ⌘ https://account.hana.ondemand.com/cockpit/#/globalaccount/abf8ff85-obfuscatedguid-bab4117afcda/subaccount/bc0a9250-obfu-4b03-a... 18 Marcus Conrad

SAP Cloud Platform Cockpit

Overview Service Bindings Security User-Provided Variables Environment Variables Events Logs

Restart Start Instance Instance Delete

Application Routes

mqtrouterD039026.cfapps.eu10.hana.ondemand.com

Application Information

Instances: 1 of 1 running
Package Uploaded: 8 Jan 2020, 14:24:41 (GMT+01:00) (STAGED)
Buildpack: nodejs
Stack: Cloud Foundry Linux-based filesystem (Ubuntu 18.04) (cflinuxfs3)

Quota Information (per Instance)

Instance Memory Limit: 8192 MB
Memory Quota: 128 MB (available memory 2688 MB)
Disk Quota: 1024 MB

Change Quota

Instances

State	Since	CPU Usage	Memory Usage	Disk Usage
RUNNING	22 Jan 2020, 19:31:23 (GMT+01:00)	0%	53.3 MB	170.7 MB

Useful Links Legal Information

The Things Network Console | leonardo-iot-ttn-integration/start | Home [Europe (Rot)] > iot-sandbox | Home | Home | Home | +

iot-sandbox.leonardo-iot.cfapps.eu10.hana.ondemand.com/cp.portal/site#Shell-home

SAP Home ▾

Thing Engineer OData Custom Master Data IoT Rules and Actions Ingestion Error Location Management

Thing Modeler Modeling and Onboarding Thing Properties Catalog Grouping Properties Packages Defining Containers

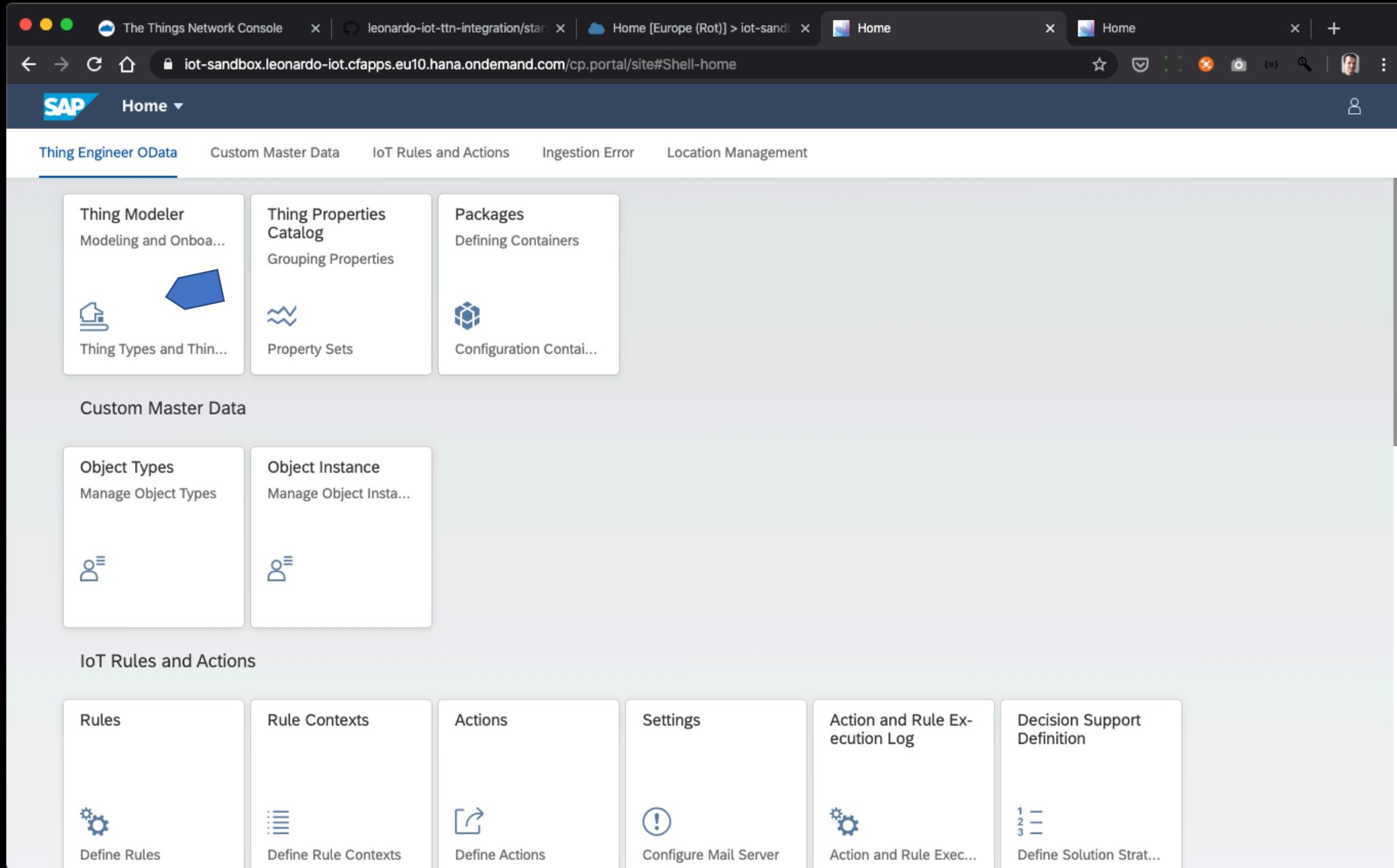
Thing Types and Thin... Property Sets Configuration Contai...

Custom Master Data

Object Types Manage Object Types Object Instance Manage Object Insta...

