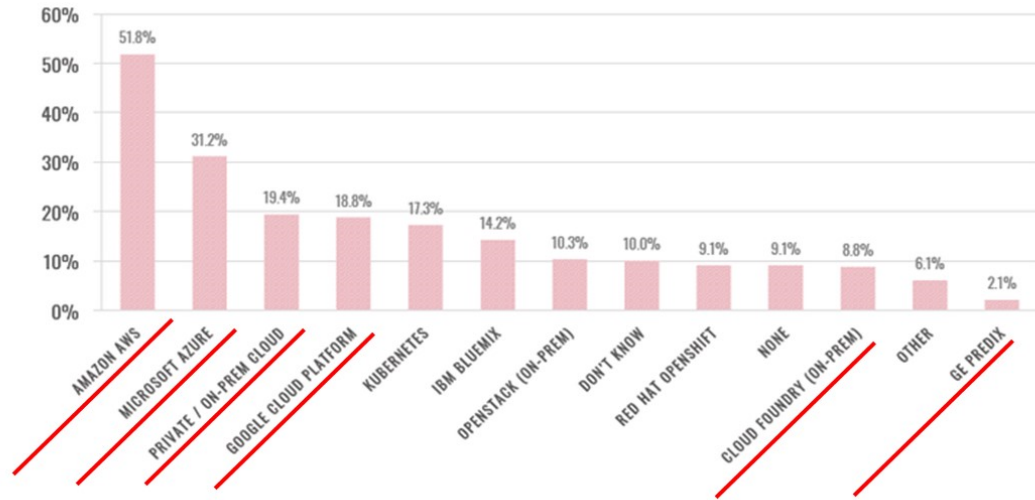


Chapter 1: Introduction to Industrial IoT

CLOUD SERVICES FOR IOT

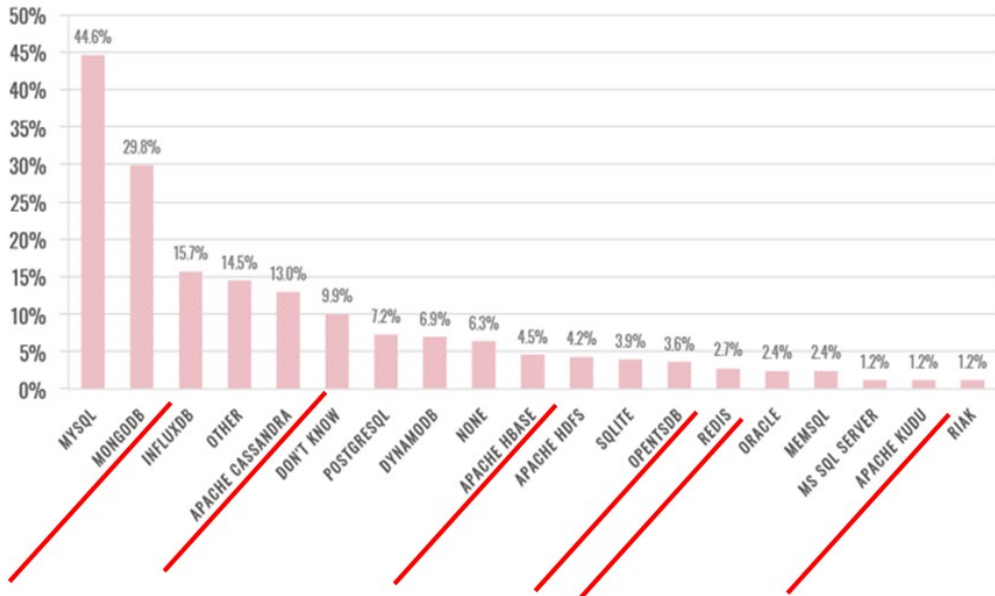
Do you use, or plan to use, any of the following cloud service offerings for implementing your IoT solution?



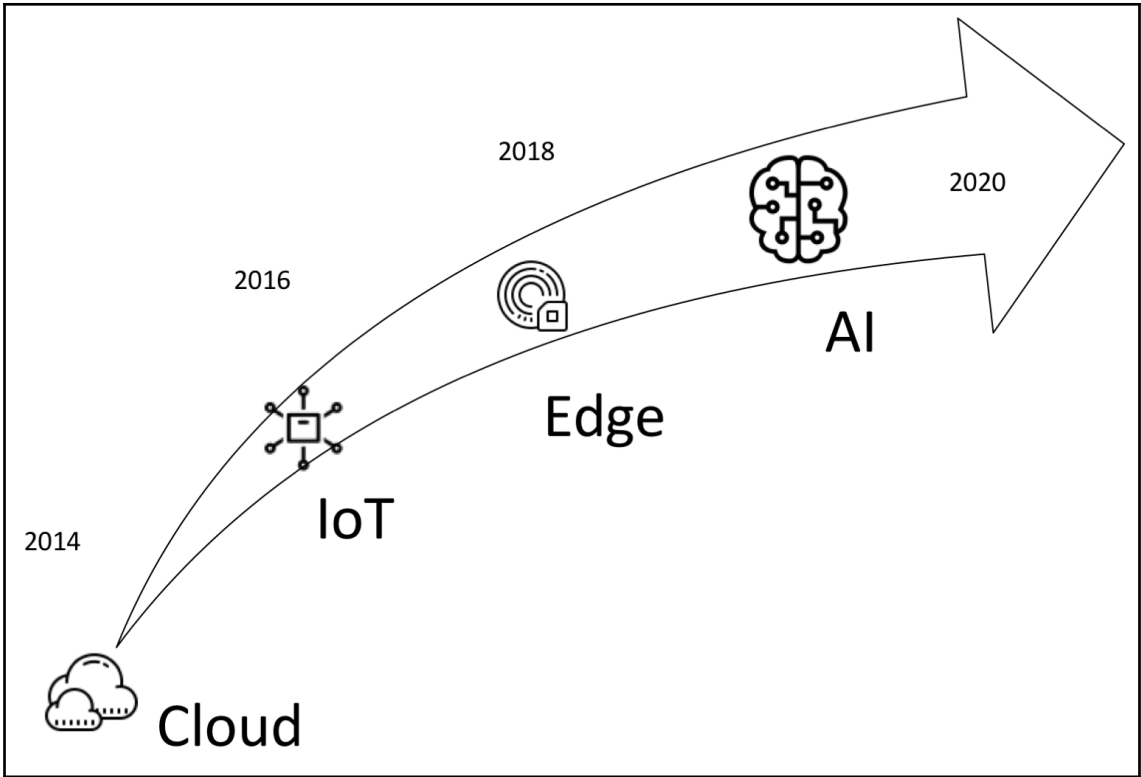
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IoT DATABASES

Which of the following database technologies do you use in your IoT solution?



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The Fourth Industrial Revolution

First Industrial Revolution

- Introduction of mechanical production tools



1780:
First loom powered by steam

Second Industrial Revolution

- Labor organization, mass production, use of electricity



1870:
First assembly line

Third Industrial Revolution

- First step regarding automation, with electronics and computer science entering companies



1970:
First PLCs

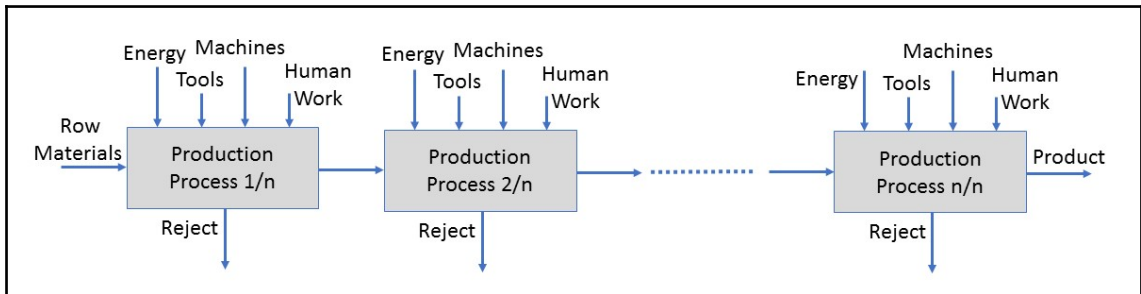
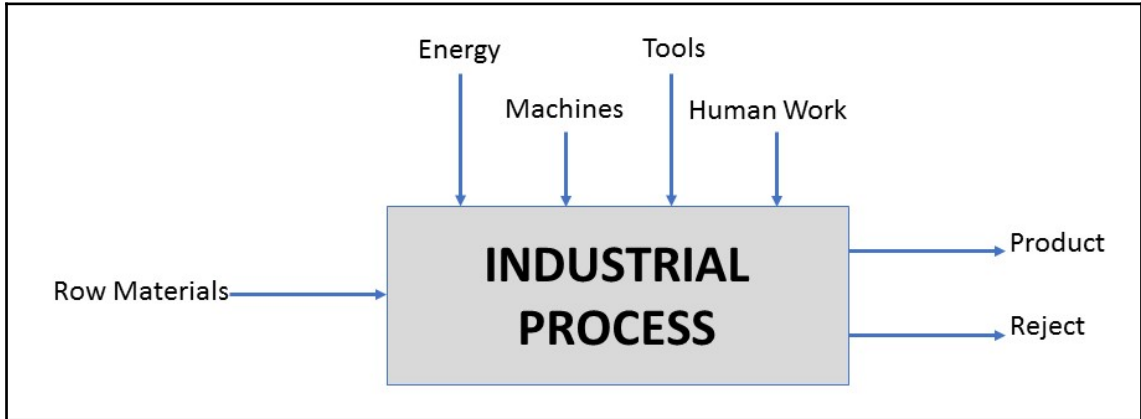
Fourth Industrial Revolution

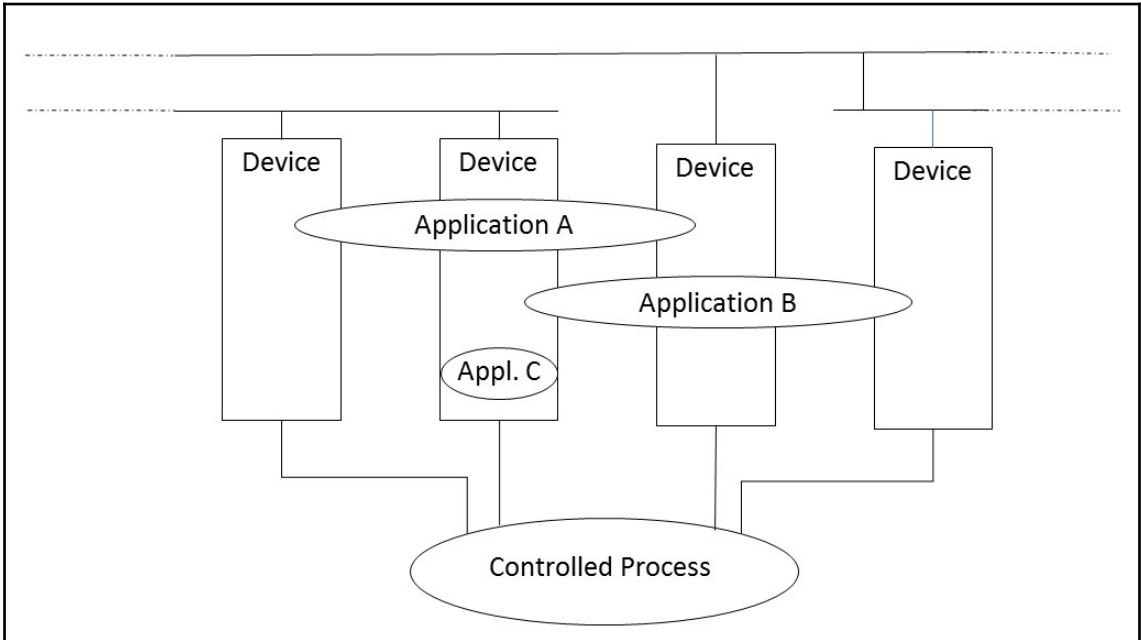
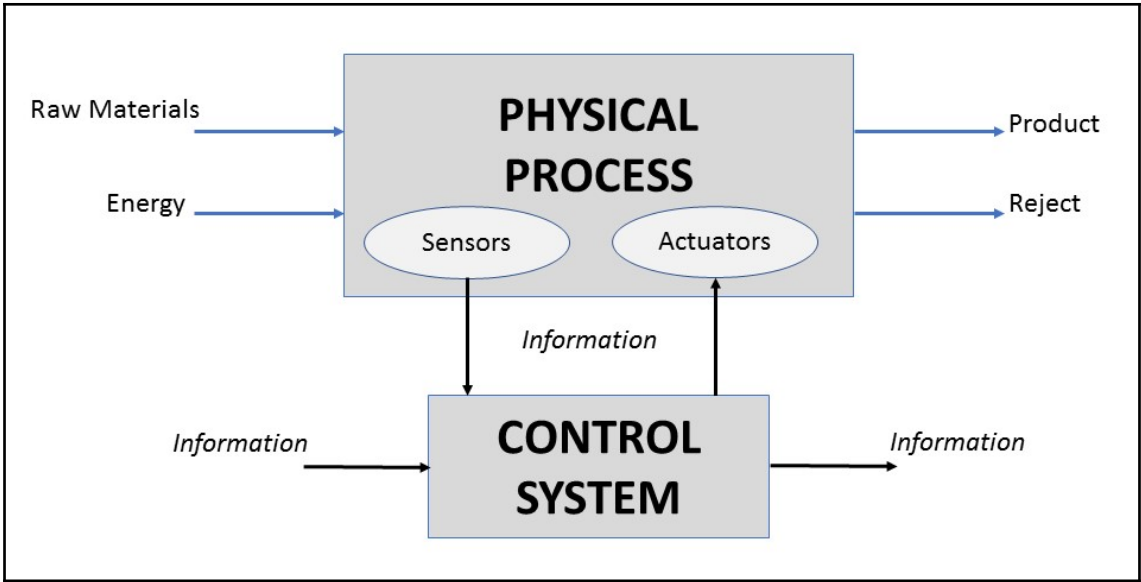
- Interconnected products and services thanks to the new digital technologies

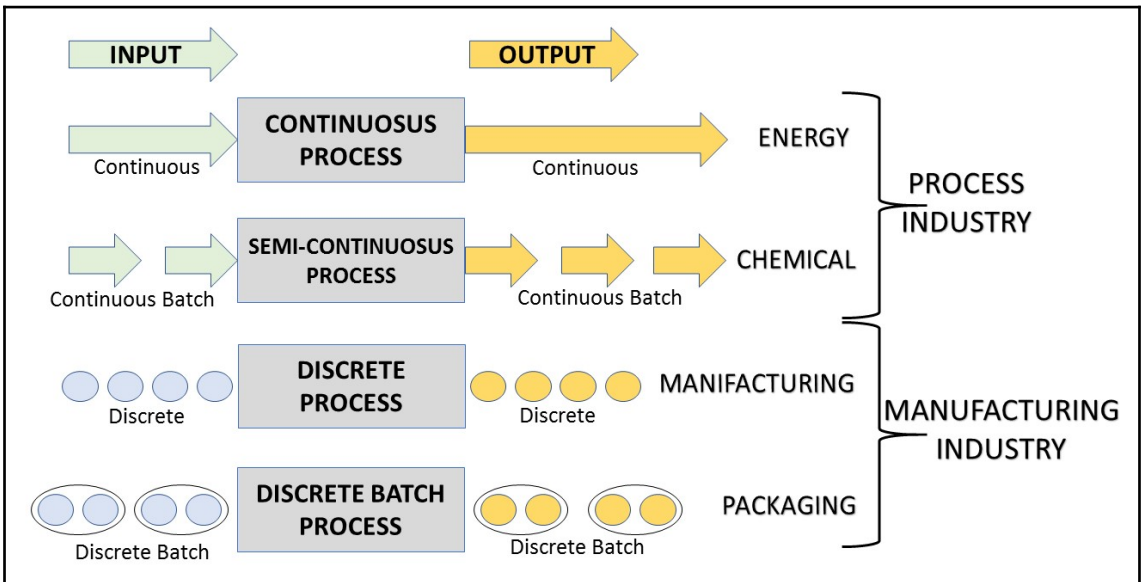
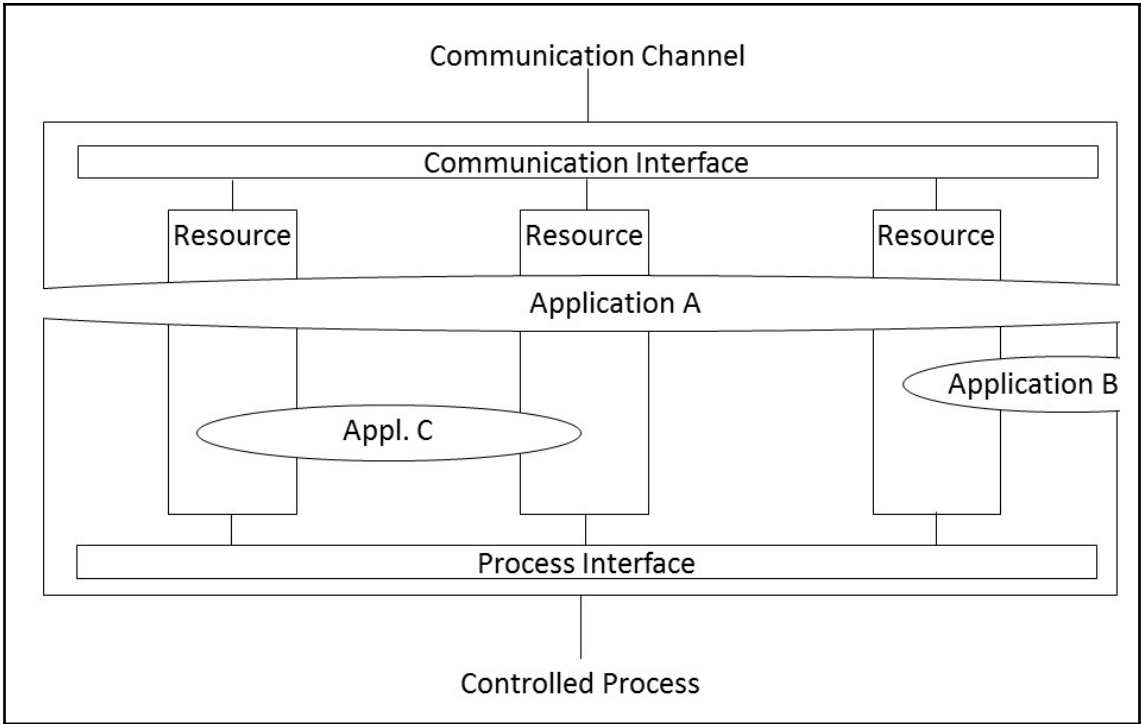


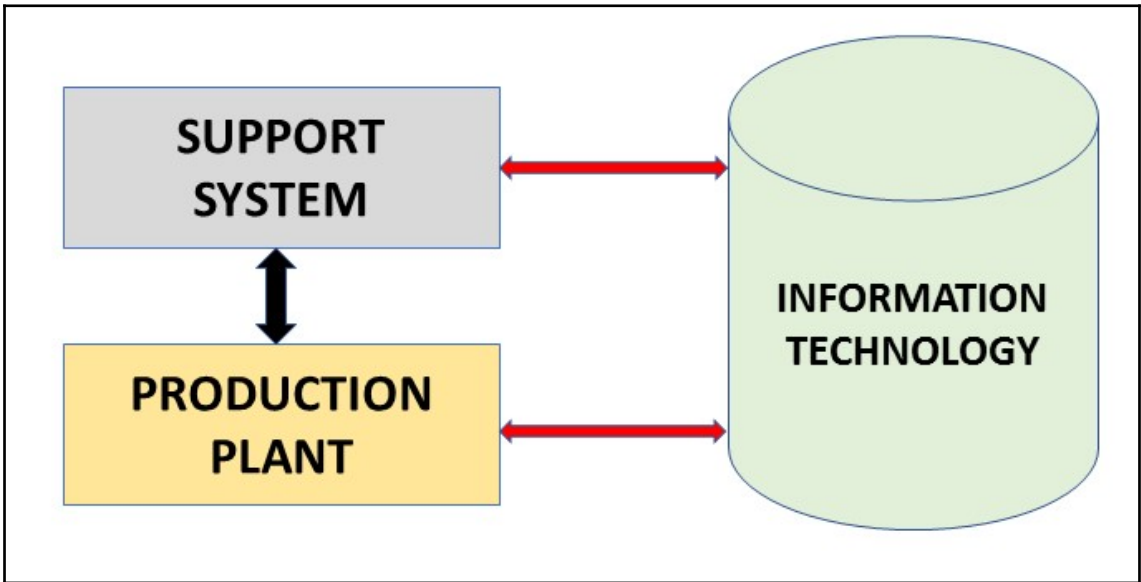
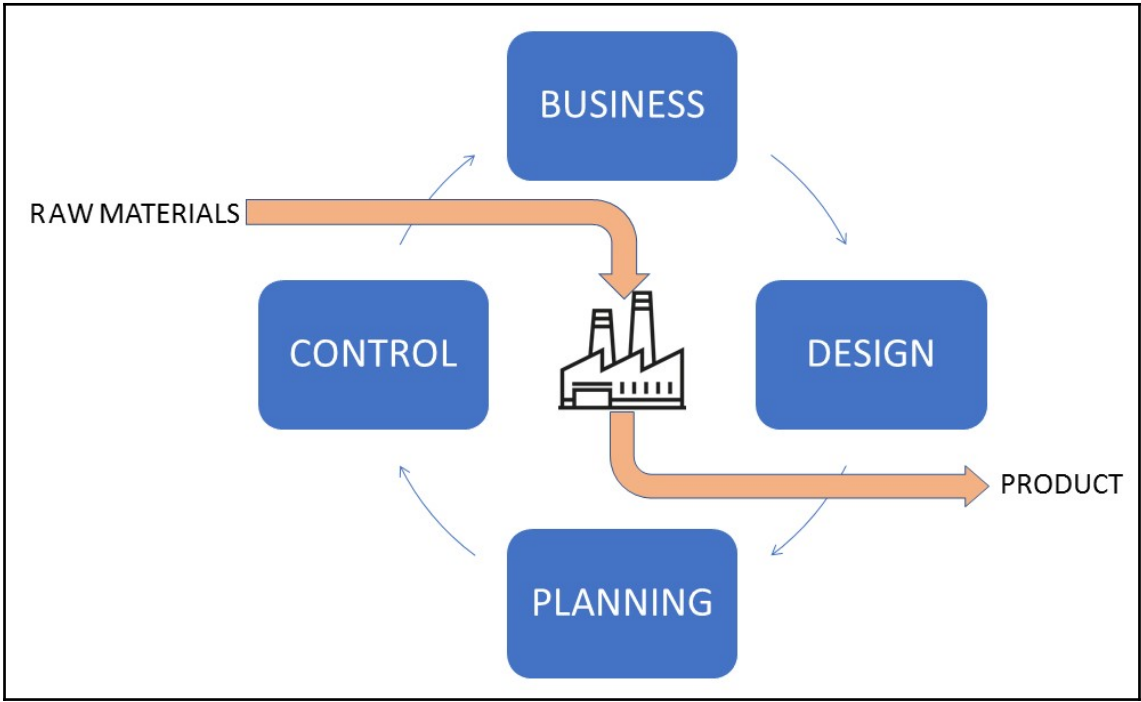
2011:
First appearance of "Industry 4.0"

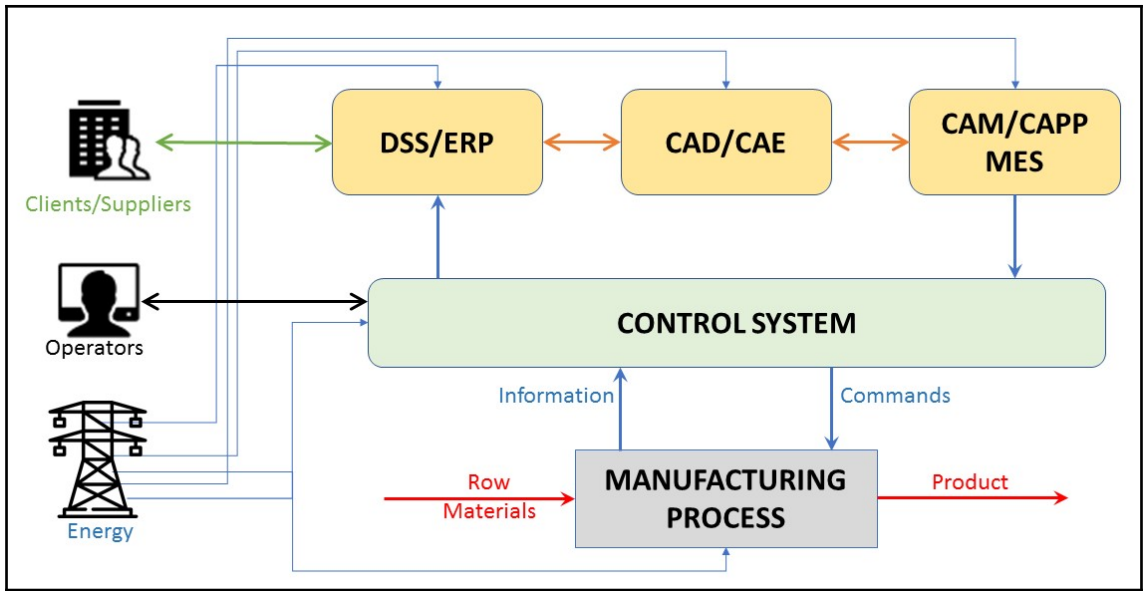
Chapter 2: Understanding the Industrial Process and Devices

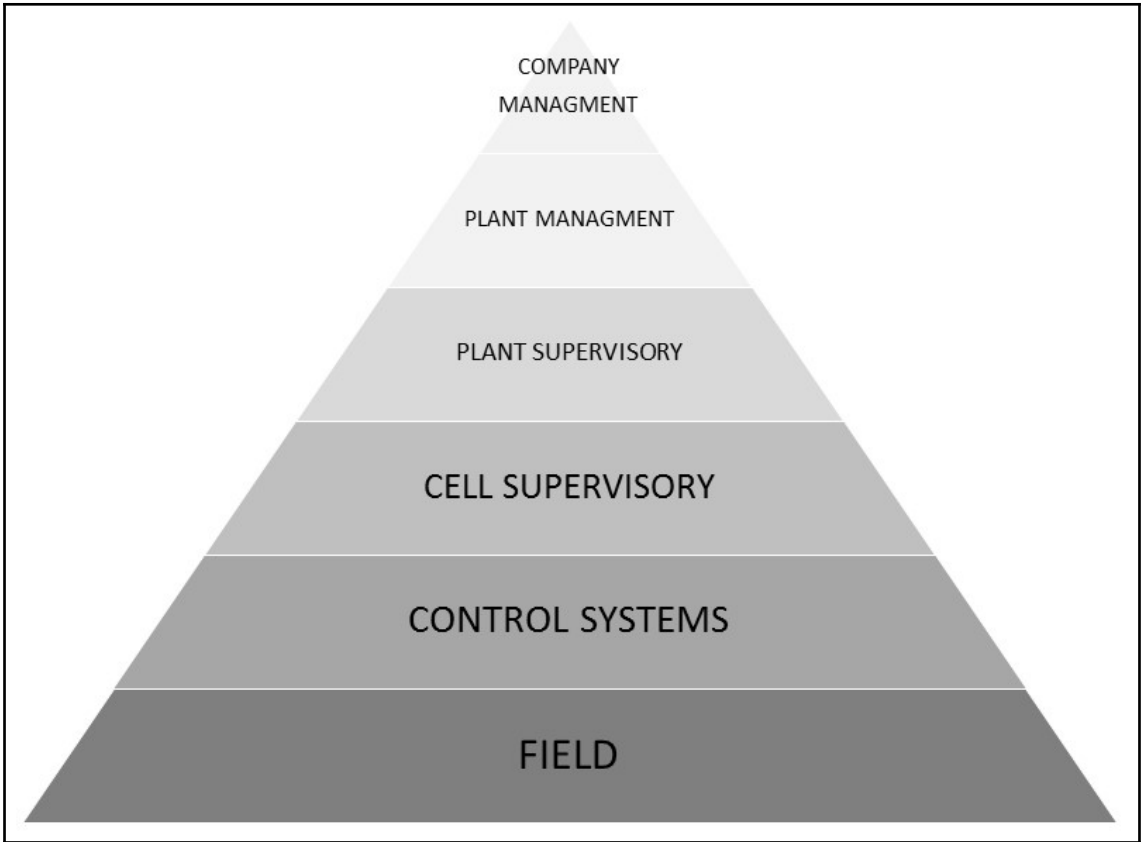


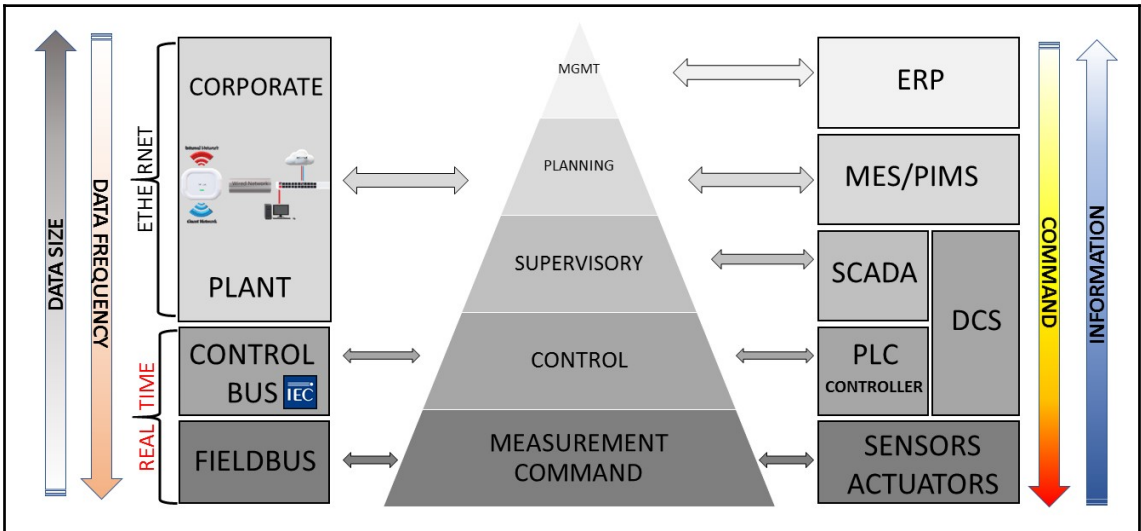
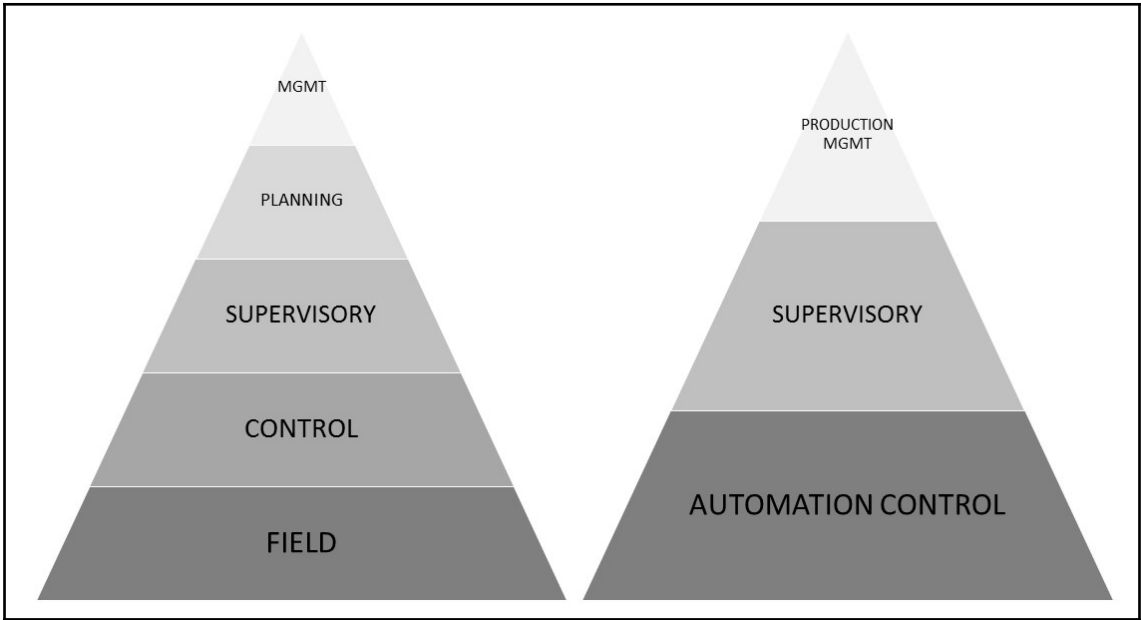


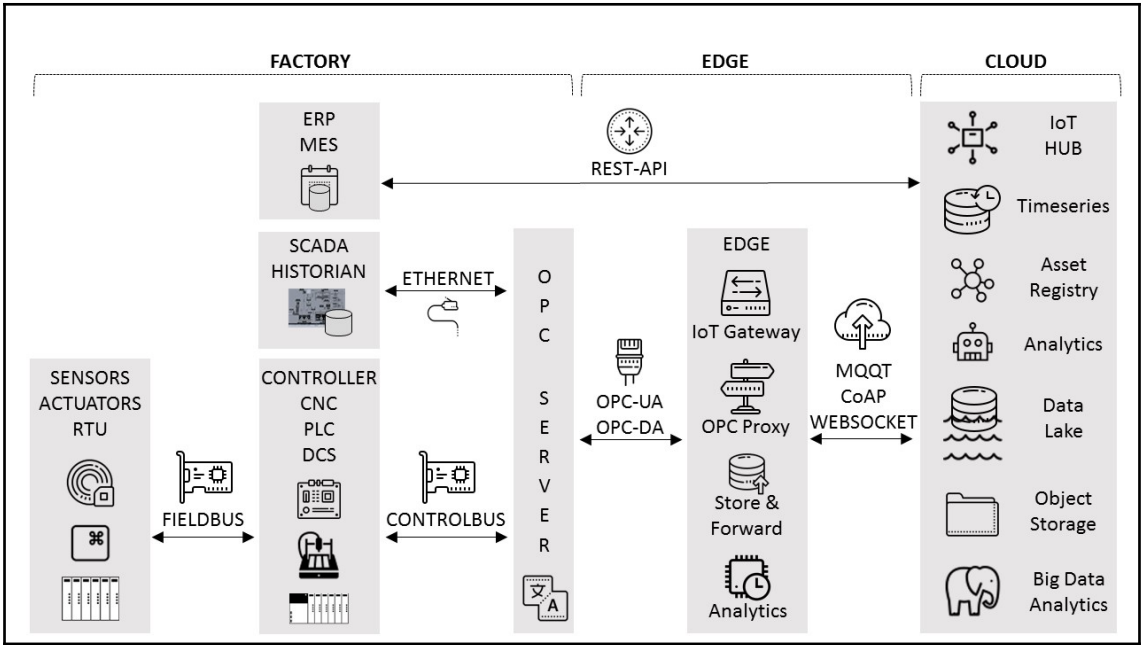




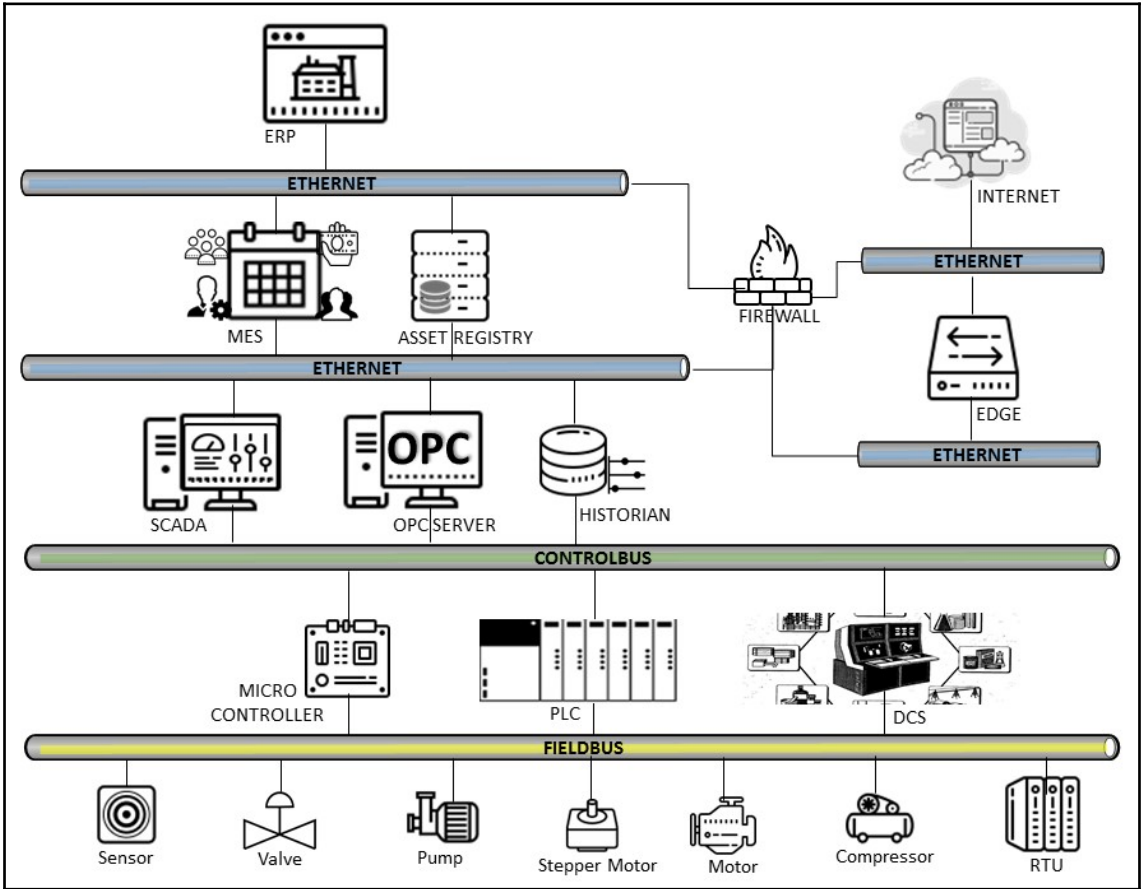


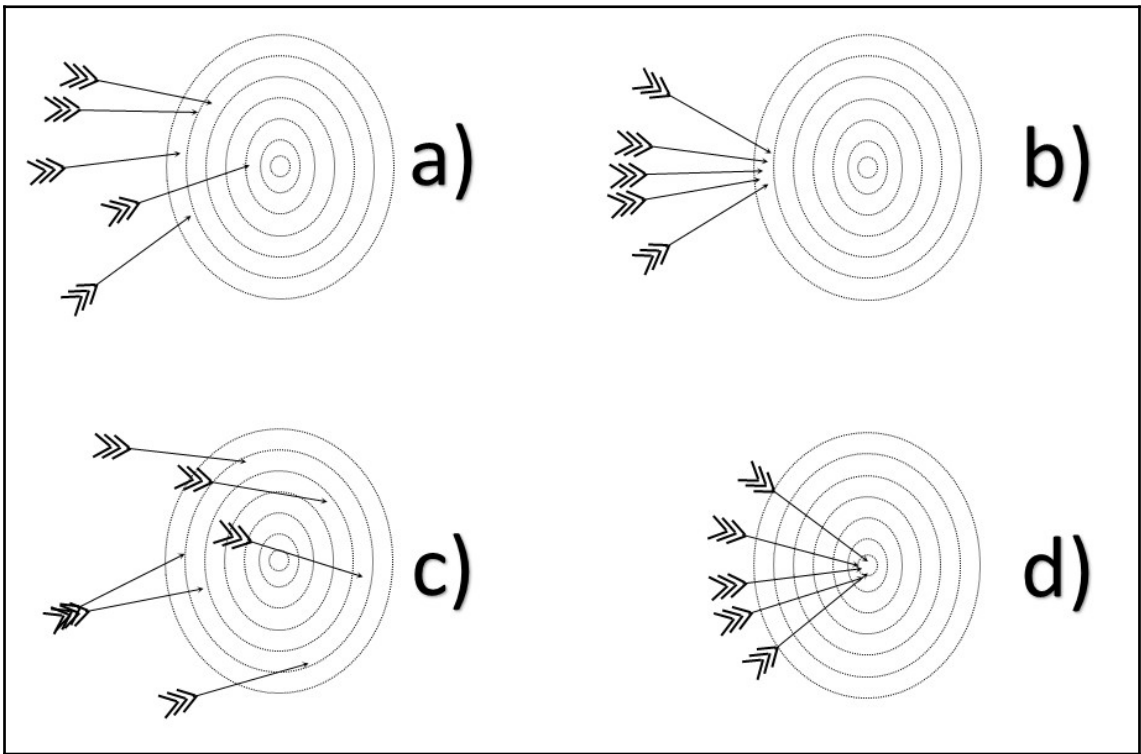
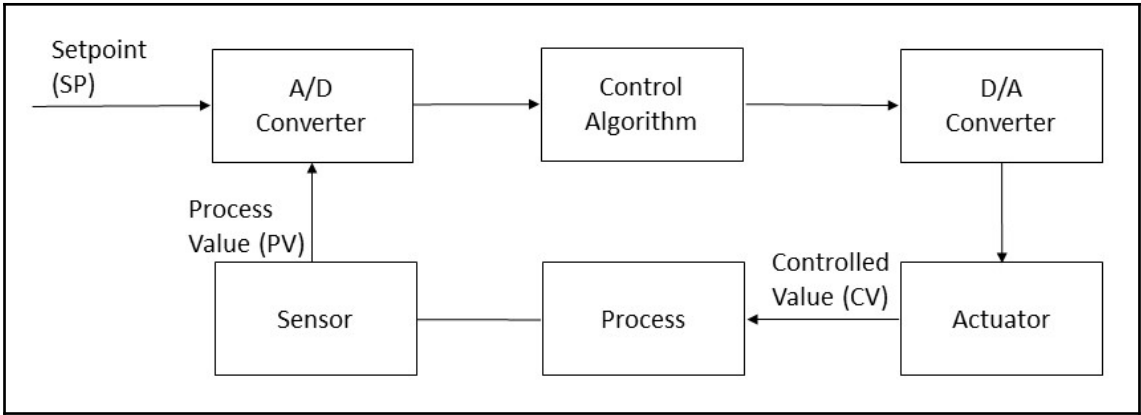