IoT Rules and Actions

Rules Define Rules Rule Contexts Define Rule Contexts Actions Define Actions Settings Configure Mail Server Action and Rule Execution Log Action and Rule Exec... Decision Support Definition Define Solution Strat...



The Things Network Console | leonardo-iot-ttn-integration/start | Home [Europe (Rot)] > iot-sandbox | Thing Modeler | +

[iot-sandbox.leonardo-iot.cfapps.eu10.hana.ondemand.com/cp.portal/site#ThingModel-manageThingModel&/packages/iot.sandbox.com....](#)

SAP Thing Modeler

com.sap.delivery.insights

Search

Thing Types (1) Things (1)

order1234

Alternate Name: order1234
order1234
Type: delivery

Basic Data (20) Measured Values (4) Calculated Values (0) Images (0) Connectivity (3)

Organizations: Thing Type: delivery

Location: 49 8 Authorization Group.*: TENANT_ROOT

Search

Property Sets / ...	Description	Value	Unit of Measure	Type	Length	Sensitivity Level
delivery_data				delivery_data		None
CUSTOM_ERID		10100001		String	127	
CUSTOM_ER_NAME		Inlandskunde...		String	127	
DELIVERY		8005973		String	127	
DELIVERY_ITEM		10		String	127	
HU_ID		1000000158		String	127	
MATERIAL		TG12		String	127	
MATERIAL_DESCRIPTION		Trad.Good 1...		String	127	

+ Save Cancel Delete Copy Thing Properties Catalog

The Things Network Console | leonardo-iot-ttn-integration/start | Home [Europe (Rot)] > iot-sandbox.com... | Thing Modeler

[iot-sandbox.leonardo-iot.cfapps.eu10.hana.ondemand.com/cp.portal/site#ThingModel-manageThingModel&/packages/iot.sandbox.com.../order1234](#)

SAP Thing Modeler

com.sap.delivery.insights

Search

Thing Types (1) Things (1)

order1234

Alternate Name: order1234
order1234
Type: delivery

Thing

order1234 (order1234)

Basic Data (20) Measured Values (4) Calculated Values (0) Images (0) Connectivity (3)

Provider: SAP Cloud Platform IoT Service for Cloud Foundry Environment

Sensor/Mapping Selection

Mapping: more_capability

ttn_env_tracker_type: eq007648

Thing Model or Device Model Mapping

Property Sets or Properties	Mapped	Device Property	Capability	Sensor Type	Actions
condition					
battery	←	analog_in_4	8a63246b-e96a-41fd-af7...	0417ebfb-01b3-4d1f-81...	(X)
luminosity	←	luminosity_6	8a63246b-e96a-41fd-af7...	0417ebfb-01b3-4d1f-81...	(X)
temperature	←	temperature_5	8a63246b-e96a-41fd-af7...	0417ebfb-01b3-4d1f-81...	(X)

+ ↑ ↓ ↴ Save Cancel Delete Copy Thing Properties Catalog

The Things Network Console | leonardo-iot-ttn-integration/start | Home [Europe (Rot)] > iot-sandbox | Thing Modeler

iot-sandbox.leonardo-iot.cfapps.eu10.hana.ondemand.com/cp.portal/site#ThingModel-manageThingModel&/packages/iot.sandbox.com....

Thing Modeler

com.sap.delivery.insights

Search

Thing Types (1) Things (1)

order1234

Alternate Name: order1234
order1234
Type: delivery

Thing

order1234 (order1234) Thing Type

Basic Data (20) Measured Values (4) Calculated Values (0) Images (0) Connectivity (3)

Search

Property Sets / ...	Description	Value	Unit of Measure	Type	Length	Sensitivity Level
condition				condition		None
battery		3.91	V	Float		
luminosity		51	lux	Integer		
temperature		24.1	°C	Float		

Status Values

Search

+ ↑ ↓ ↴

Save Cancel Delete Copy Thing Properties Catalog

The Things Network Console | leonardo-iot-ttn-integration/start | Home [Europe (Rot)] > iot-sandbox | Home | Home | Home | +

iot-sandbox.leonardo-iot.cfapps.eu10.hana.ondemand.com/cp.portal/site#Shell-home

SAP Home ▾

Thing Engineer OData Custom Master Data IoT Rules and Actions Ingestion Error Location Management

Thing Modeler Modeling and Onboa... Thing Properties Catalog Grouping Properties Packages Defining Containers

Thing Types and Thin... Property Sets Configuration Contai...

Custom Master Data

Object Types Manage Object Types Object Instance Manage Object Insta...

IoT Rules and Actions

Rules Define Rules Rule Contexts Define Rule Contexts Actions Define Actions Settings Configure Mail Server Action and Rule Execution Log Action and Rule Exec... Decision Support Definition Define Solution Strat...

The screenshot shows a web-based interface for managing IoT rules. The top navigation bar includes tabs for 'The Things Network Console', 'leonoardo-iot-ttn-integration/start', 'Home [Europe (Rot)] > iot-sandbox', 'Rules', and 'Home'. The main title is 'Rules' with a blue shield icon.

The page displays a rule titled 'too much light for thing'. The 'Definition' tab is selected, indicated by a dashed border around it. Other tabs include 'General Information' and 'Rule Context'.

Rule Context

Rule Context*: delivery_tracker_thing
Data Object: condition

Rule Editor

Left Rule (If condition.luminosity > 500, Then IoT_Event_Name: 'too much light', IoT_Event_Severity: 'Medium')

Right Rule (If condition.luminosity > 500, Then IoT_Event_Name: 'too much light', IoT_Event_Severity: 'Medium')

At the bottom right are buttons for 'Activate', 'Save', and 'Cancel'.