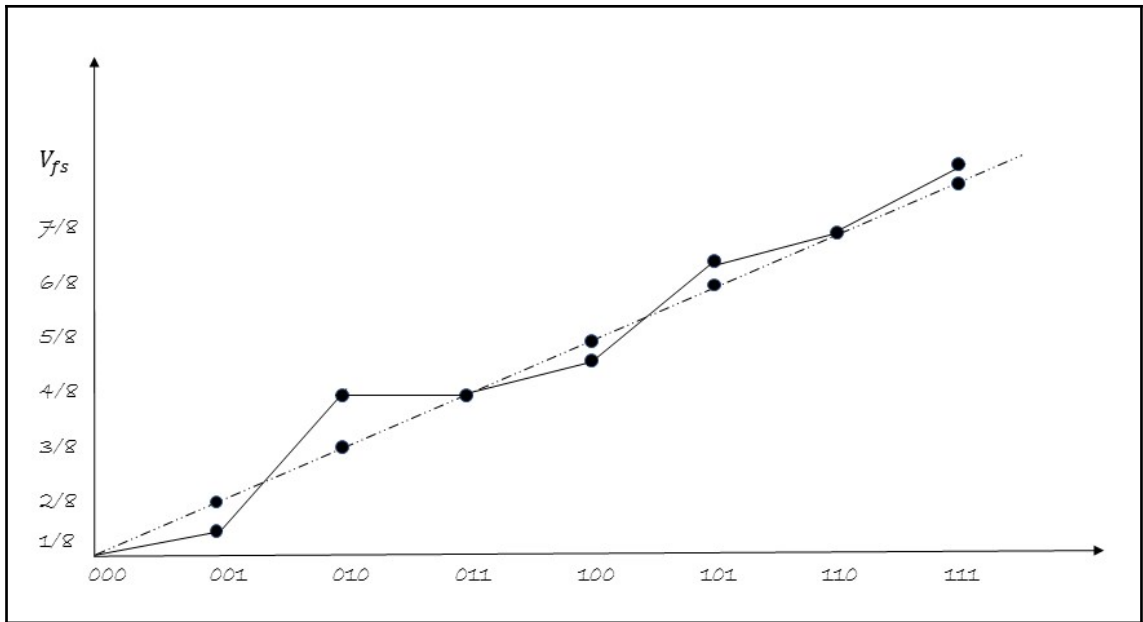


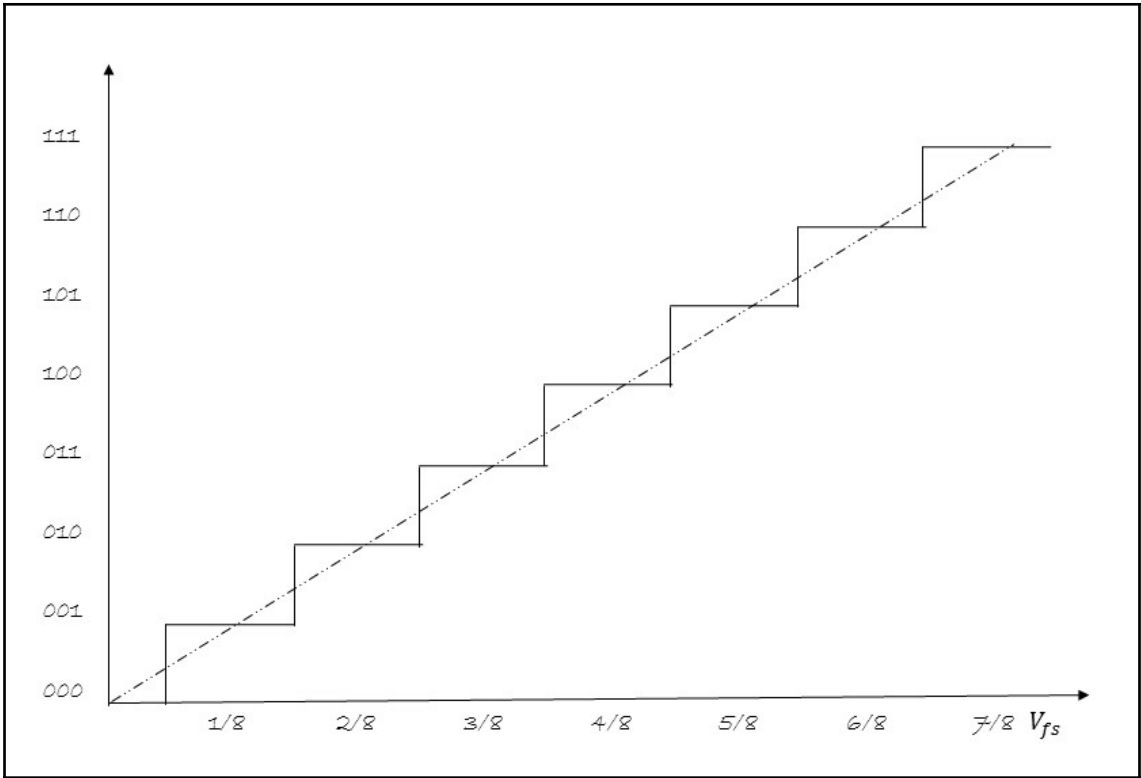


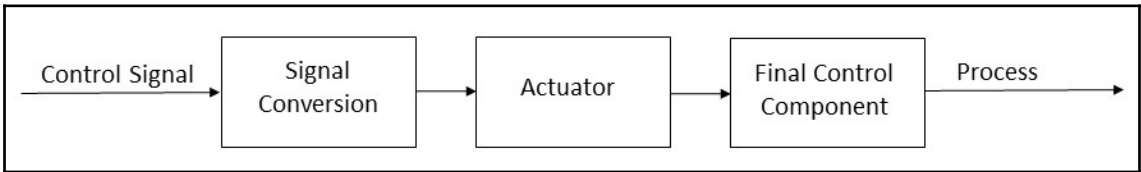
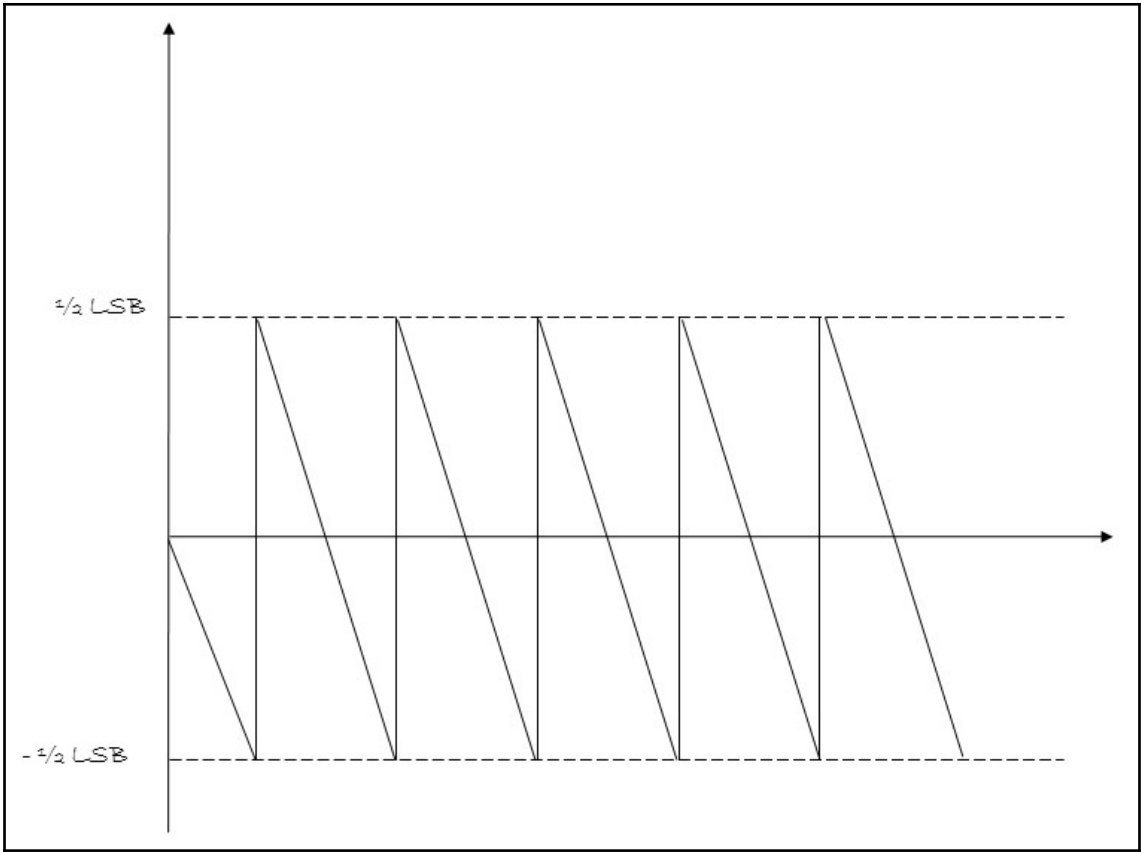
Chapter 3: Industrial Data Flow and Devices





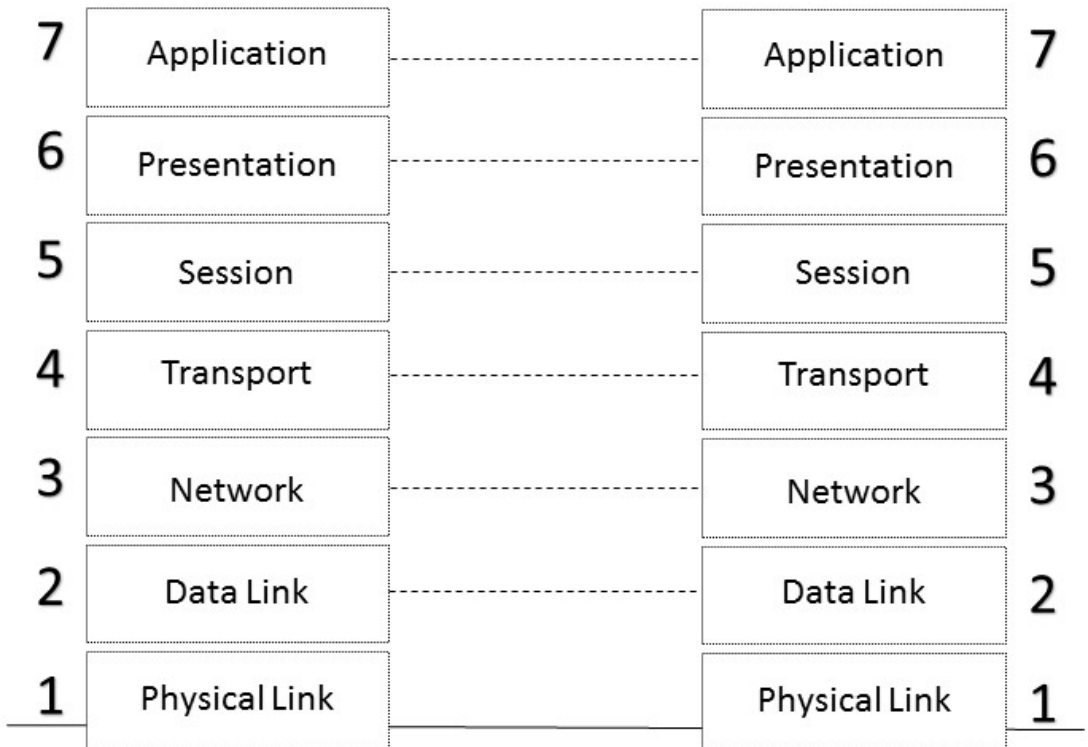


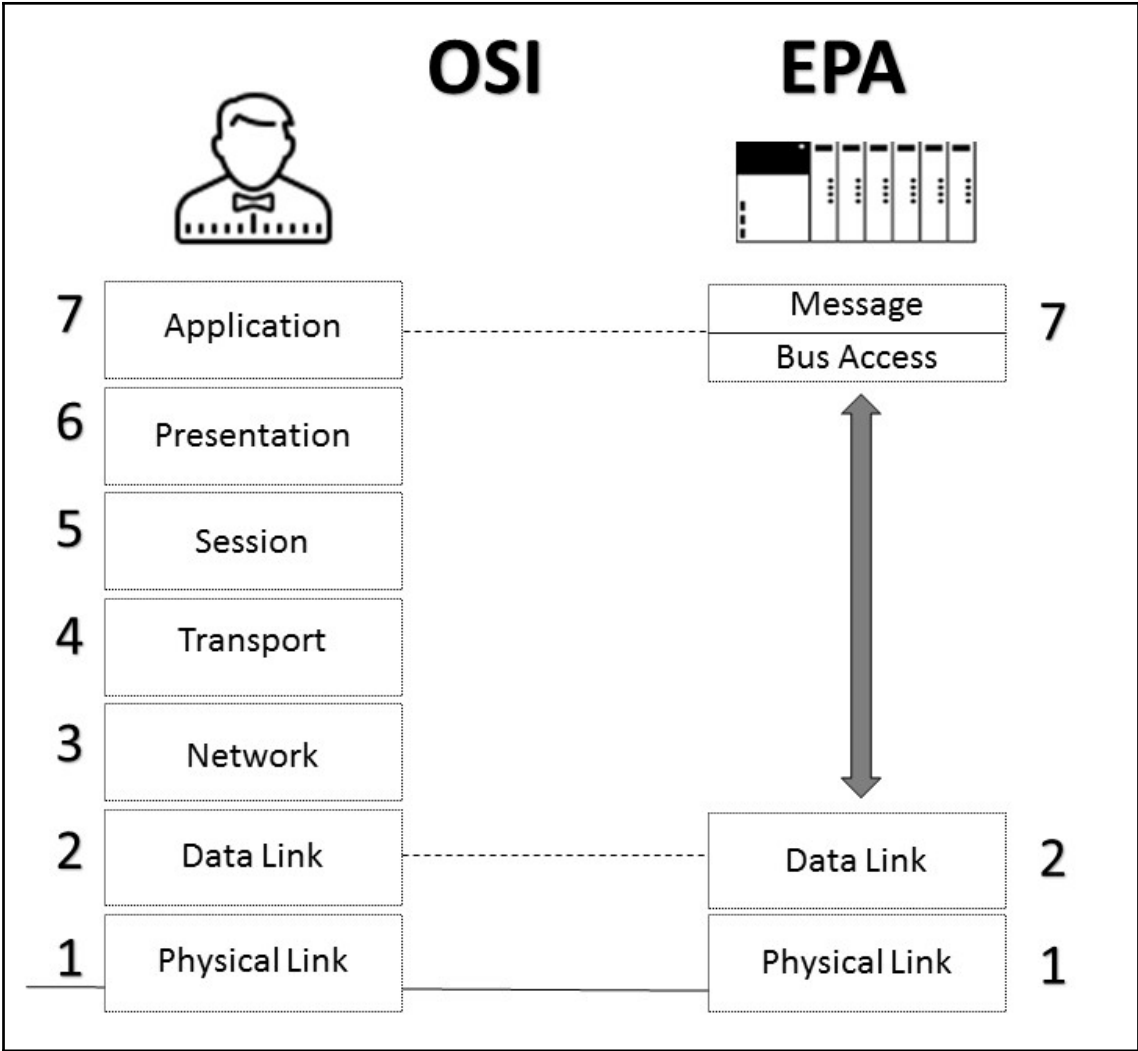


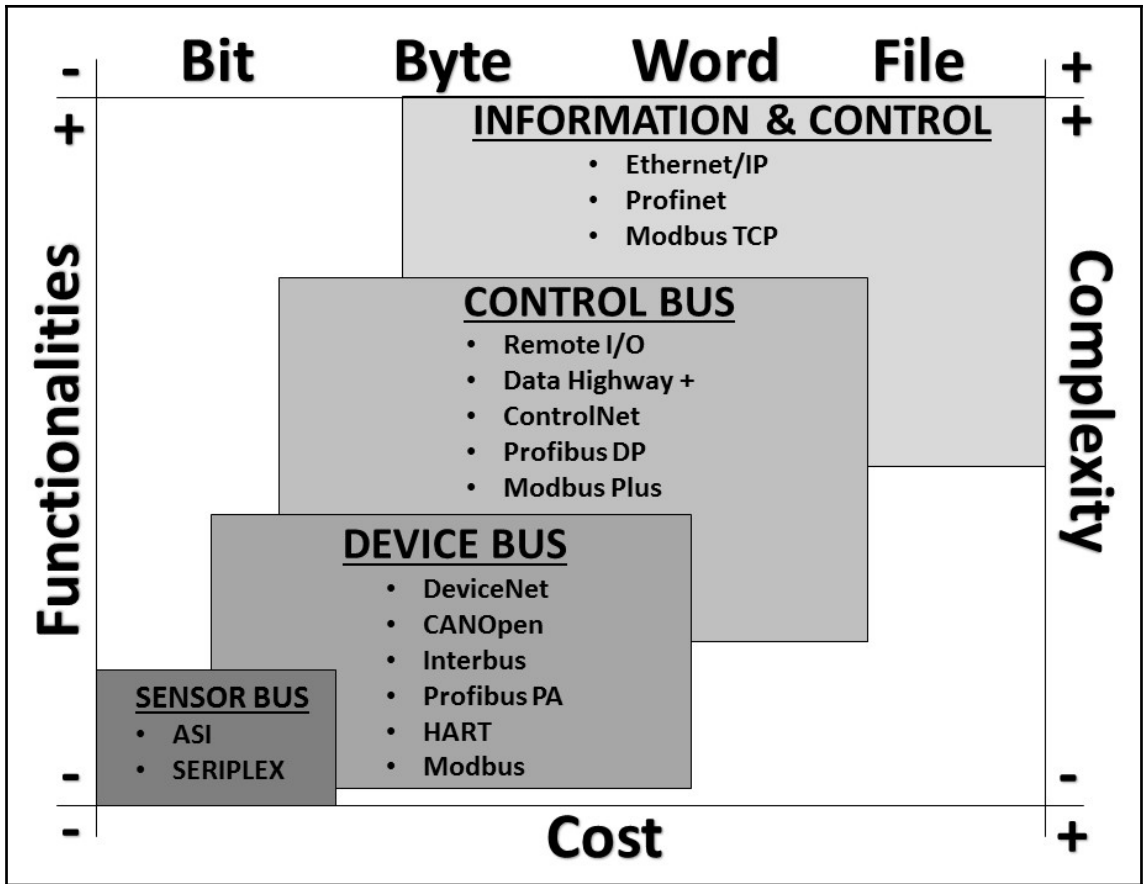


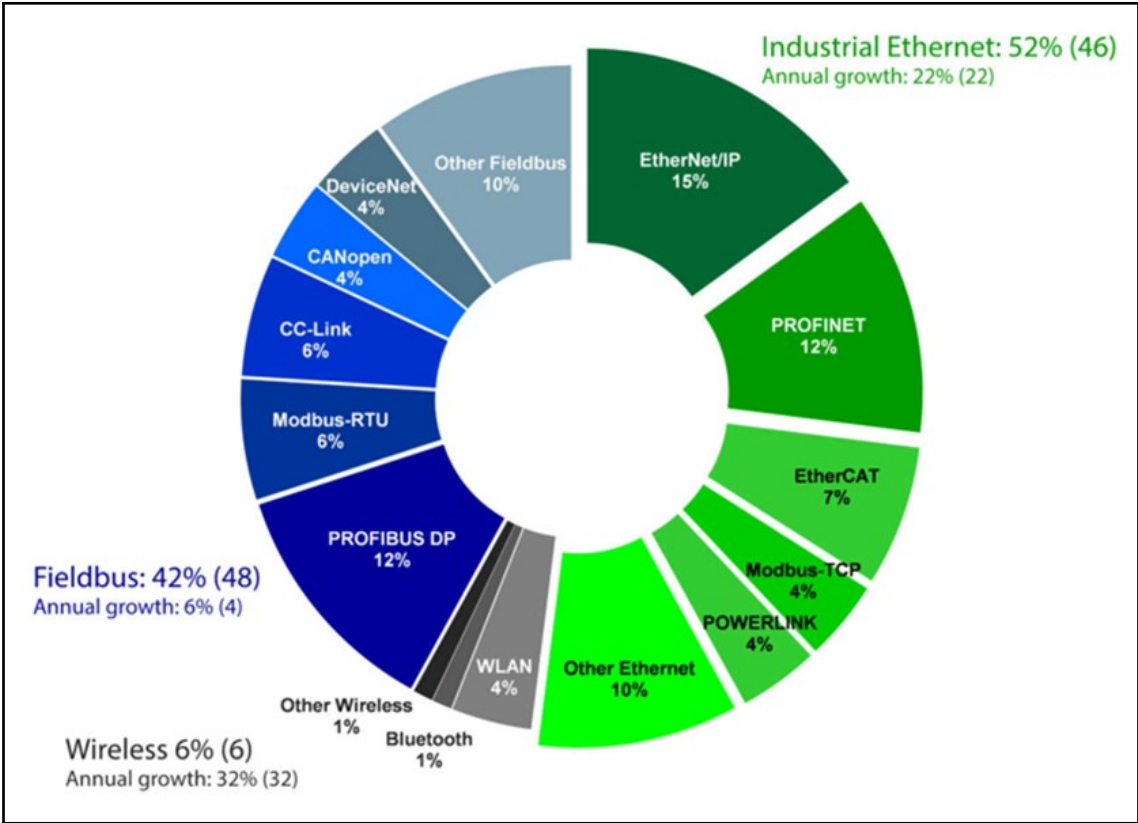


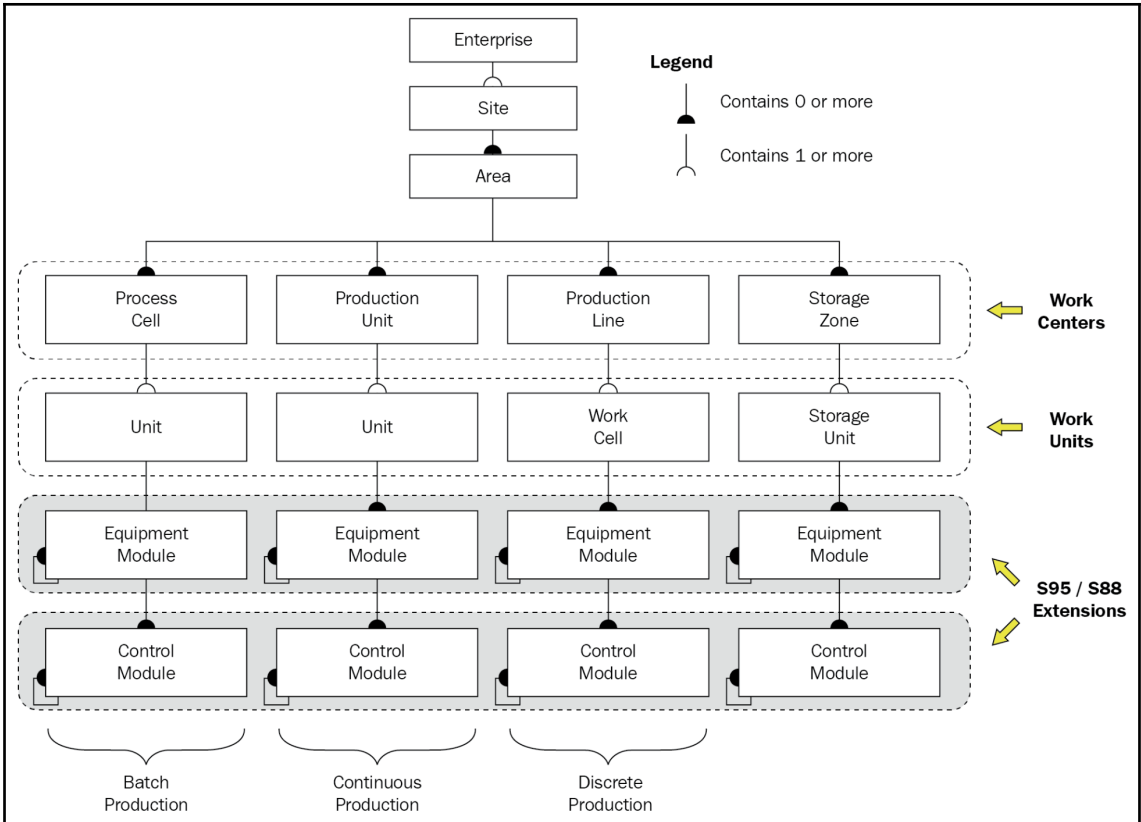
ISO-OSI

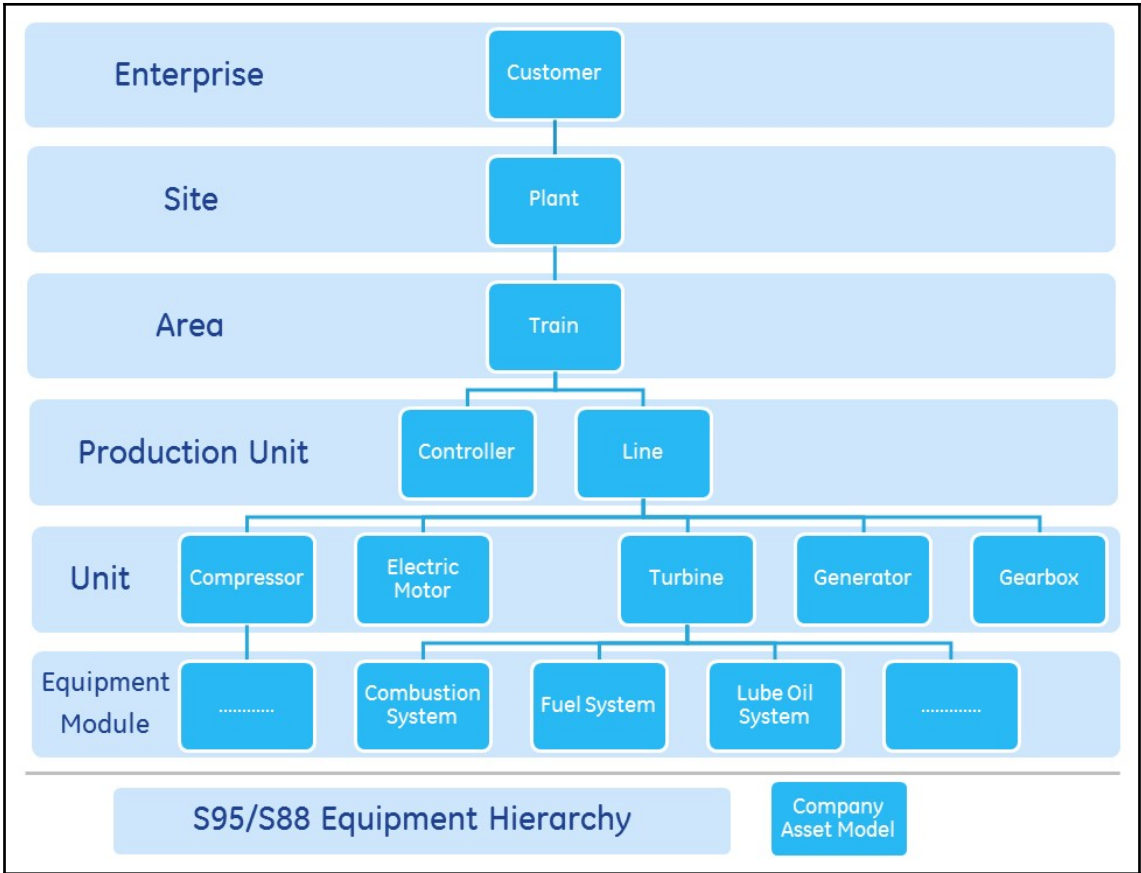




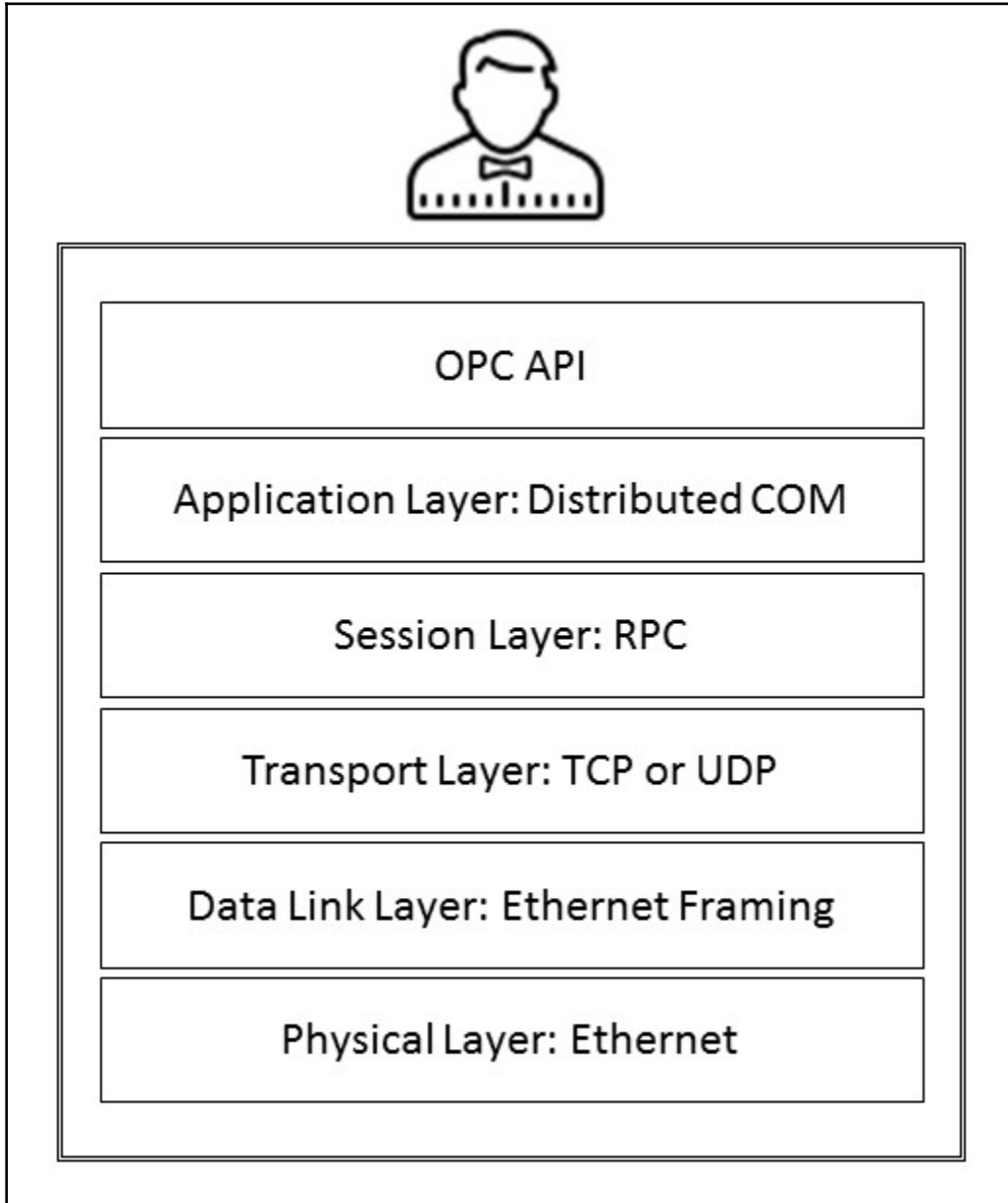


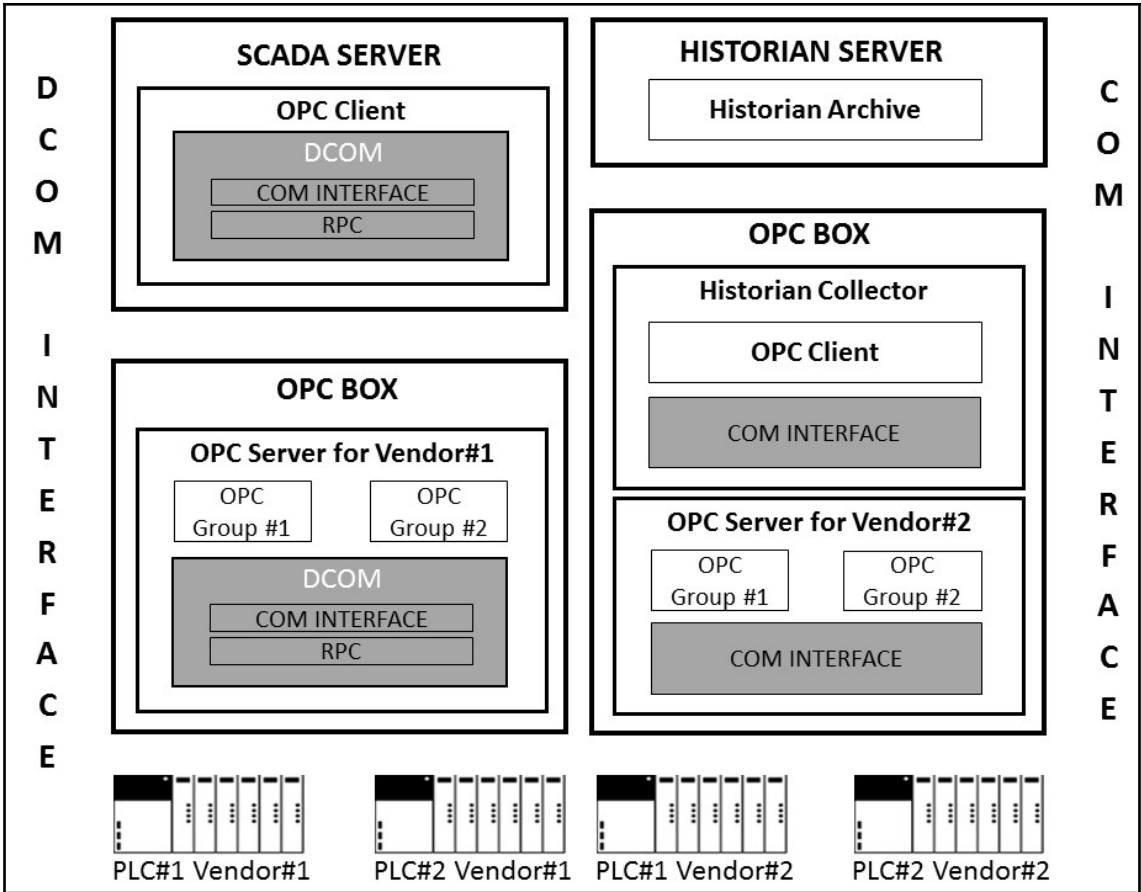


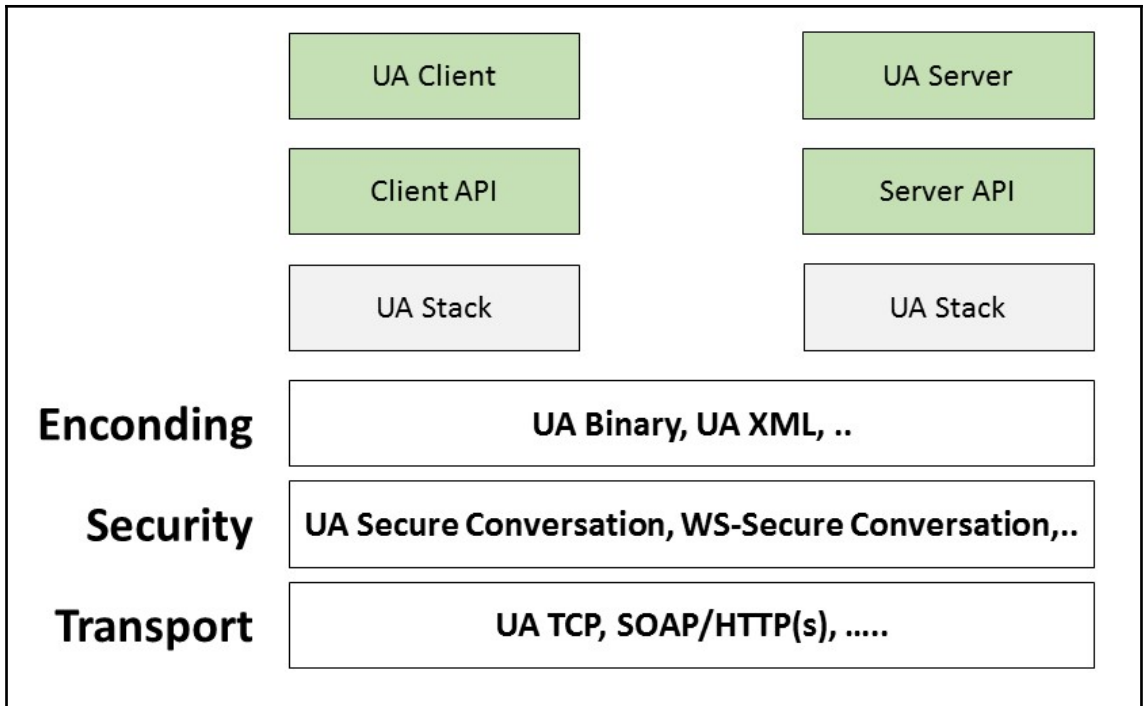


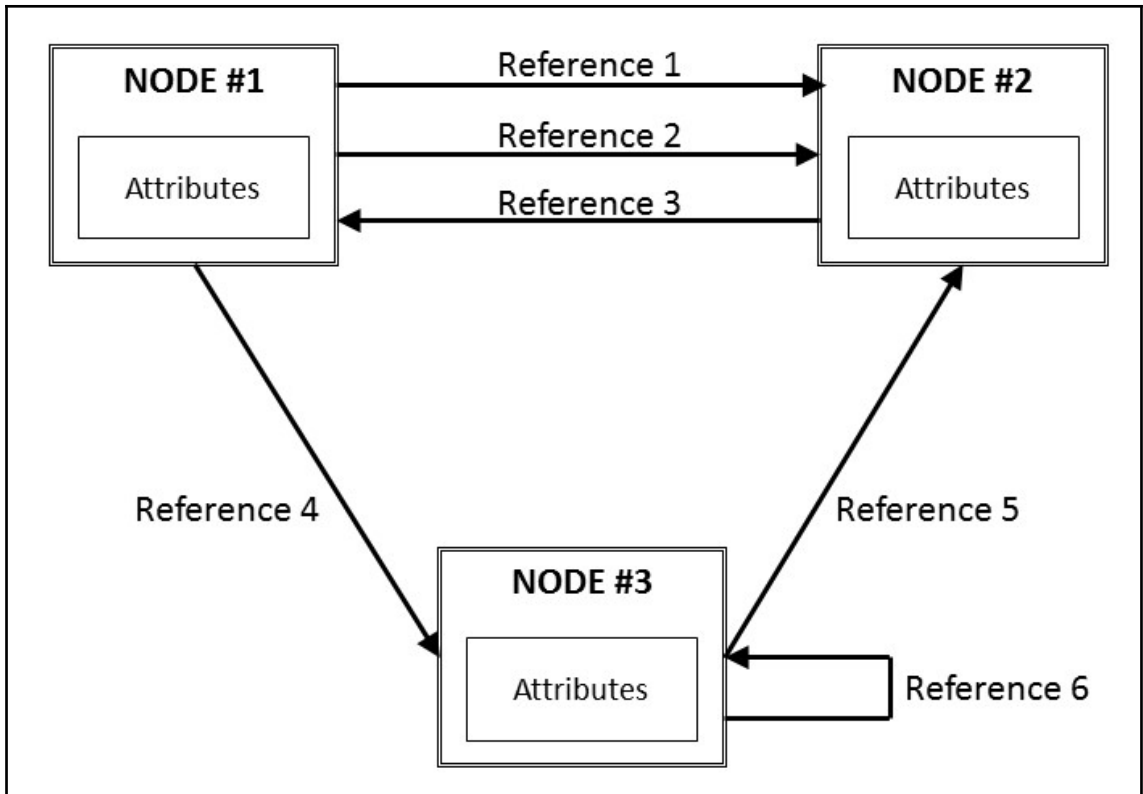


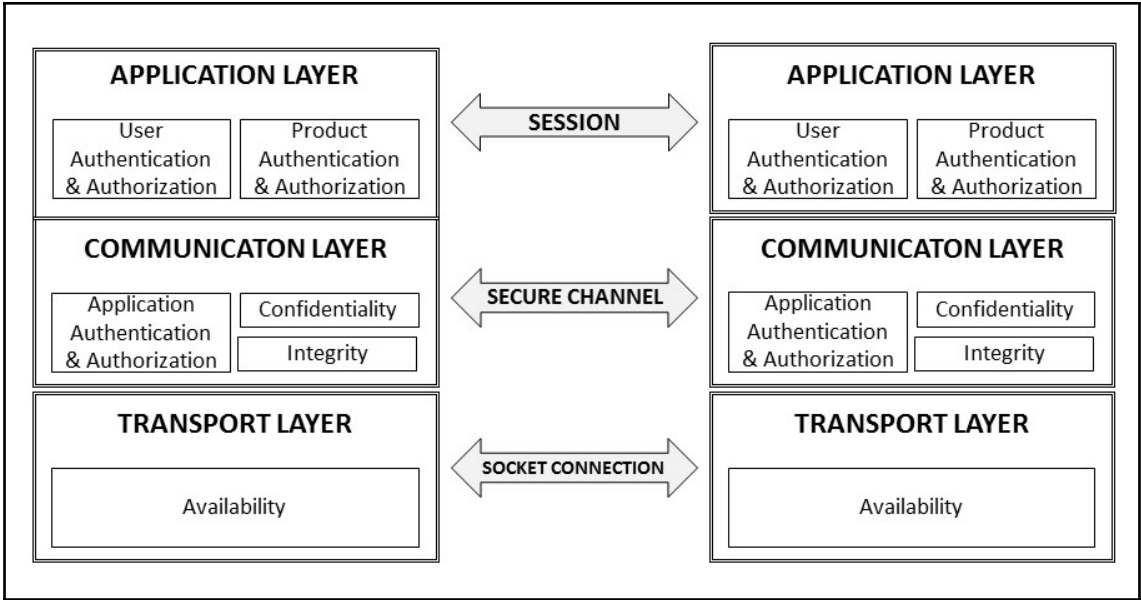
Chapter 4: Implementing the Industrial IoT Data Flow