The Things Network Console | leonardo-iot-ttn-integration/start | Home [Europe (Rot)] > iot-sandbox | Home | Home | Home | +

iot-sandbox.leonardo-iot.cfapps.eu10.hana.ondemand.com/cp.portal/site#Shell-home

SAP Home ▾

Thing Engineer OData Custom Master Data IoT Rules and Actions Ingestion Error Location Management

Thing Modeler Modeling and Onboa... Thing Properties Catalog Grouping Properties Packages Defining Containers

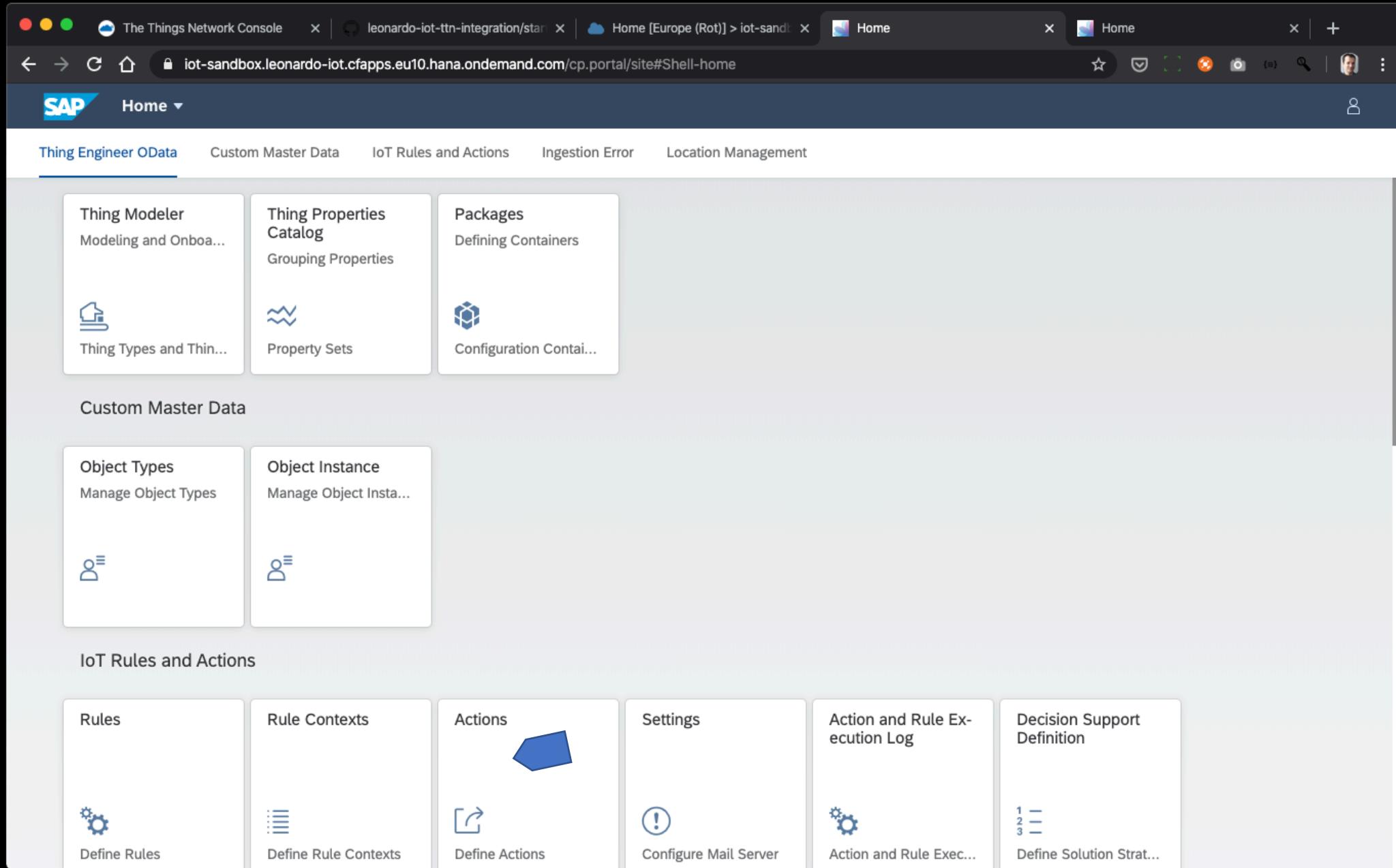
Thing Types and Thin... Property Sets Configuration Contai...

Custom Master Data

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IoT Rules and Actions

Rules Define Rules Rule Contexts Define Rule Contexts Actions Define Actions Settings Configure Mail Server Action and Rule Execution Log Action and Rule Exec... Decision Support Definition Define Solution Strat...



The Things Network Console | leonardo-iot-ttn-integration/start | Home [Europe (Rot)] > iot-sandbox | Actions | Home | +

iot-sandbox.leonardo-iot.cfapps.eu10.hana.ondemand.com/cp.portal/site#ActionModeler-Actions?sap-ui-app-id=hint=sap.appiot.ui.adm... | :star: | :link: | :green: | :camera: | :gear: | :magnifying-glass: | :person: | :

SAP Actions

Basic Information

Action Id: Obcc79c5ec1945a3ac62fd2277cdadaa

Name: * create situation for too much light

Description:

Status: Active

Triggered by: Event from Rule

Rule: * Rule - too much light for thing

Thing Type: iot.sandbox.com.sap.delivery.insights:delivery

Action Type: Service Integration

HTTP Information

Destination: * CC8

URL: https://my300470-api.s4hana.ondemand.com/sap/bc/http/sap/...