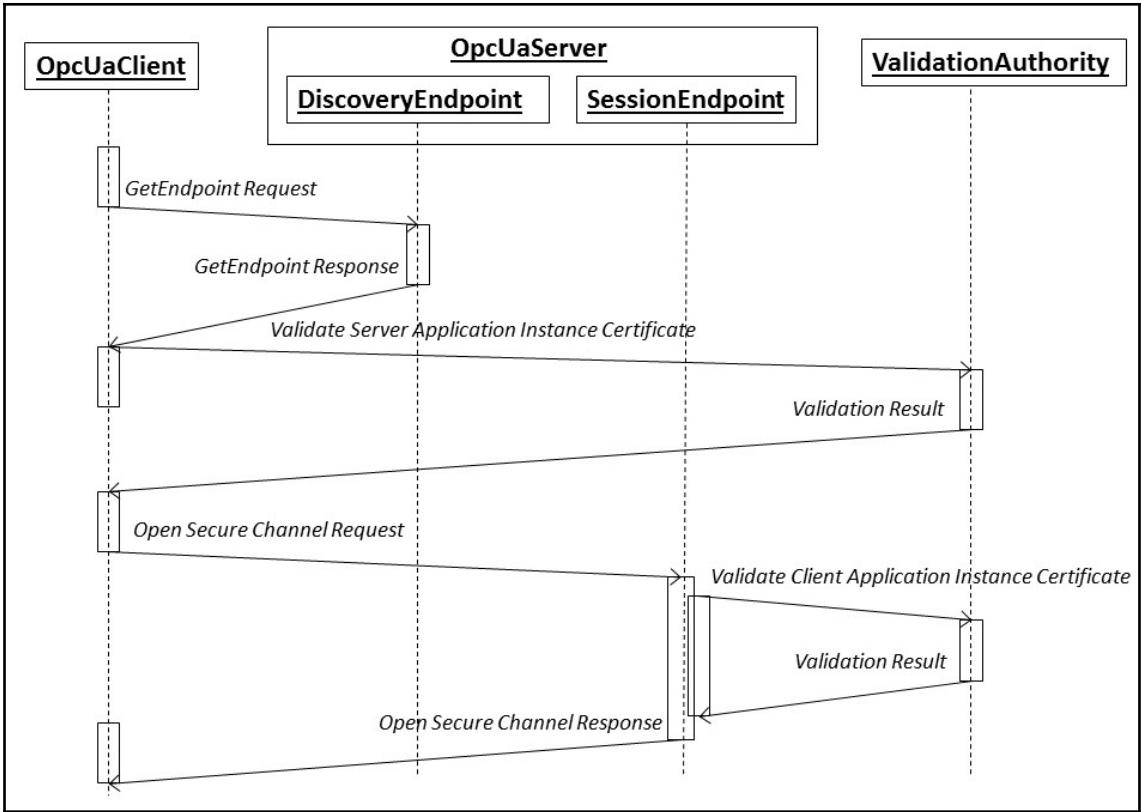


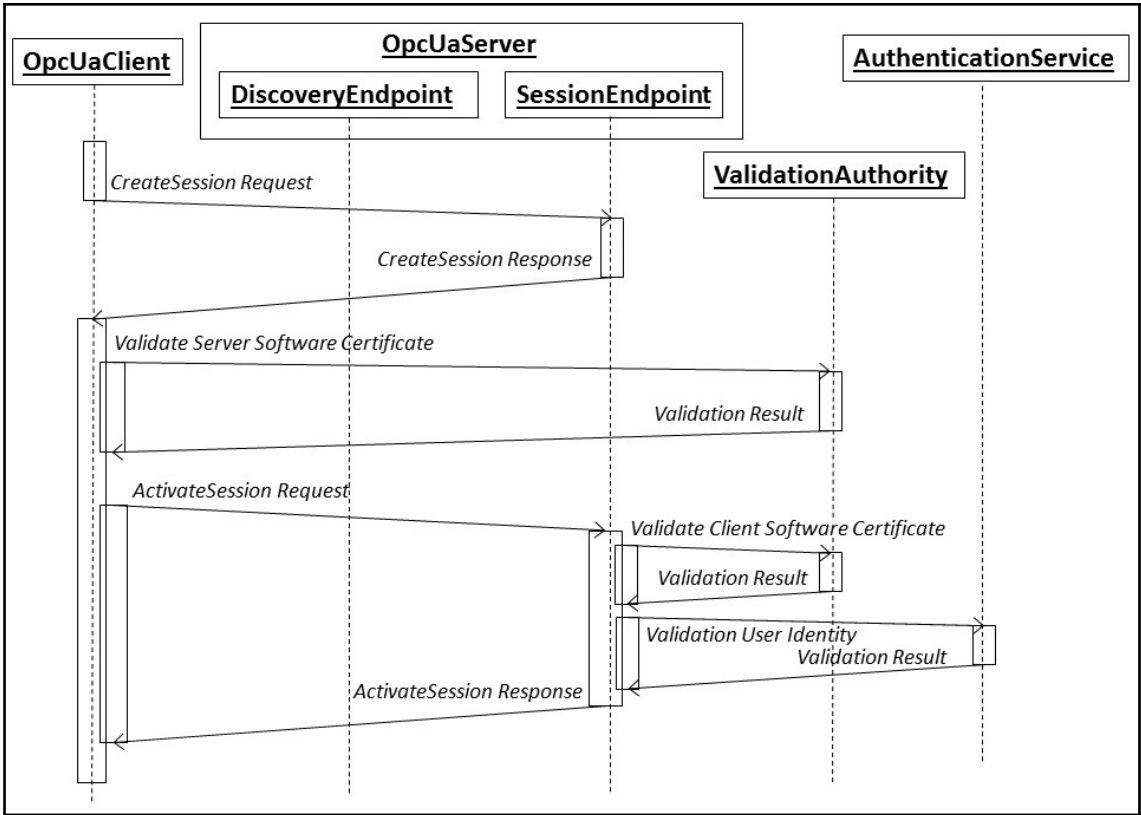


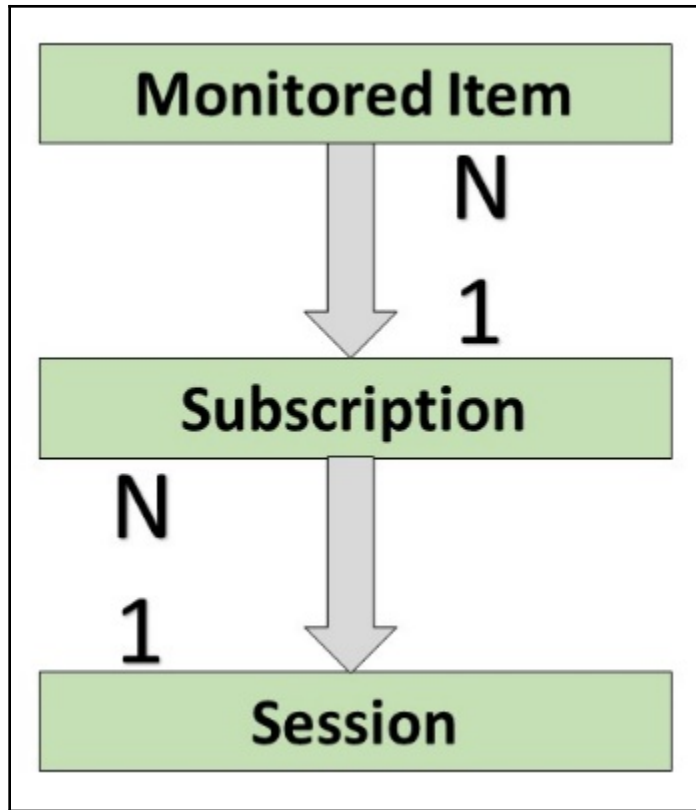


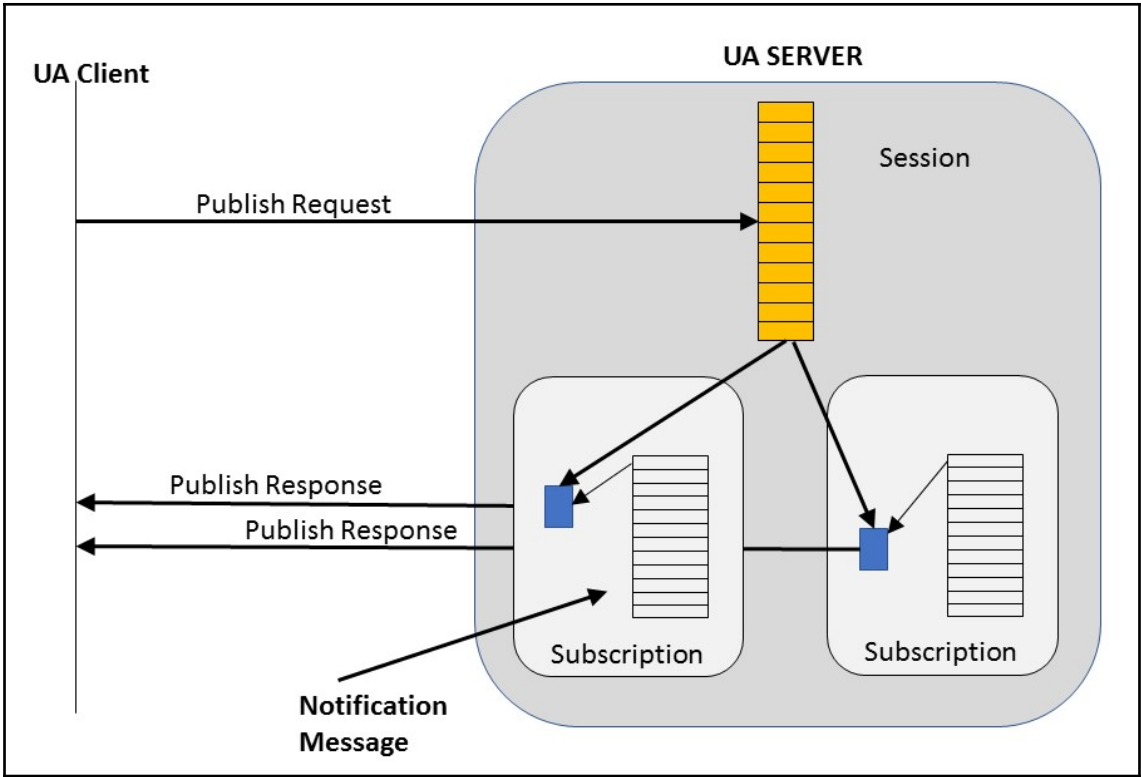


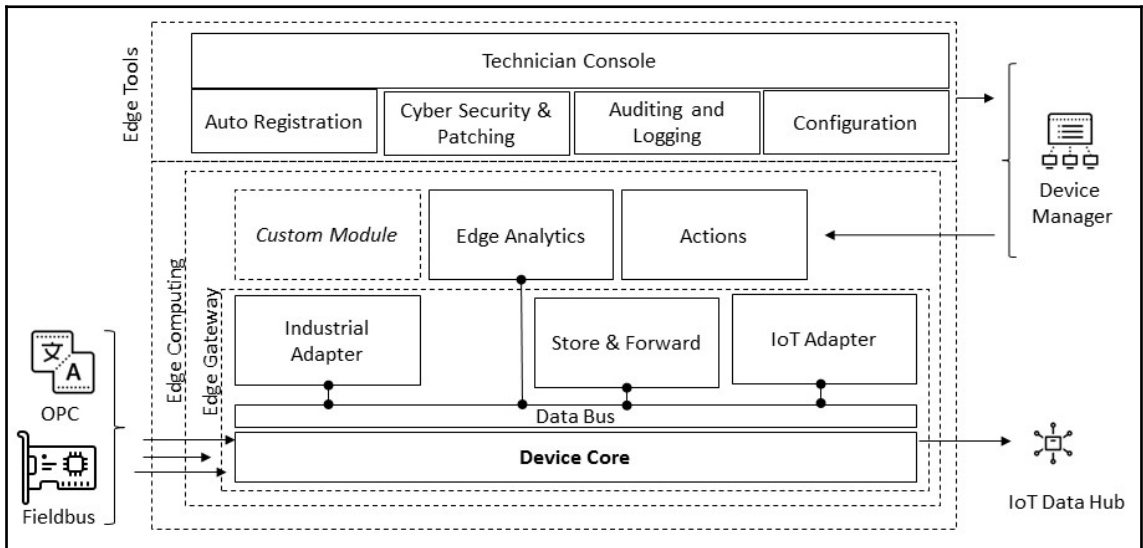
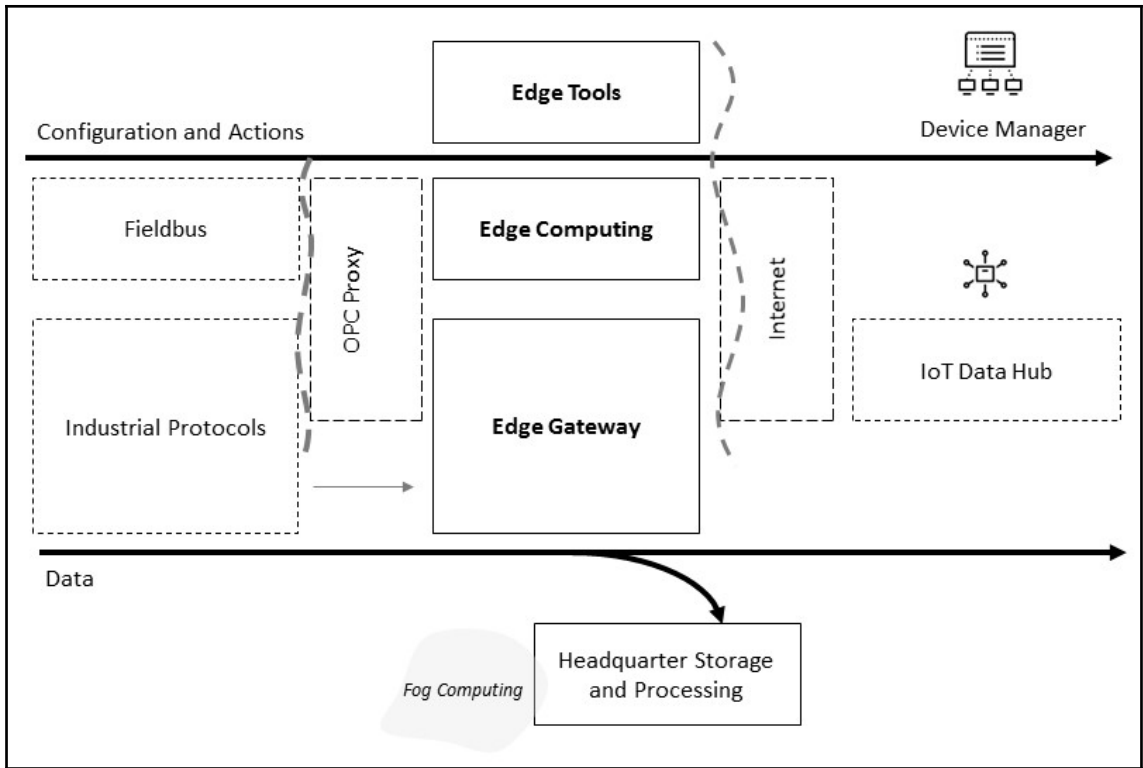


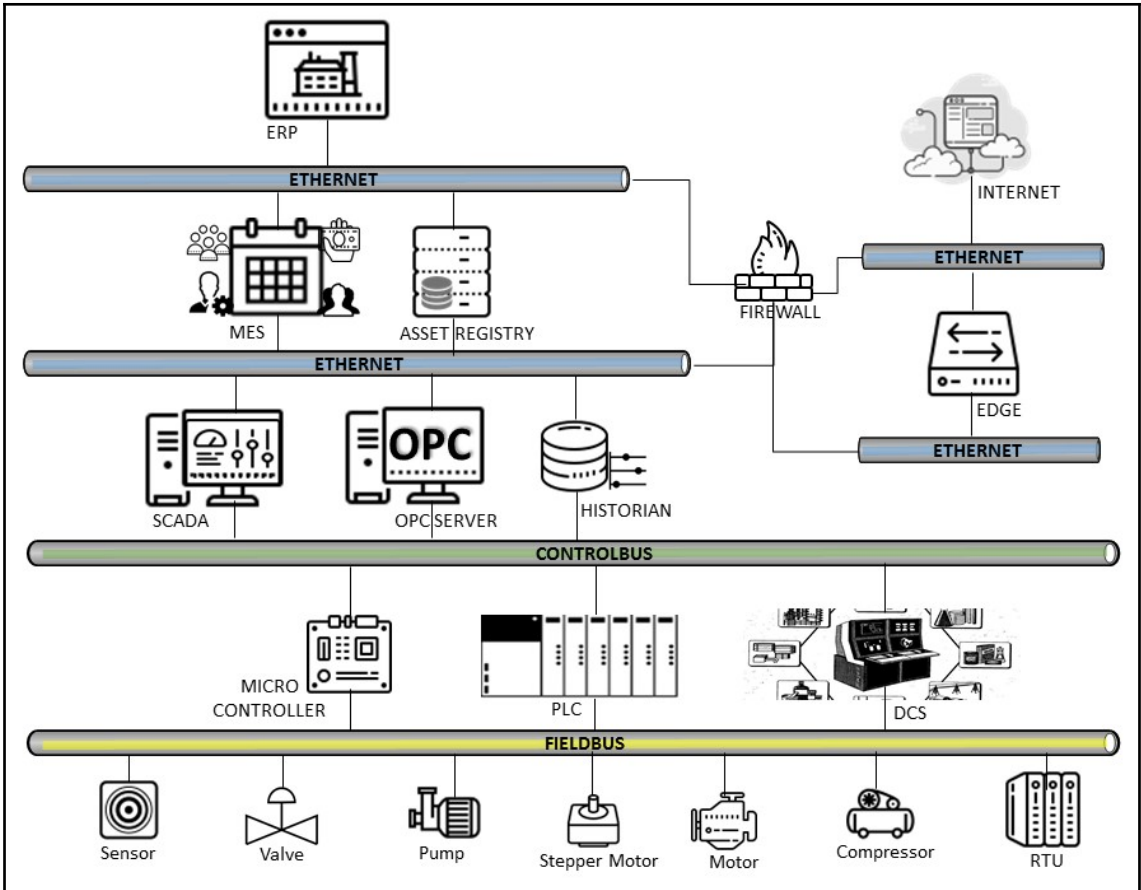


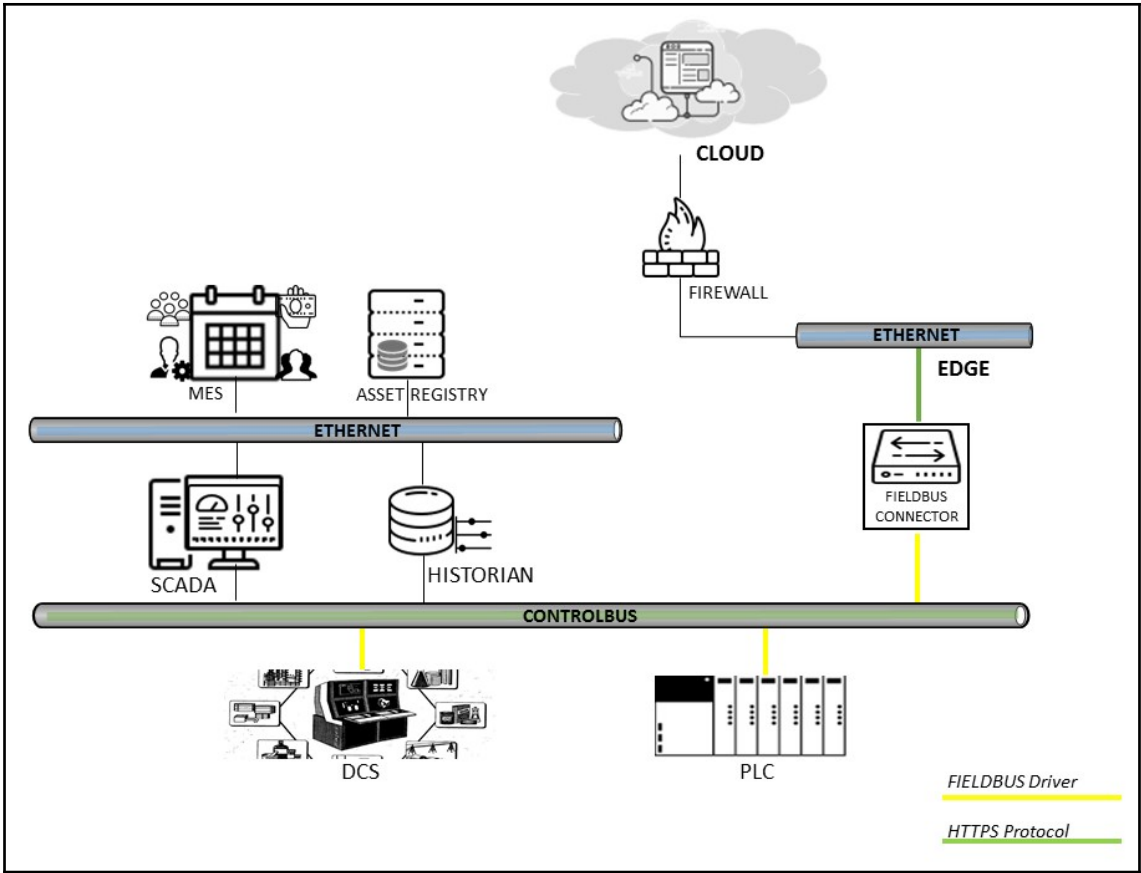


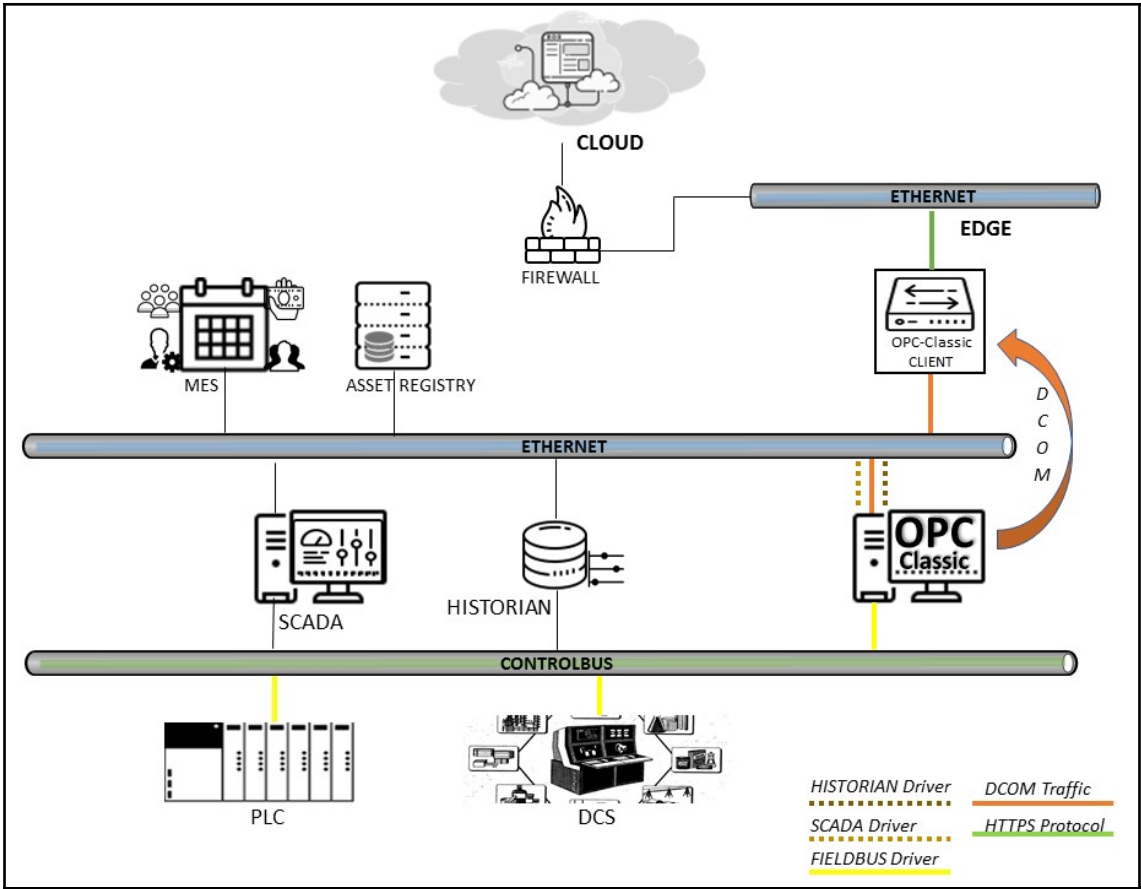


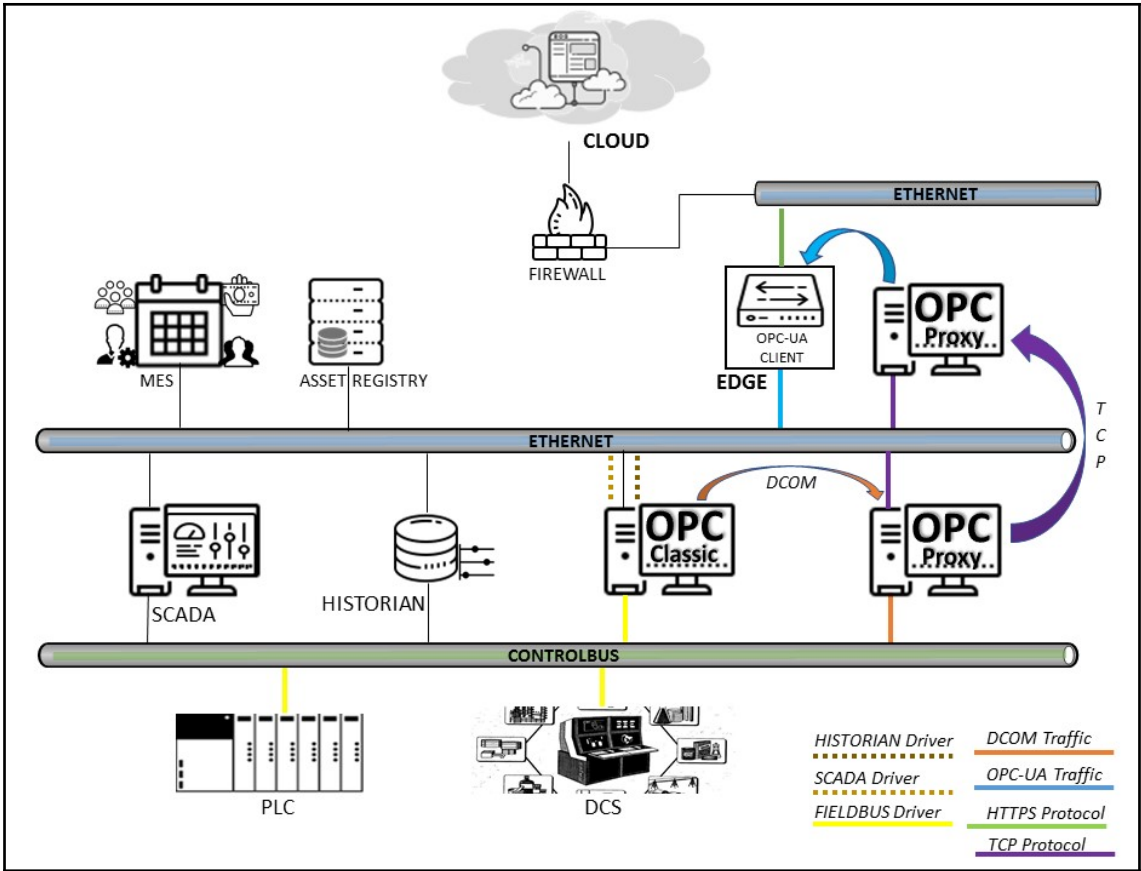


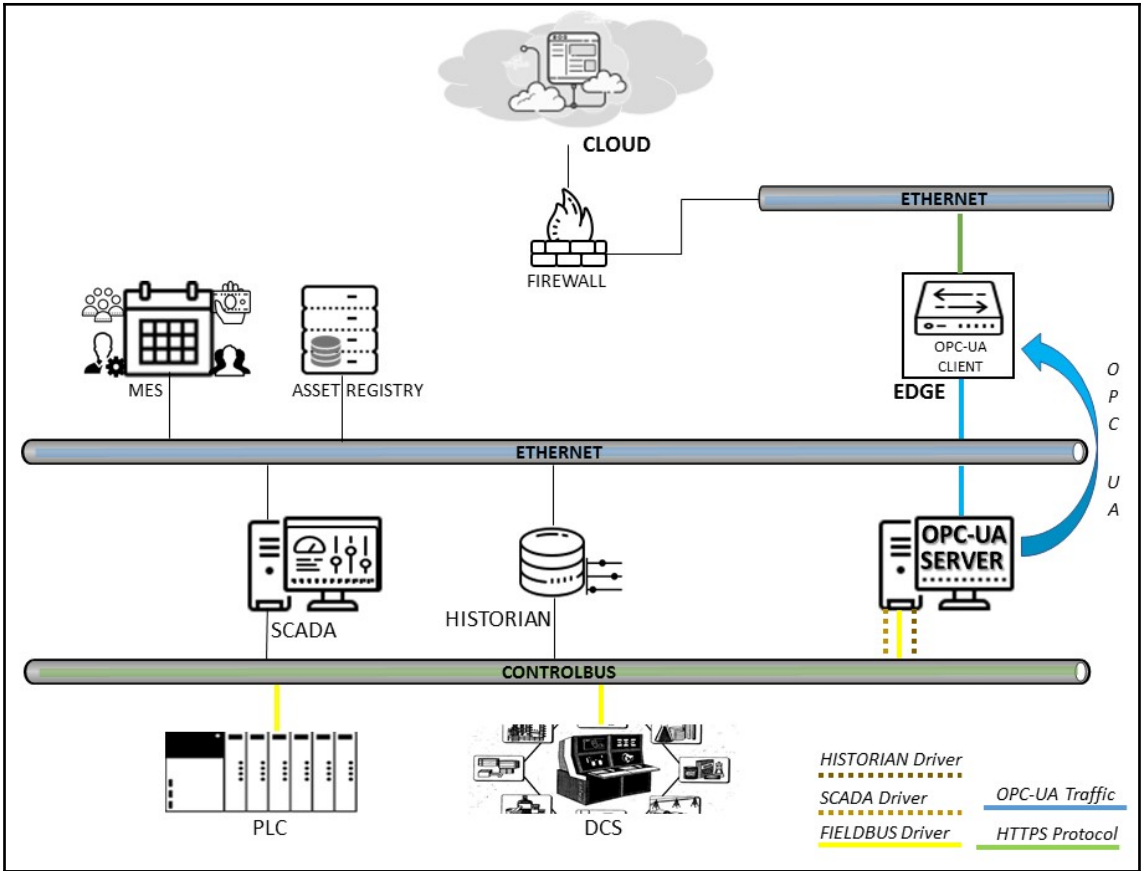


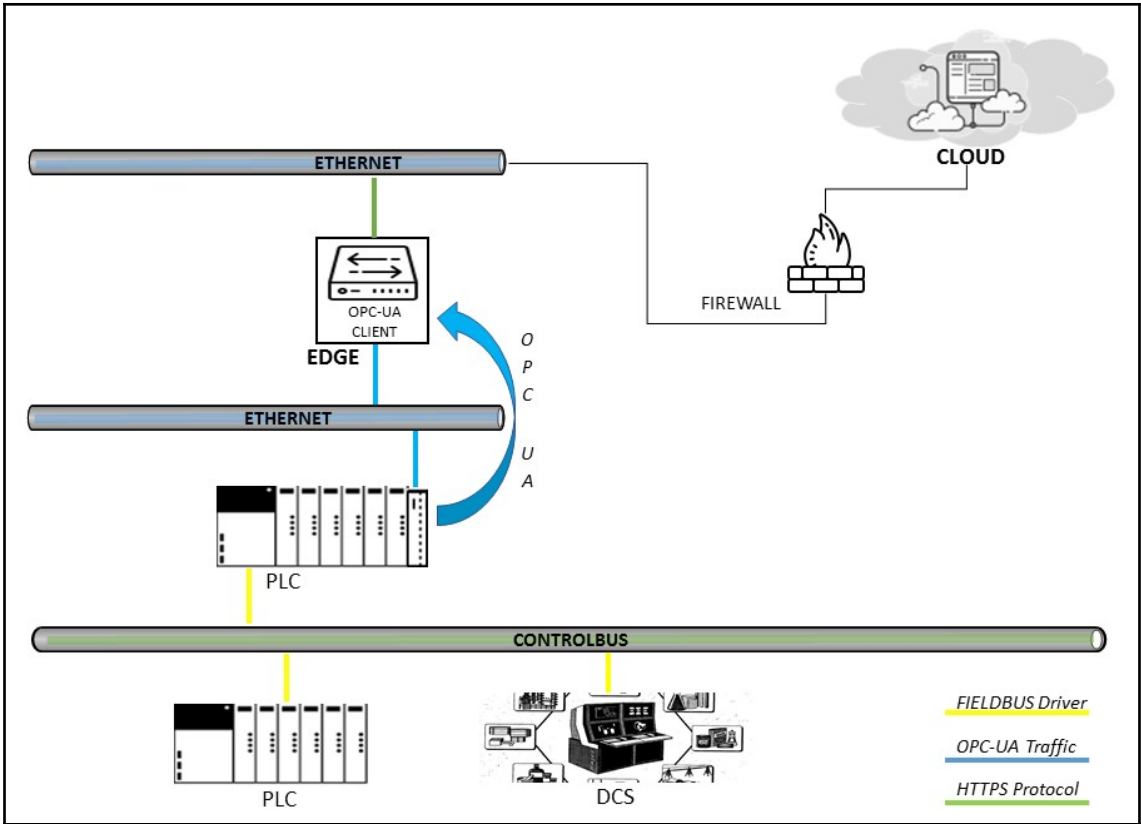




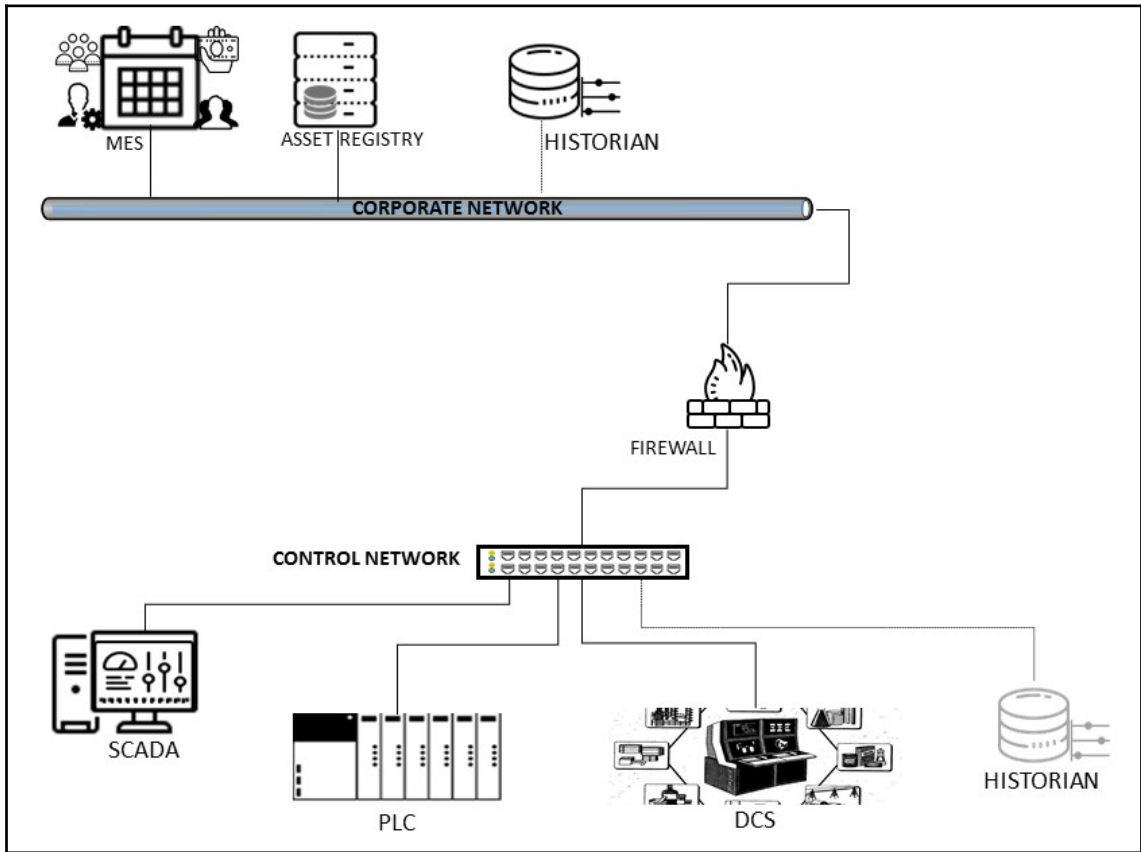


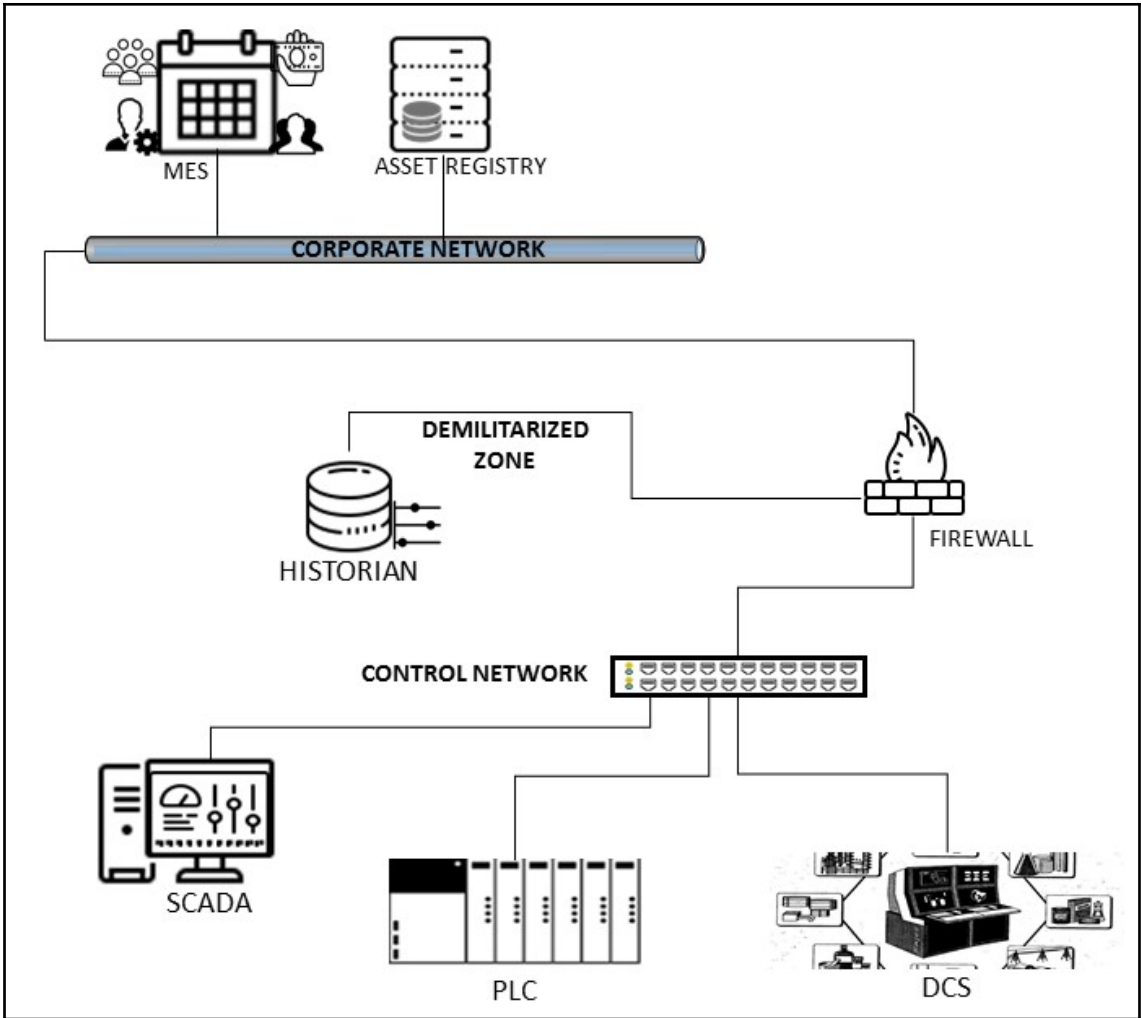


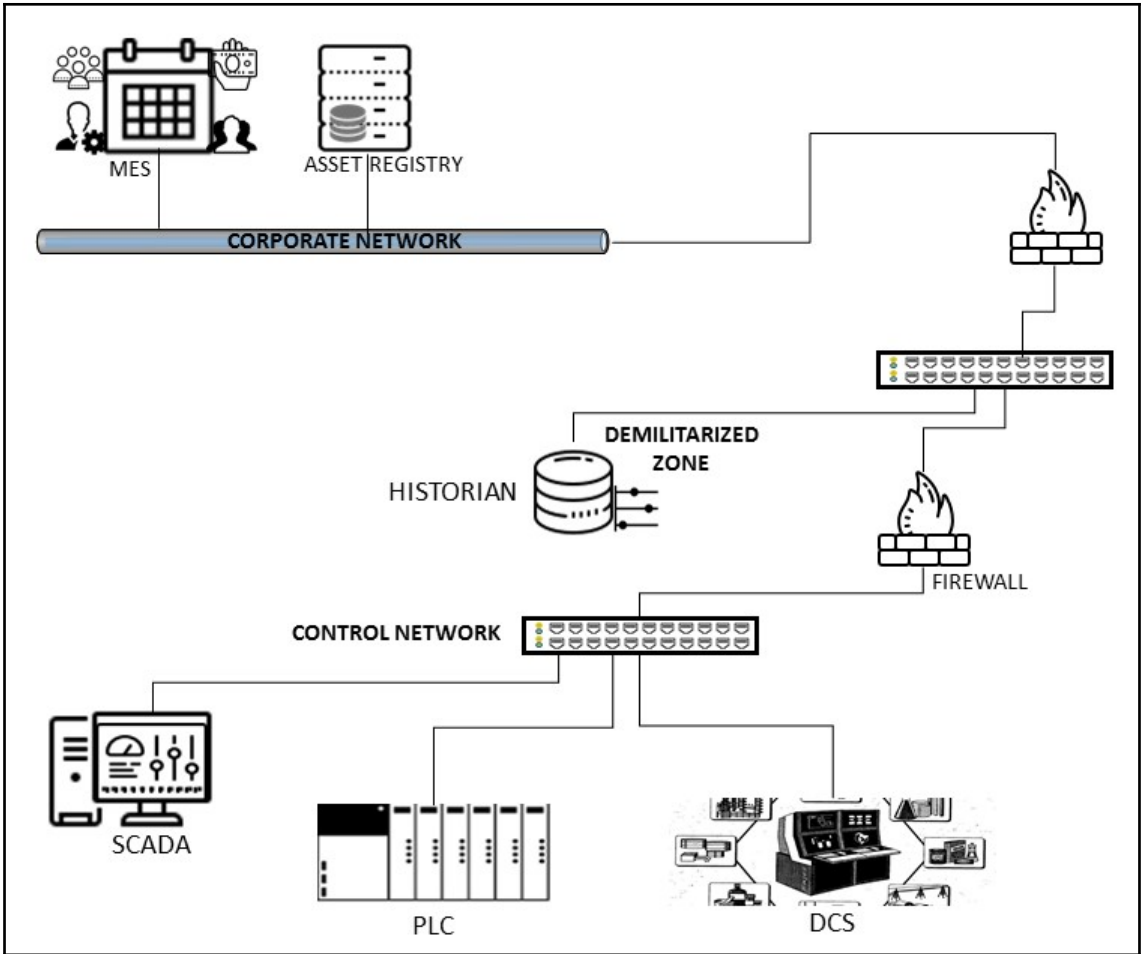


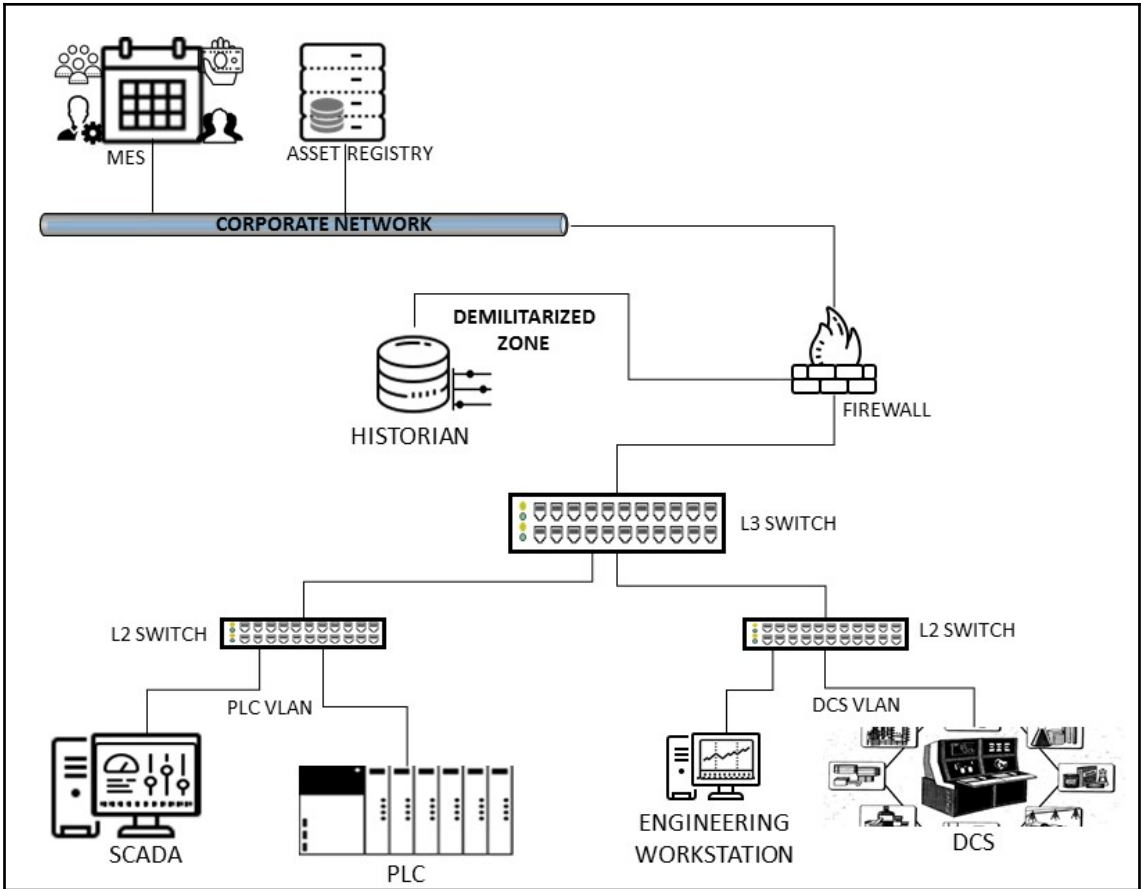


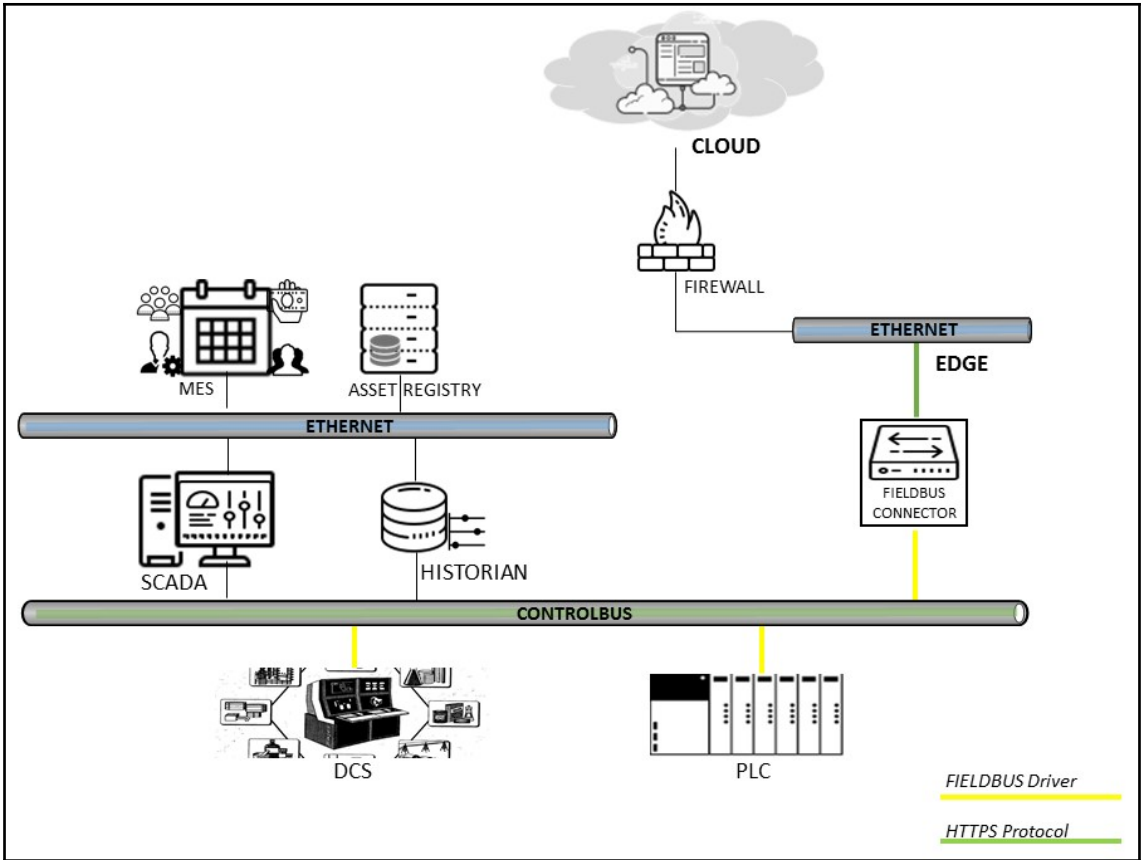
Chapter 5: Applying Cybersecurity

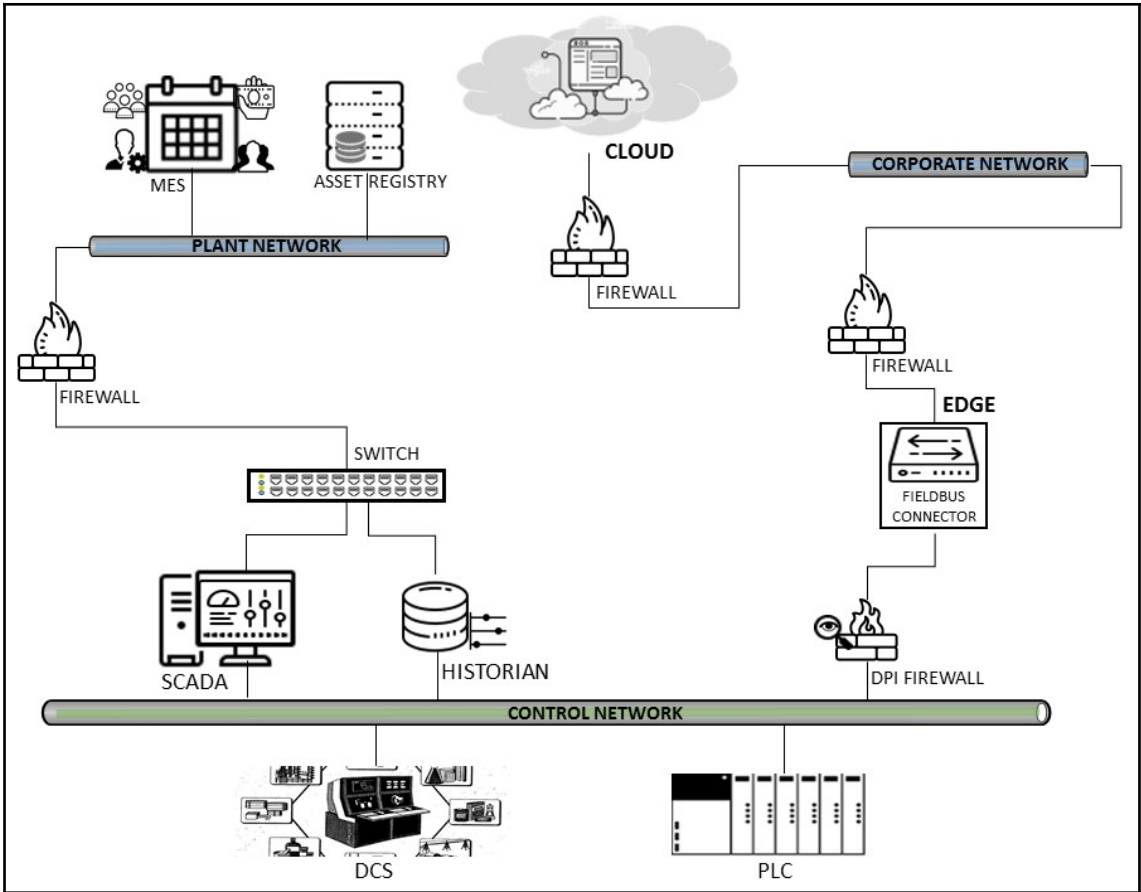


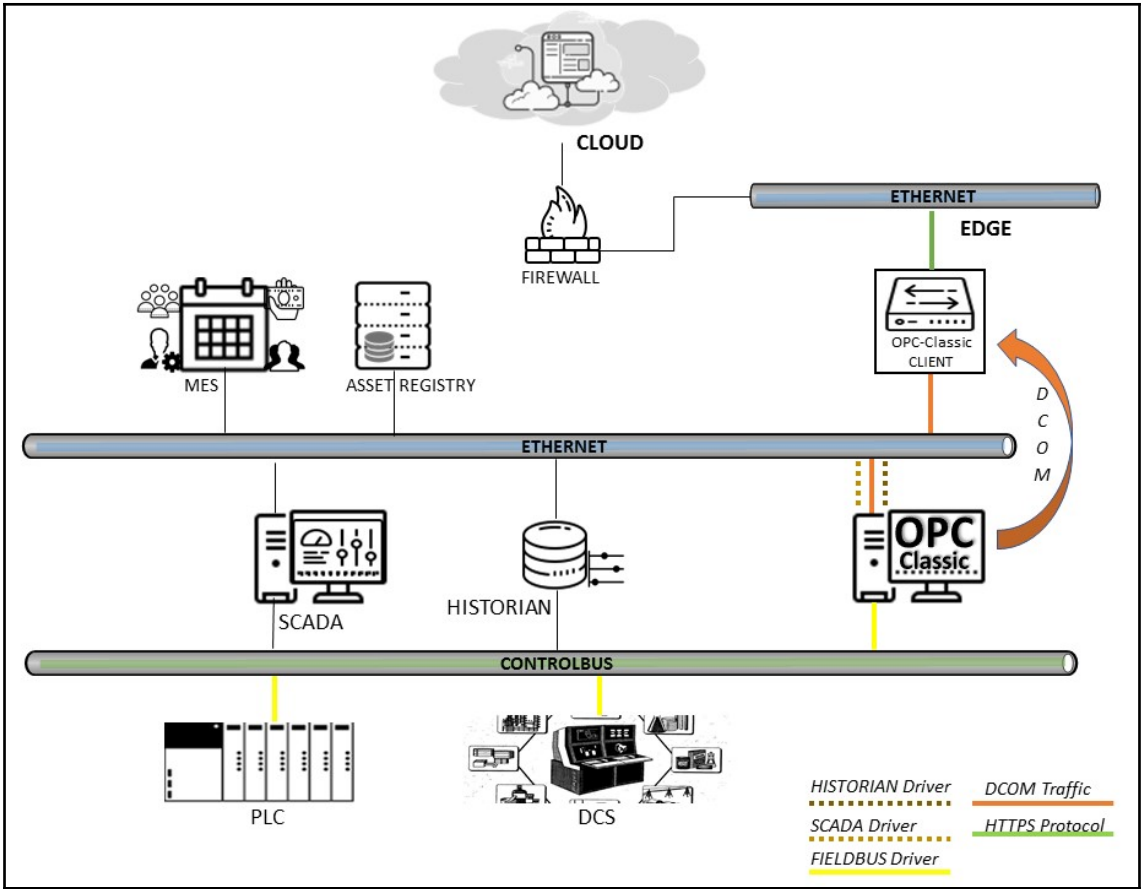


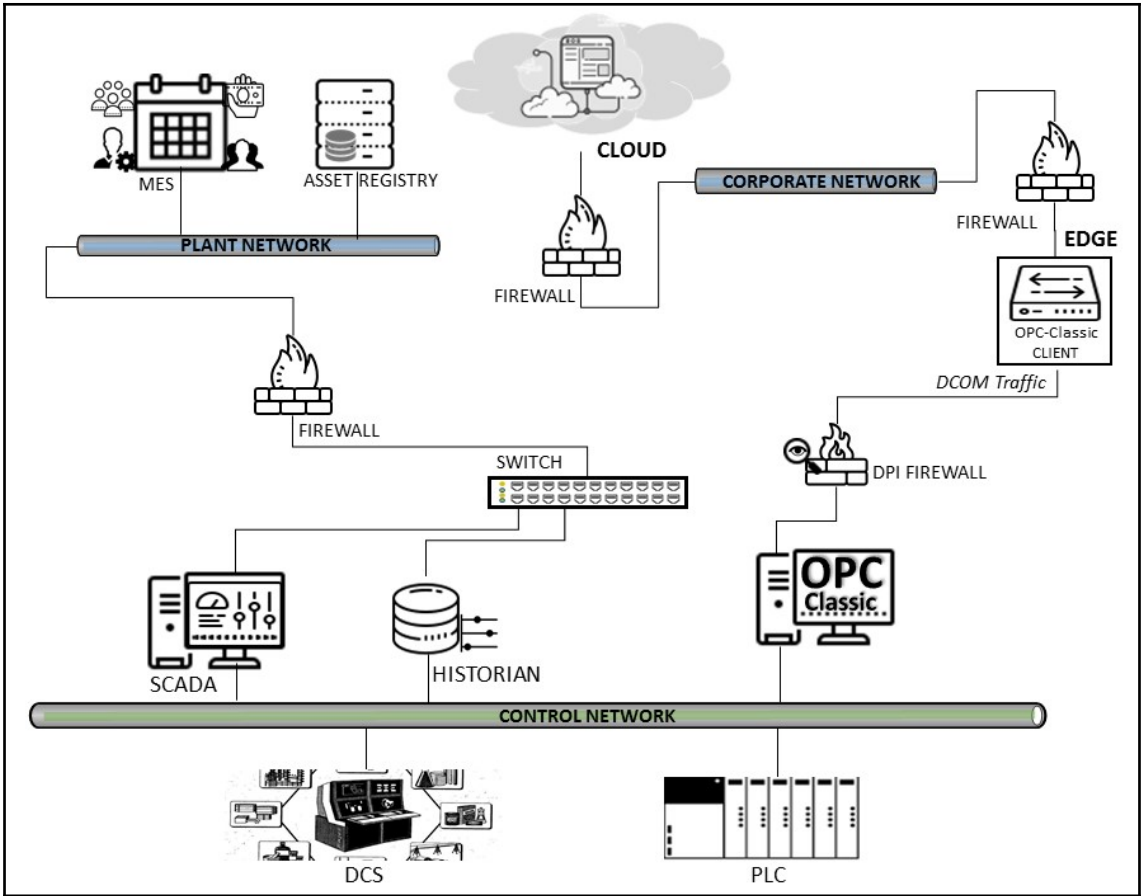


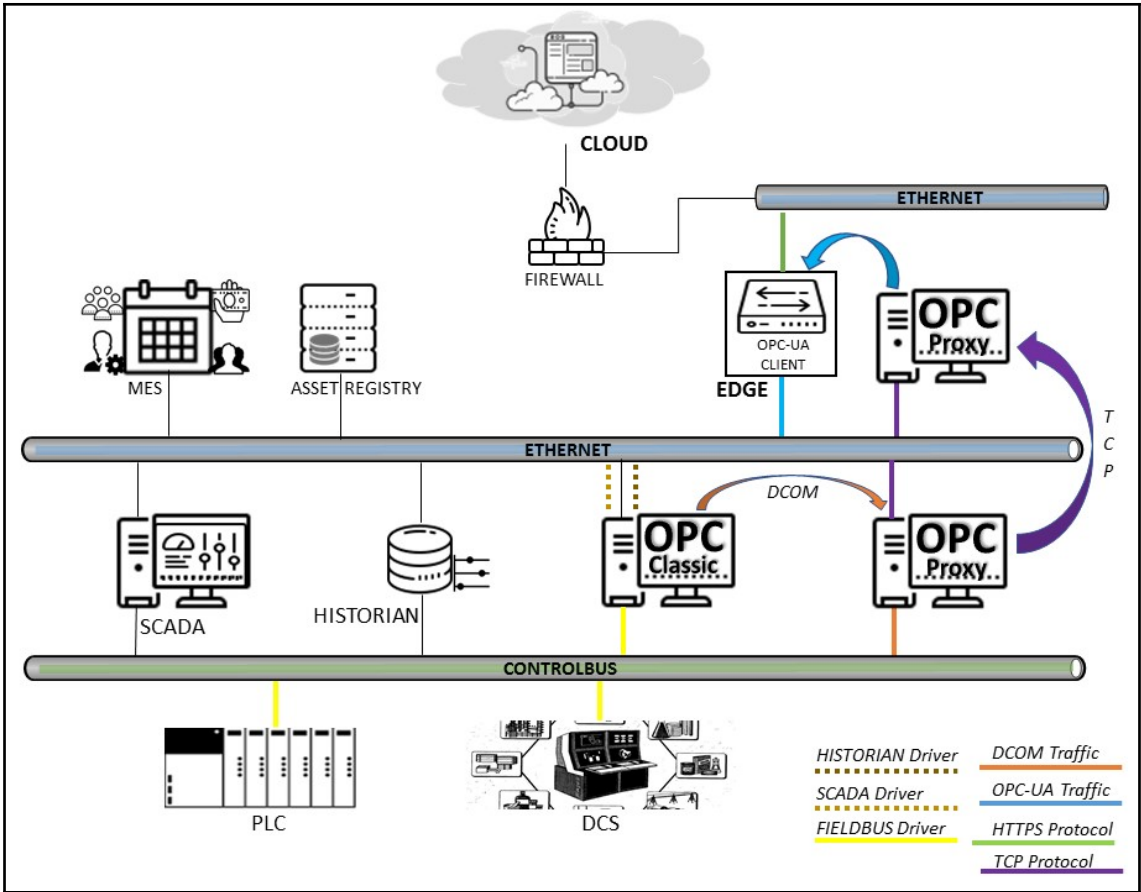


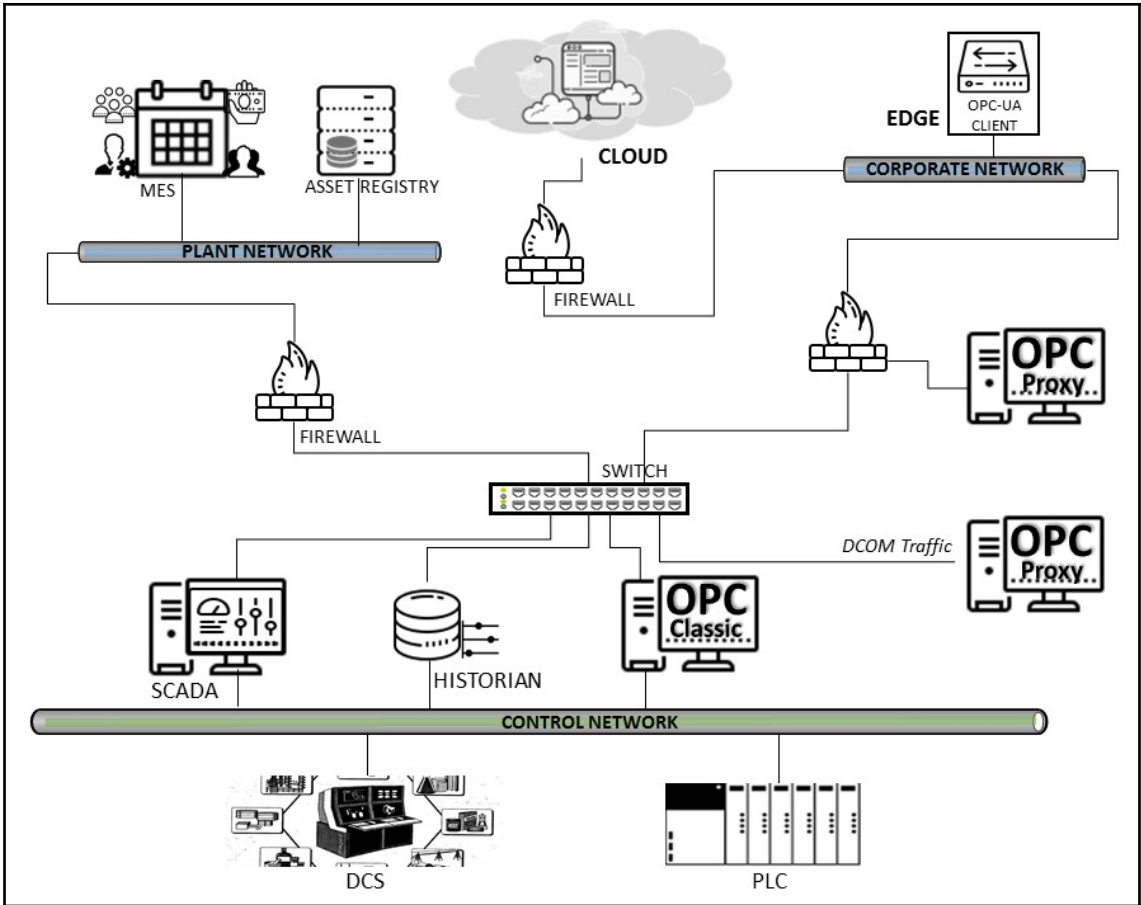


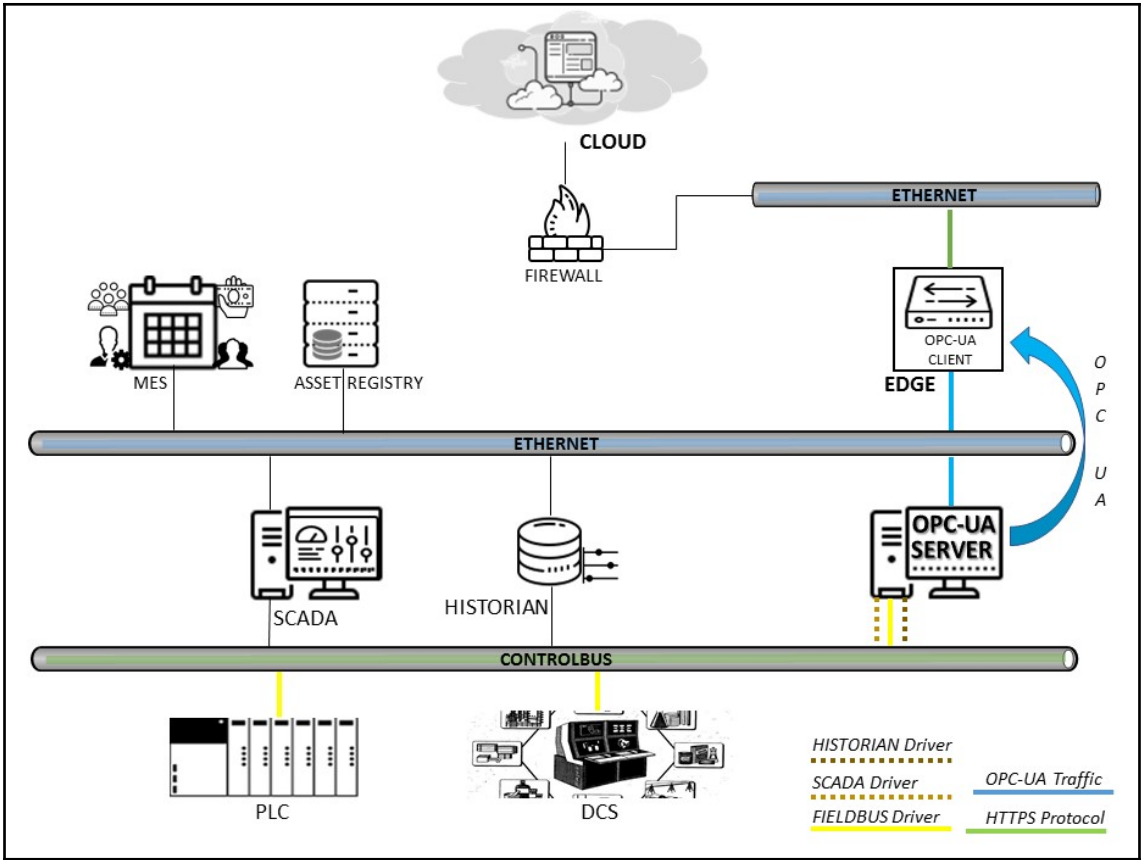


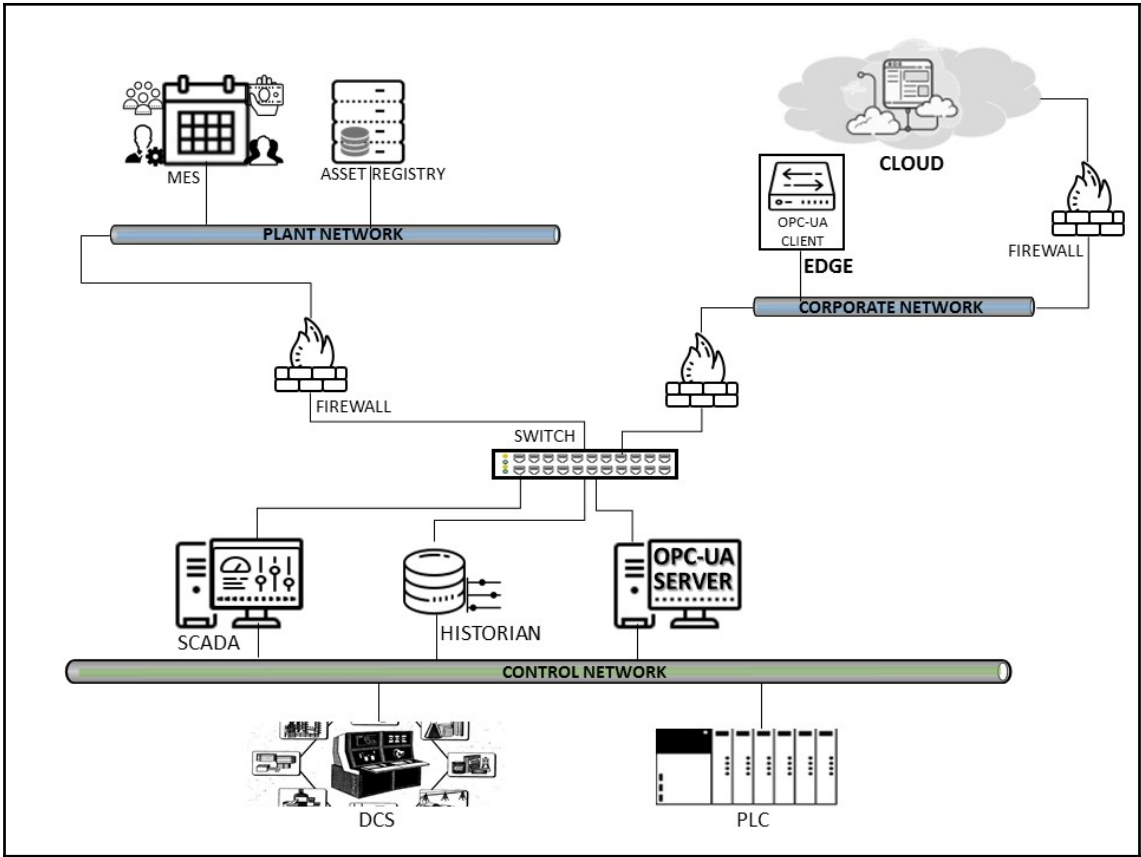


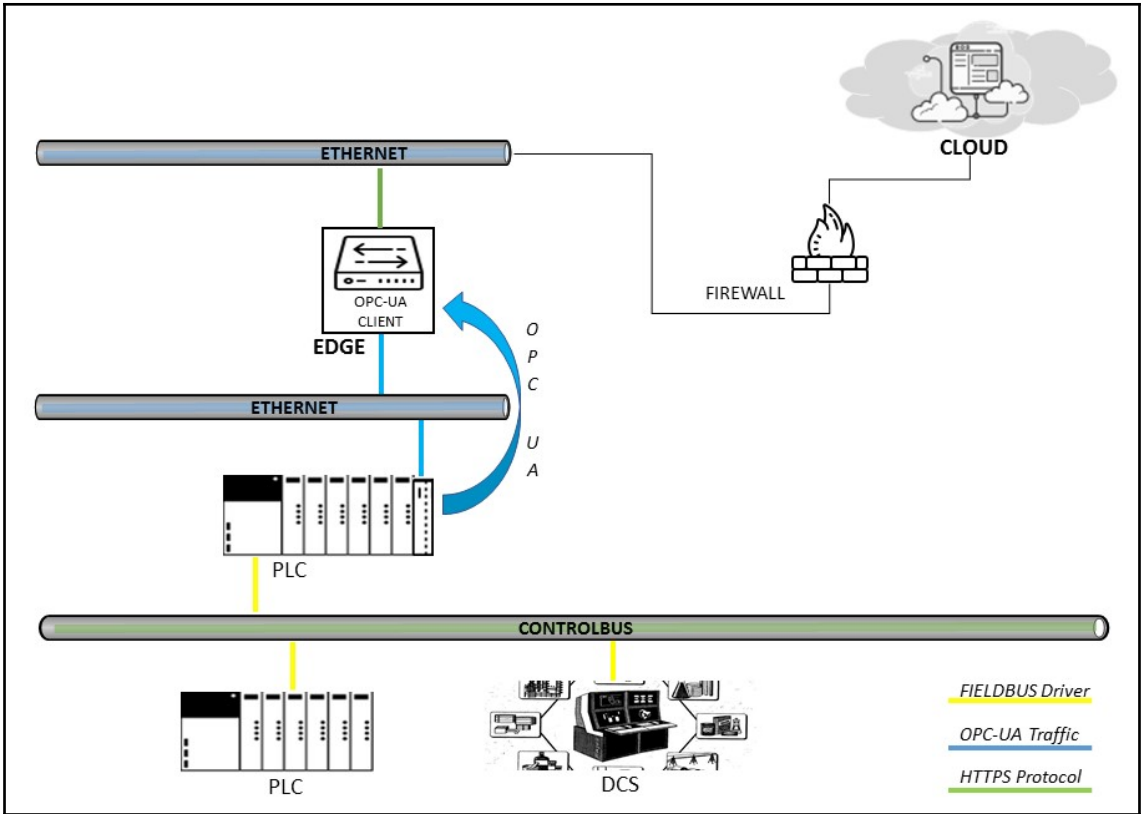


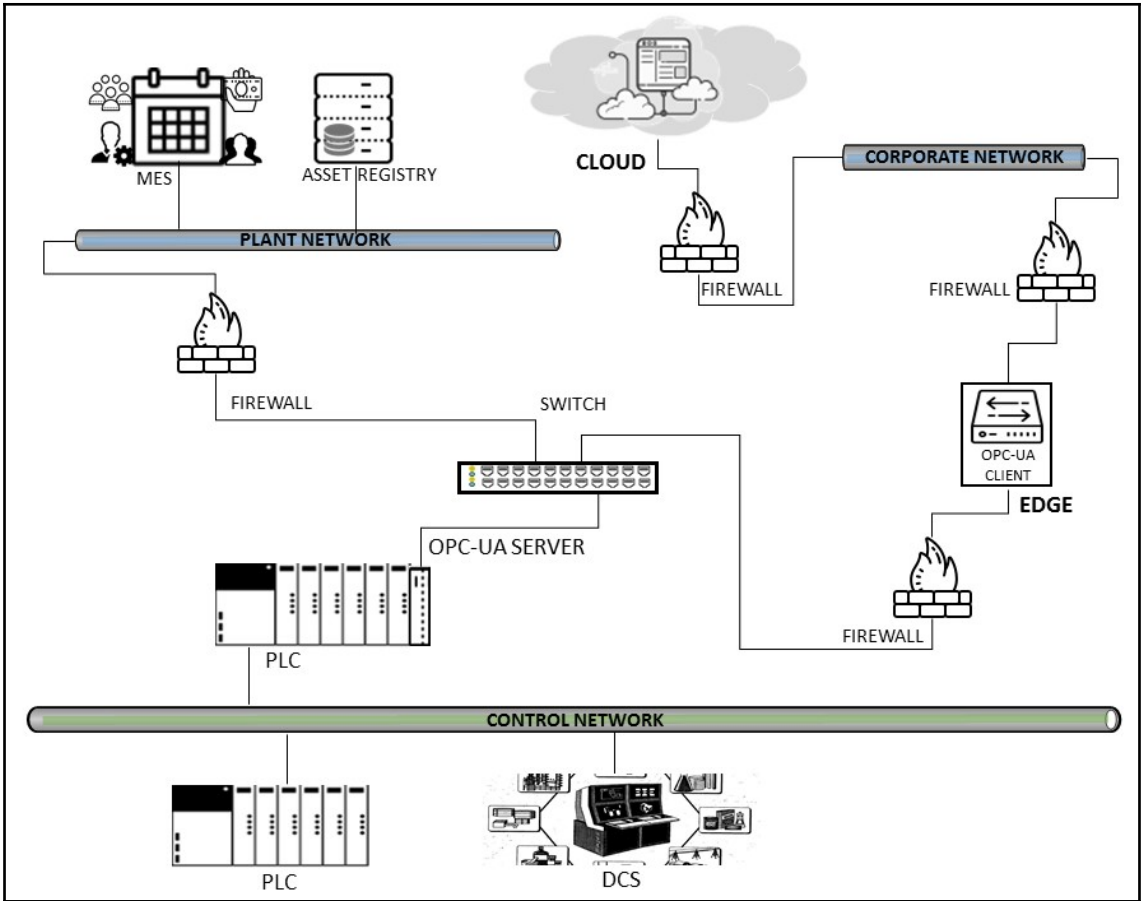




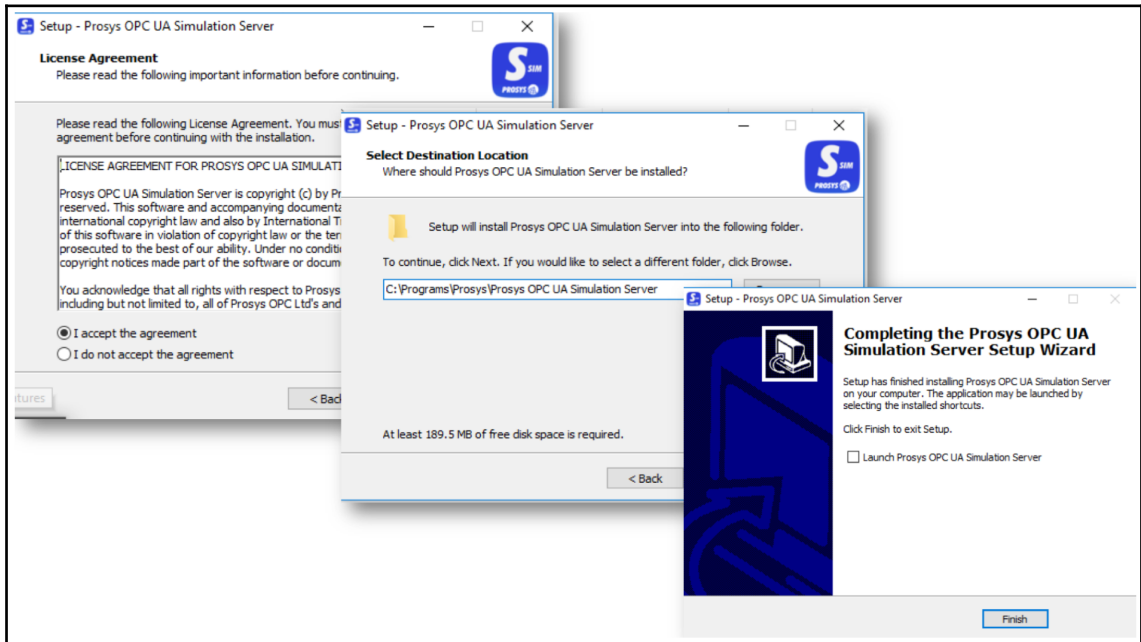








Chapter 6: Performing an Exercise Based on Industrial Protocols and Standards



Proslys OPC UA Simulation Server

Help

Status Endpoints Users Sessions Certificates Connection Log Address Space **Simulation** Debug Log Req/Res Log

Run Simulation Interval (ms): 1000 Simulation Time: 02.10.2018 12:58:59.000

Signal Name / NodeId	Visualize	Value
Counter1	<input type="checkbox"/>	34
Random1	<input type="checkbox"/>	0.1965140296037563
IIOT_SIM_RND_01	<input type="checkbox"/>	0.3066766856710803
Sinusoid1	<input type="checkbox"/>	-0.8134736271864131
Square1	<input type="checkbox"/>	2.0

Create New Signal

Signal Type
Sinusoid

NodeId/Name
MyDevice.Pump_01.Pressure

150
100
50
0

12:56:43 PM CEST

Show Legend Animated Symbols Show data for last (seconds) 60

Running v3.0.0-157

Prosys OPC UA Simulation Server

Help

Status Endpoints Users Sessions Certificates Connection Log Address Space Simulation Debug Log Req/Res Log

Run Simulation Interval (ms): 1000 Simulation Time: 02.10.2018 12:59:43.000

Signal Name / NodeId	Visualize	Value
Sawtooth1	<input type="checkbox"/>	0.8000001907348633
Triangle1	<input type="checkbox"/>	0.8000005182741307
IOT_Sim_SIN_01	<input type="checkbox"/>	4.755281431440678
Expression1	<input type="checkbox"/>	3.975571353942956
MyDevice.Pump_01.P...	<input checked="" type="checkbox"/>	1.1755711632080925

Create New Signal