Request body: * Sample Payload

```
{  
    "alias": "IOT_S4_SIT_SO",  
    "guid": "1234",  
    "data": {  
        "device": {  
            "customerid": "${delivery_data.CUSTOMERID}",  
            "customer_name": "${delivery_data.CUSTOMER_NAME}",  
            "material": "${delivery_data.MATERIAL}",  
            "material_description": "${delivery_data.MATERIAL_DESCRIPTION}",  
            "delivery": "${delivery_data.DELIVERY}"  
        }  
    }  
}
```

Invocation Type: Auto

Method: POST

Trigger subsequent event:

Save Cancel

The Things Network Console | leonardo-iot-ttn-integration/start | Home [Europe (Rot)] > iot-sand... | Actions | Home | +

← → C ⌘ ⌘ my300470.s4hana.ondemand.com/ui#Shell-home

SAP Home ▾

My Home Message Monitoring Sales Orders Current Settings My Inbox Approvals Checks Analytics for Accounts Payable Advanced Compliance Reporting AR A > ▾

Manage Sales Orders 
2.67 K

Manage Situation Types
My Situations 110

Message Monitoring

Message Dashboard Assign Recipients to Users

Sales Orders

Manage Sales Orders Track Sales Orders Sales Order Fulfillment Sales Order Fulfillment Sales Order Fulfillment Sales Order Fulfillment

Resolve Issues Analyze Issues Issues in Next 7 Days Resolve Incomplete ...

Inlandeskunde DE 1	725
Inlandeskunde DE 3	599
Domestic Custom...	364

Overdue	2.99K
Due Today	3

2.67 K 3 K 280

The Things Network Console | leonardo-iot-ttn-integration/start | Home [Europe (Rot)] > iot-sand... | Thing Modeler | Manage Sales Orders +

my300470.s4hana.ondemand.com/ui#SalesOrder-manage&/?sap-iapp-state=AS7RCOKBSUM7RTV4I2GJPFPUL5MFIN0F9LRKC56S

SAP Manage Sales Orders ▾

Standard * ▾

Sales Order: =23395 X Sold-To Party: Customer Reference: Requested Delivery Date: Overall Status:

Document Date:

Adapt Filters (1) Go

Sales Orders (1) Standard ▾

<input type="checkbox"/> Sales Order	Sold-To Party	Customer Reference	Requested Delivery Date	Overall Status	Net Value	Document Date
23395	Inlandskunde DE 1 (10100001)	KF	11/26/2019	Completed	3,900.00 EUR	11/26/2019 >

https://my300470.s4hana.ondemand.com/ui

The Things Network Console | leonardo-iot-ttn-integration/start | Home [Europe (Rot)] > iot-sand... | Actions | Sales Order | +

← → C ⌂ 🔍 my300470.s4hana.ondemand.com/ui#SalesOrder-displayFactSheet?NAV_ORIGIN=NOTIF&SITNANCOBJTYPE=SalesOrder&SITNINSTAN... ☆ 🌐 🌈 📸 ⓘ 🔍 ⌂

Sales Order ▾

Standard Order 23395

Related Apps

Sold-To Party: Inlandskunde DE 1 (10100001) Overall Status: Completed Ovrl Delivery Status: Completed Approval Status: ◇ Not Relevant Net Value:

Rejection Status: Nothing Rejected Credit Status: Not Performed 3,900.00 EUR

General Information Items Business Partners Process Flow Workflow Log

Sales Area: Dom. Sales Org DE, Direct Sales, Product Division 00 Customer Reference: KF Document Date: 11/26/2019

Employee Responsible: Customer Ref. Date: Billing Block: ◇

Delivery Block: ◇

Items

Item	Product	Requested Quantity	Item Category	Requested Delivery Date	Overall Status	Rejection Status	Net Value
10	HIB vaccine (TG12)	1.000 EA	Standard Item (TAN)	11/26/2019	Completed	Nothing Rejected	3,900.00 EUR

Configuration: >

Business Partners

The Things Network Console | leonardo-iot-ttn-integration/start | Home [Europe (Rot)] > iot-sand... | Actions | Home | +

← → C ⌘ ⌘ my300470.s4hana.ondemand.com/ui#Shell-home

SAP Home ▾

My Home Message Monitoring Sales Orders Current Settings My Inbox Approvals Checks Analytics for Accounts Payable Advanced Compliance Reporting AR

Manage Sales Orders Manage Situation Types My Situations

2.67 K 110

Message Monitoring

Message Dashboard Assign Recipients to Users

Sales Orders

Manage Sales Orders Track Sales Orders Sales Order Fulfillment Sales Order Fulfillment Sales Order Fulfillment Sales Order Fulfillment

Resolve Issues Analyze Issues Issues in Next 7 Days Resolve Incomplete ...

Inlandeskunde DE 1	725
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Overdue	2.99K
Due Today	3

2.67 K 3 K 280

The Things Network Console | leonardo-iot-ttn-integration/start | Home [Europe (Rot)] > iot-sand... | Actions | Home | +

← → C ⌘ ⌘ my300470.s4hanacloud.com/ui#Shell-home

SAP Home ▾

My Home Message Monitoring Sales Orders Current Settings My Inbox Approvals Checks Analytics for Accounts Payable Advanced Compliance Reporting AR A > ▾

Manage Sales Orders Manage Situation Types My Situations

2.67 K 110

Message Monitoring

Message Dashboard Assign Recipients to Users

Sales Orders

Manage Sales Orders Track Sales Orders Sales Order Fulfillment Sales Order Fulfillment Sales Order Fulfillment Sales Order Fulfillment

Resolve Issues Analyze Issues Issues in Next 7 Days Resolve Incomplete ...

Inlandskunde DE 1	725
Inlandskunde DE 3	599
Domestic Custom...	364

Overdue	2.99K
Due Today	3

2.67 K 3 K 280

The Things Network Console | leonardo-iot-ttn-integration/start | Home [Europe (Rot)] > iot-sand... | Actions | Sales Order | +

console.thethingsnetwork.org/applications/com_sap_delivery_insights/data

THE THINGS CONSOLE
COMMUNITY EDITION

Applications Gateways Support marcusbehrens

Applications > com_sap_delivery_insights > Data

APPLICATION DATA

Filters: uplink (selected), downlink, activation, ack, error

time counter port

time	counter	port	dev id	payload	analog_in_4	luminosity_6	ter
▲ 12:15:03	18	2	eq007648	04 02 01 87 05 67 00 F0 06 65 00 10	3.91	16	term
▲ 12:09:34	17	2	eq007648	04 02 01 87 05 67 00 F1 06 65 03 CF	3.91	975	term
▲ 12:04:04	16	2	eq007648	04 02 01 87 05 67 00 F0 06 65 00 2E	3.91	46	term
▲ 11:58:35	15	2	eq007648	04 02 01 87 05 67 00 F0 06 65 00 30	3.91	48	term
▲ 11:53:05	14	2	eq007648	04 02 01 87 05 67 00 F1 06 65 00 33	3.91	51	term
▲ 11:42:06	12	2	eq007648	04 02 01 87 05 67 00 F2 06 65 00 38	3.91	56	term
▲ 11:36:37	11	2	eq007648	04 02 01 87 05 67 00 F3 06 65 00 3A	3.91	58	term
▲ 11:31:07	10	2	eq007648	04 02 01 87 05 67 00 F3 06 65 00 31	3.91	49	term

The Things Network Console | leonardo-iot-ttn-integration/start | Home [Europe (Rot)] > iot-sand... | Actions | Home | +

← → C ⌘ ⌘ my300470.s4hana.ondemand.com/ui#Shell-home

SAP Home ▾

My Home Message Monitoring Sales Orders Current Settings My Inbox Approvals Checks Analytics for Accounts Payable Advanced Compliance Reporting AR ↗

Manage Sales Orders Manage Situation Types My Situations

2.67 K 110

Message Monitoring

Message Dashboard Assign Recipients to Users

Sales Orders

Manage Sales Orders Track Sales Orders Sales Order Fulfillment Sales Order Fulfillment Sales Order Fulfillment Sales Order Fulfillment

Resolve Issues Analyze Issues Issues in Next 7 Days Resolve Incomplete ...

Inlandskunde DE 1	725
Inlandskunde DE 3	599
Domestic Custom...	364

Overdue	2.99K
Due Today	3

2.67 K 3 K 280

The Things Network Console | leonardo-iot-ttn-integration/start | Home [Europe (Rot)] > iot-sand... | Actions | Home

my300470.s4hana.ondemand.com/ui#Shell-home

SAP Home

My Home Message Monitoring Sales Orders Current Settings My Inbox Approvals Checks Analytics for

Manage Sales Orders Manage Situation Types My Situations

2.67 K 111

Message Monitoring

Message Dashboard Assign Recipients to Users

Sales Orders

Manage Sales Orders Track Sales Orders Sales Order Fulfillment Resolve Issues

2.67 K 3 K

Analyze Issues

Inlandskunde DE 1	725
Inlandskunde DE 3	599
Domestic Custom...	364

Sales Order Fulfillment Issues in Overdue Due Today

By Date By Type By Priority

Temperature outside permissible range

Material Trad.Good 12,Reorder Point,Reg.Trad. (TG12) of Delivery 8005973 is outside its permissible temperature range. Max. permitted temperature is 500 lux, measured temperature is 975 lux.

7 minutes ago Show Less

Errors occurred in output processing.

Output item processing resulted in 102 errors

13 minutes ago

An error with error guid 00000000247441200000000000000000...

1 hour ago Show More

Sales Contract Fulfillment Rate Is Low

The validity period of sales contract 0040000883 has elapsed by 83.56%, but only 18.18% of its...

17 hours ago Show More

Sales Contract Fulfillment Rate Is Low

The validity period of sales contract 0040000924 has elapsed by 97.89%, but only 0.00% of its...

https://my300470.s4hana.ondemand.com/ui

The Things Network Console | leonardo-iot-ttn-integration/start | Home [Europe (Rot)] > iot-sand... | Actions | Sales Order | +

← → C ⌂ 🔍 my300470.s4hana.ondemand.com/ui#SalesOrder-displayFactSheet?NAV_ORIGIN=NOTIF&SITNANCOBJTYPE=SalesOrder&SITNINSTAN... ☆ 🌐 🌈 📸 ⓘ 🔍 ⌂

SAP Sales Order ▾

Standard Order 23395 Related Apps ↗

Sold-To Party: Inlandskunde DE 1 (10100001) Overall Status: Completed Ovrl Delivery Status: Completed Approval Status: ◇ Not Relevant Net Value:

Rejection Status: Nothing Rejected Credit Status: Not Performed 3,900.00 EUR

Situations General Information Items Business Partners Process Flow Workflow Log

⚠ Temperature outside permissible range
1 hour ago
In Item 000010, the sensor attached to Handling Unit 1000000158 of Delivery 8005973 reported: The threshold of 500 lux was exceeded. The actual value is 975 lux.