Signal Type: Sinusoid

NodeId/Name:

Create

MyDevice.Pump_01.Pressure

Show Legend Animated Symbols Show data for last (seconds) 60

Running v3.0.0-157

Node-RED

filter nodes Example 1 Flow 1

- > input
- > output
- > function
- > social
- > storage
- > analysis
- > advanced
- > Raspberry Pi
- > performance
- > IIoT
- ▼ opcua
 - OpcUa Item
 - OpcUa Client
 - OpcUa Browser
 - OpcUa Server
 - OpcUa Event

Info

Node Help

Connect to an endpoint like
opc.tcp://host:port/UA/EndpointName.

Actions are:

- Read
- Write
- Browse
- Subscribe
- Unsubscribe
- Event
- Info

Inject your OPC UA address (NodeId) by the **Topic** of an Inject node or with the OpcUa-Item controlled by an Inject node.

To Read/Write inject the Topic for every operation.

The value to Write should be injected by an OpcUa-Item.

Inject the Topic only once on Subscribe or Event for subscription and you got the changin value on every Interval. Every inject subscribes

Dragging a node onto a wire will splice it into the link

Node-RED

filter nodes Example 1

input

- inject
- catch
- status
- link
- mqtt
- http
- websocket
- tcp
- udp

output

function

social

storage

analysis

advanced

Raspberry Pi

Edit inject node

Delete Cancel Done

node properties

Payload [random string]

Topic [empty]

Inject once after 0.1 seconds, then

Repeat interval

every 1 seconds

Name Name

Note: "interval between times" and "at a specific time" will use cron. "interval" should be less than 596 hours. See info box for details.

node settings

info

Information

Node	"1ce12688.e72acf"
Type	inject

show more

Node Help

Injects a message into a flow either manually at regular intervals. The message payload can be a variety of types, including strings, JavaScript objects or the current time.

Outputs

payload various
The configured payload of the message.

topic string
An optional property that can be configured in the node.

Details

The Inject node can initiate a flow with a specific payload value. The default payload is timestamp of the current time in millisecs since

Hold down [Shift] when you click on a node to also select all of its connected nodes

Node-RED

filter nodes

Example 1

Flow 1

Deploy

Information

Flow	"5b43bb45.40e804"
Name	Flow 1
Status	Enabled

Flow Description

None

Hold down **⌘** when you **click** on a node port to enable quick-wiring