Dismiss Situation

General Information

Sales Area: Dom. Sales Org DE, Direct Sales, Product Division 00	Customer Reference: KF	Document Date: 11/26/2019
Employee Responsible:	Customer Ref. Date:	Billing Block: ◇
		Delivery Block: ◇

Items

Data and Process Mapping

Step 1: TTN Node & SAP ERP running in parallel

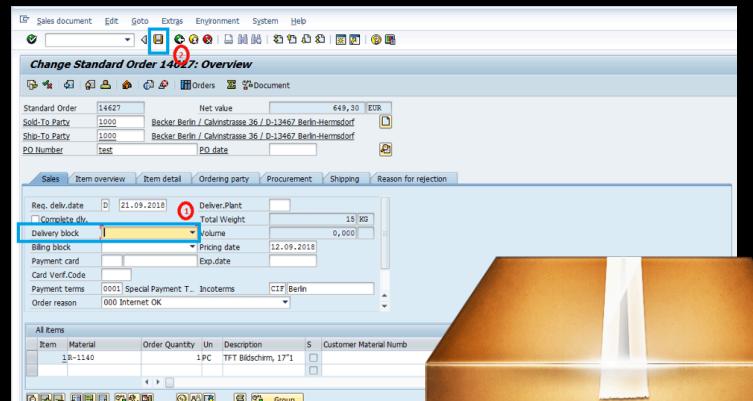
TTN

Device ID: EQ007648
analog_in_4: 4.2
temperature_5: 16.0
luminosity_6: 0



SAP ERP

Delivery ID: 9874
Order ID: TA1235
Material Type:
Artificial Heart



Step 2: TTN Node registered in SAP Leonardo IoT

TTN	SAP Leonardo IoT	SAP ERP
Device ID: EQ007648 analog_in_4: 4.1 temperature_5: 16.0 luminosity_6: 0	<i>Device ID: EQ007648</i> <i>analog_in_4: 4.1</i> <i>temperature_5: 16.0</i> <i>luminosity_6: 0</i>	Delivery ID: 9874 Order ID: TA1235 Material Type: Artificial Heart

Step 3: Digital Twin for Delivery is Created

TTN

Device ID: EQ007648
analog_in_4: 4.0
temperature_5: 16.0
luminosity_6: 0

SAP Leonardo IoT

*Device ID: EQ007648
analog_in_4: 4.0
temperature_5: 16.0
luminosity_6: 0*

SAP ERP

Delivery ID: 9874
Order ID: TA1235
Material Type:
Artificial Heart



*Delivery ID: 9874
Order ID: TA1235
Material Type: Artificial Heart
battery null
temperature null
luminosity null*

Step 4: Delivery is mapped to Tracking Device

TTN

Device ID: EQ007648
analog_in_4: 3.9
temperature_5: 16.5
luminosity_6: 10

SAP Leonardo IoT

*Device ID: EQ007648
analog_in_4: 3.9
temperature_5: 16.5
luminosity_6: 10*

SAP ERP

Delivery ID: 9874
Order ID: TA1235
Material Type:
Artificial Heart



mapping started January 31 9:15:12

*Delivery ID: 9874
Order ID: TA1235
Material Type: Artificial Heart
battery 3.9 (max 3.9)
temperature 16.5 (max 16.5)
luminosity 10 (max 10)*



Step 5: Tracking Device sends Data and Leonardo IoT monitors it in business context

TTN

Device ID: EQ007648
analog_in_4: 3.8
temperature_5: 32.0
luminosity_6: 10

SAP Leonardo IoT

*Device ID: EQ007648
analog_in_4: 3.8
temperature_5: 32.0
luminosity_6: 10*

SAP ERP

Delivery ID: 9874
Order ID: TA1235
Material Type:
Artificial Heart

mapping started January 31 9:15:12

Delivery ID: 9874

Order ID: TA1235

Material Type: Artificial Heart

battery 3.8 (max 3.9)

temperature 32.0 (max 32.0)

luminosity 10 (max 10)



Step 6: Delivery is done, Mapping is removed (evtl. returns process and then Step 3)

TTN

Device ID: EQ007648
analog_in_4: 3.7
temperature_5: 18.0
luminosity_6: 10

SAP Leonardo IoT

*Device ID: EQ007648
analog_in_4: 3.7
temperature_5: 18.0
luminosity_6: 10*

SAP ERP

Delivery ID: 9874
Order ID: TA1235
Material Type:
Artificial Heart



*Delivery ID: 9874
Order ID: TA1235
Material Type: Artificial Heart
battery 3.7 (max 3.9)
temperature 18.0 (max 32.0)
luminosity 10 (max 10)*



Data Mapping Overview (Master/Copy)

TTN Device

Device ID
analog_in_4
temperature_5
luminosity_6

SAP Leonardo IoT

Device ID
analog_in_4
temperature_5
luminosity_6

SAP ERP

Delivery ID
Order ID
Material Type

Mapping of Device to Delivery

Delivery ID

Order ID

Material Type

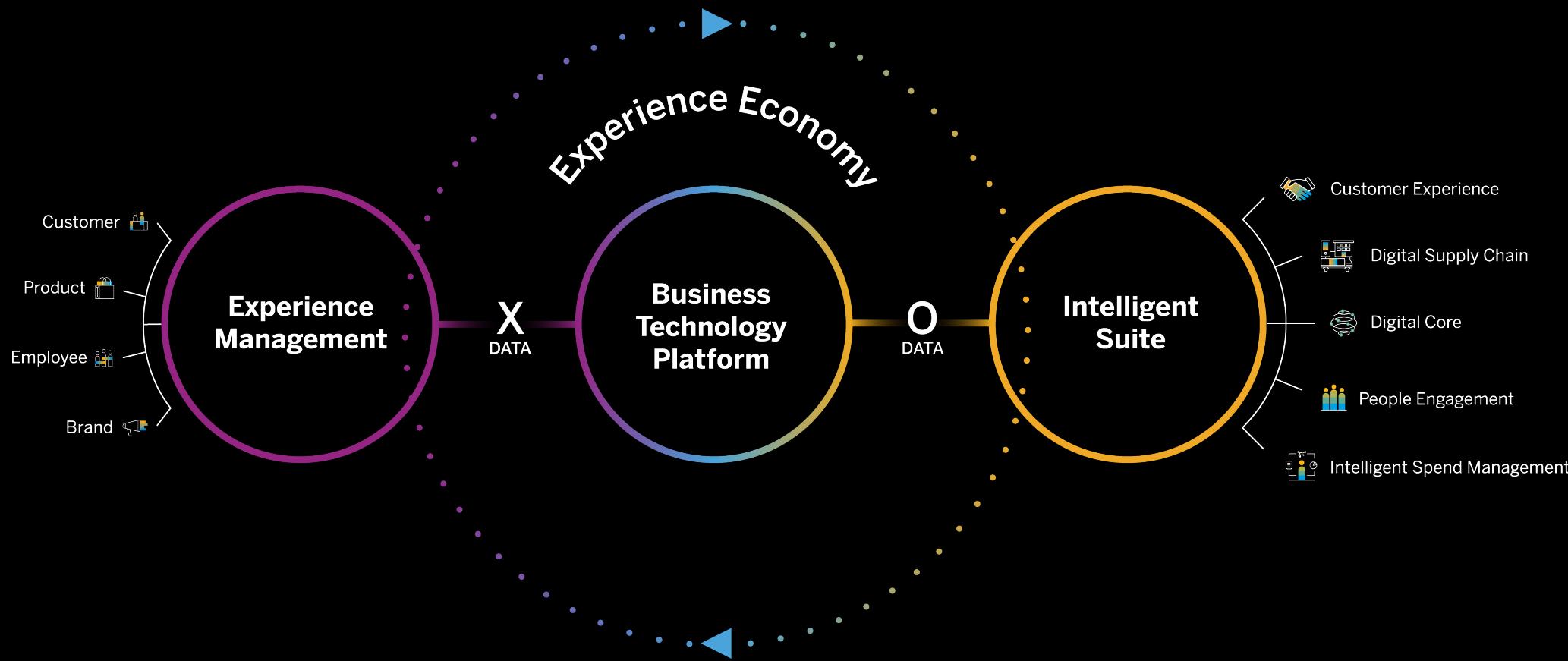
battery (max, min, avg)
temperature (max, min, avg)
luminosity (max, min, avg)

Process for Delivery Tracking

1. No Integration, ERP and tracking device system are used independently
2. Tracking Device is onboarded in TTN, Device ID in TTN maps to logical device in SAP Leonardo IoT, device might also be registered in SAP ERP for maintenance as an Equipment
3. Delivery is scheduled in SAP ERP, Delivery is replicated into SAP Leonardo IoT to act as the „Digital Twin“
4. Digital Delivery is mapped to the tracking device in use
5. Device sends data, Leonardo IoT stores data and its rules check for threshold breach and evtl trigger issue to be addressed in ERP
6. Delivery is completed and mapping is removed

SAP's Products and SAP's IoT Platform

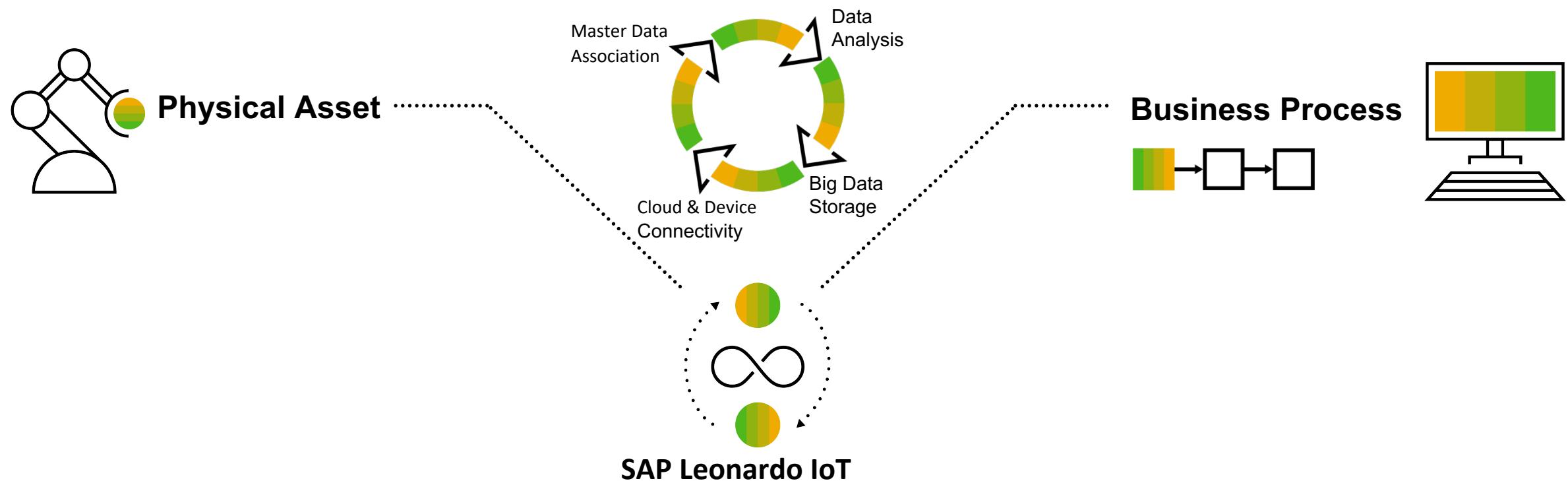
SAP: 400000 B2B customers/180 countries
100000 employees/140 countries - 27 billion € revenue



SAP Leonardo IoT – Turn signals into contextual data

Convert sensor information into business insight

SAP Leonardo IoT enables the harmonization and transformation of raw sensor data into business insights by associating it with business context and converting it into usable information



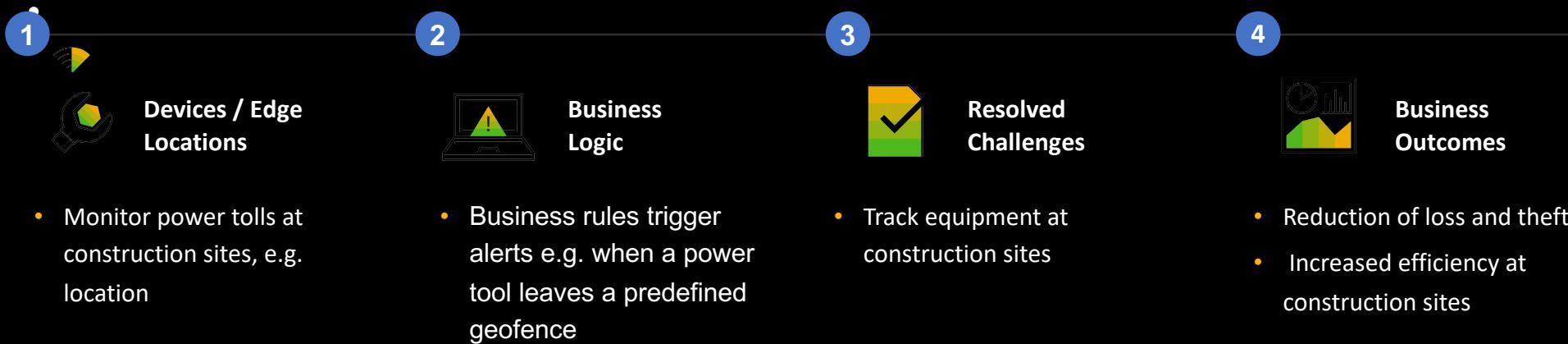
Customer Examples
(where the integration with The
Things Network would be
applicable)

Hilti - A Manufacturer of Power Tools

SAP Leonardo IoT Customer solves a billion dollar construction problem



- Based on SAP Leonardo IoT, Hilt developed an application to keep track of equipment at construction sites



Company Profile:

Industry: Manufacturer

Headquarter: Lichtenstein

Size: Large Enterprise

Solutions:

SAP Leonardo IoT

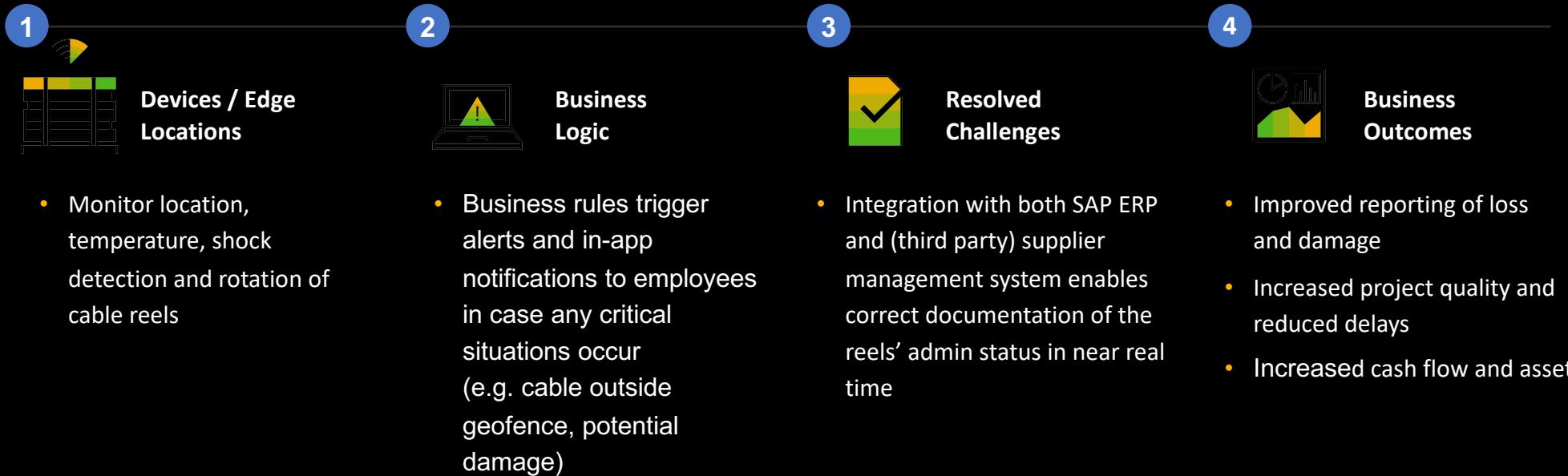
https://www.sap.com/about/customer-involvement/customer-stories/finder.html?sort=latest_desc&search=Hilti

Proximus - A Belgian Telecommunications Company

SAP Leonardo IoT Customer gaining insights into inventory



- Track cable reels from warehouse to installation site with an IoT sensor-based smart application



15% decrease in inventory level

2-3 years Anticipated ROI

https://www.sap.com/about/customer-involvement/customer-stories/finder.html?sort=latest_desc&search=Proximus

Company Profile:

Industry: Telco

Headquarter: Belgium

Size: Large Enterprise

Solutions:

SAP Leonardo IoT

SAP Fiori

SAP Cloud Platform

More Information

<https://github.com/SAP-samples/leonardo-iot-ttn-integration>

<https://community.sap.com/topics/internet-of-things>

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