The screenshot shows the Node-RED web interface. On the left, a sidebar lists various nodes under the 'opcua' category. Two nodes, 'OpcUa Item' and 'OpcUa Client', are circled in red. In the main workspace, a flow named 'Flow 1' is visible, consisting of three nodes: 'inject', 'OPC UA Item', and 'OPC UA Client', connected in a sequence. A large red oval highlights this flow. The right sidebar displays the 'info' panel for the selected flow, showing its ID, name, and status. At the bottom of the sidebar, there is a tip about using the Command key for quick-wiring.

Edit OpcUa-Item node

Delete

Cancel

Done

node properties

Item

ns=5;s=MyDevice.Pump_01.Pressure

Type

Double

Value

Name

Edit OpcUa-Client node

Delete Cancel **Done**

node properties

- Endpoint: `opc.tcp://localhost:53530/OPCUA/Simul`
- Action: READ
- Path to certificates: `../../../../node_modules/node-opcua-client/certificate:`
- Name:

Node-RED Flow

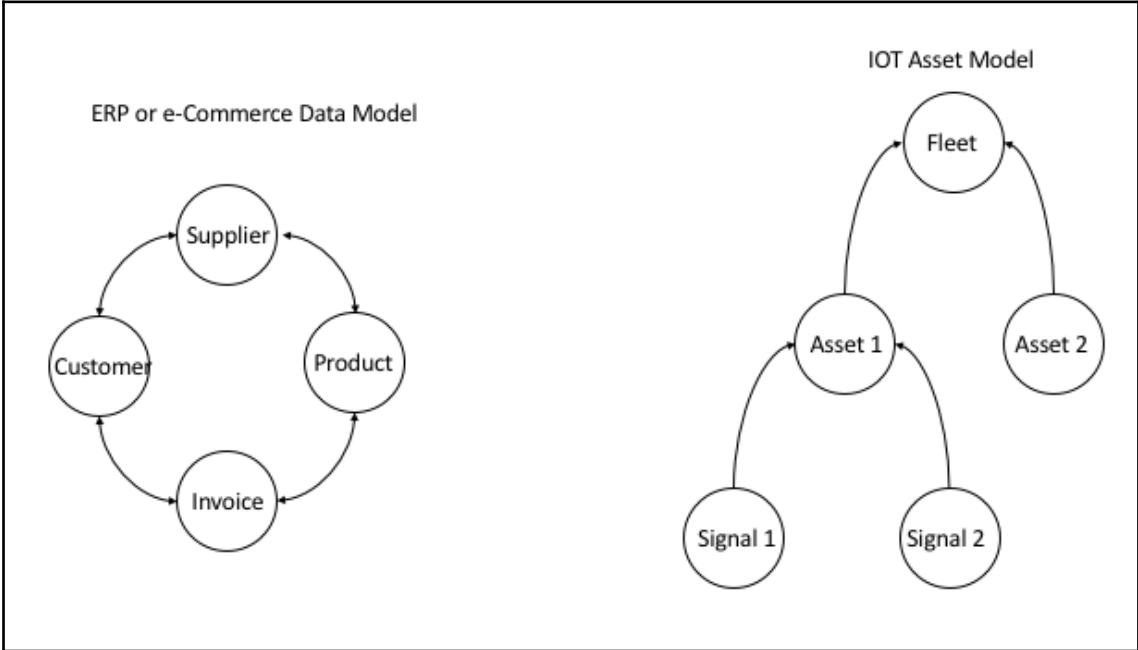
Flow 1

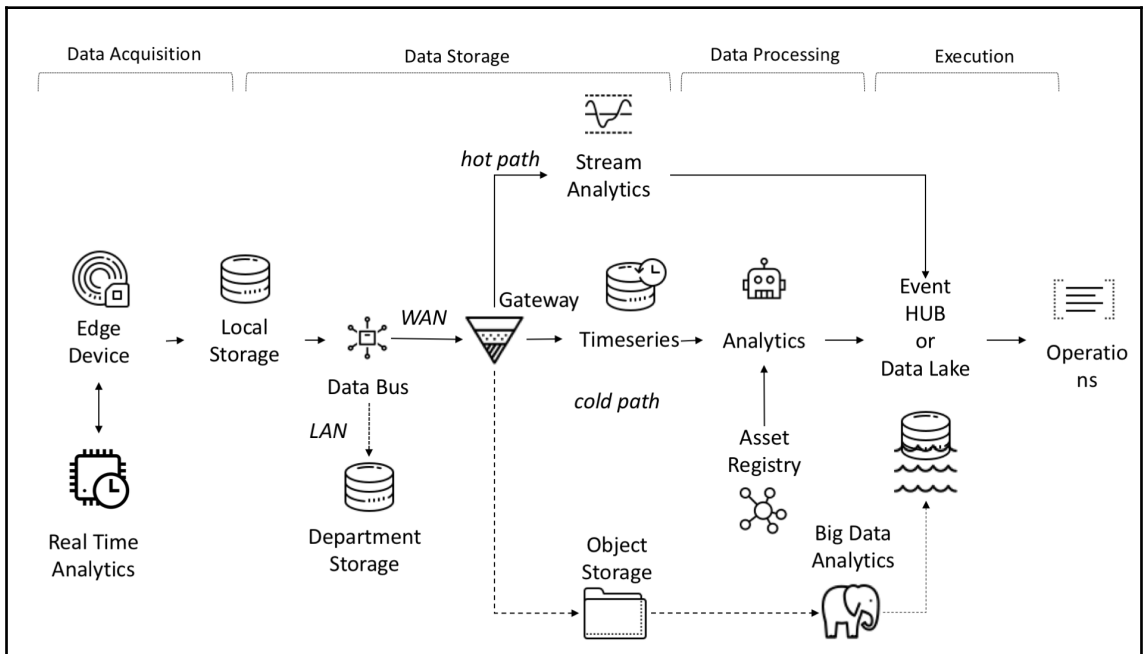
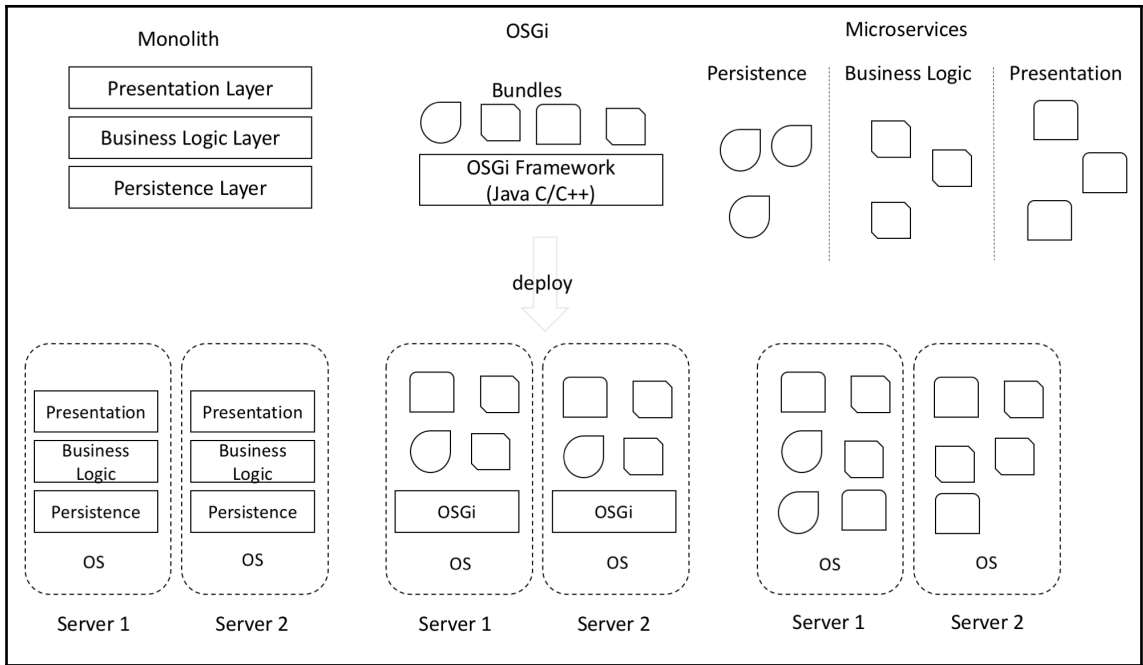
inject → OPC UA Item → OPC UA Client (active reading) → msg payload

debug console output:

```
ns=5-s=MyDevice.Pump_01.Pressure : msg payload : number  
-1.1755708406893963  
2/10/2018, 14:00:58 node: 56b8bc1e e7c054  
ns=5-s=MyDevice.Pump_01.Pressure : msg payload : number  
-0.8134740906459311  
2/10/2018, 14:00:59 node: 56b8bc1e e7c054  
ns=5-s=MyDevice.Pump_01.Pressure : msg payload : number  
-0.4158237652016526  
2/10/2018, 14:01:00 node: 56b8bc1e e7c054  
ns=5-s=MyDevice.Pump_01.Pressure : msg payload : number  
-0.573160252391382e-7  
2/10/2018, 14:01:01 node: 56b8bc1e e7c054  
ns=5-s=MyDevice.Pump_01.Pressure : msg payload : number  
0.4158230206726717  
2/10/2018, 14:01:02 node: 56b8bc1e e7c054  
ns=5-s=MyDevice.Pump_01.Pressure : msg payload : number  
0.813472524251618
```


Chapter 7: Developing Industrial IoT and Architecture





NAME	VALUE	TYPE	QUALITY	ATTRIBUTES
CT001.TEMPERATURE	25	Number	GOOD	
CT002.EVT.ANOMALY	Anomaly detected	Text	GOOD	"cause: low temp, ..."

.....



Graph
Stats
Logs
Version

From

To [\(now\)](#) Autoreload

WxH: Global annotations

metric 1
+

Metric:

Tags:

Rate Rate Ctr Right Axis

Rate Ctr Max:

Rate Ctr Reset:

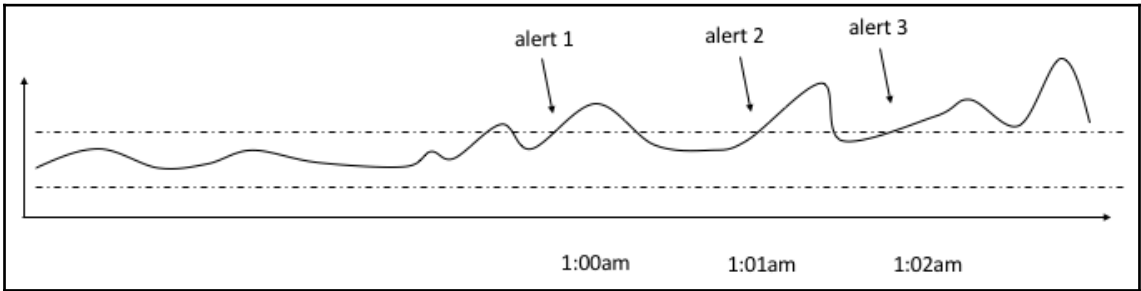
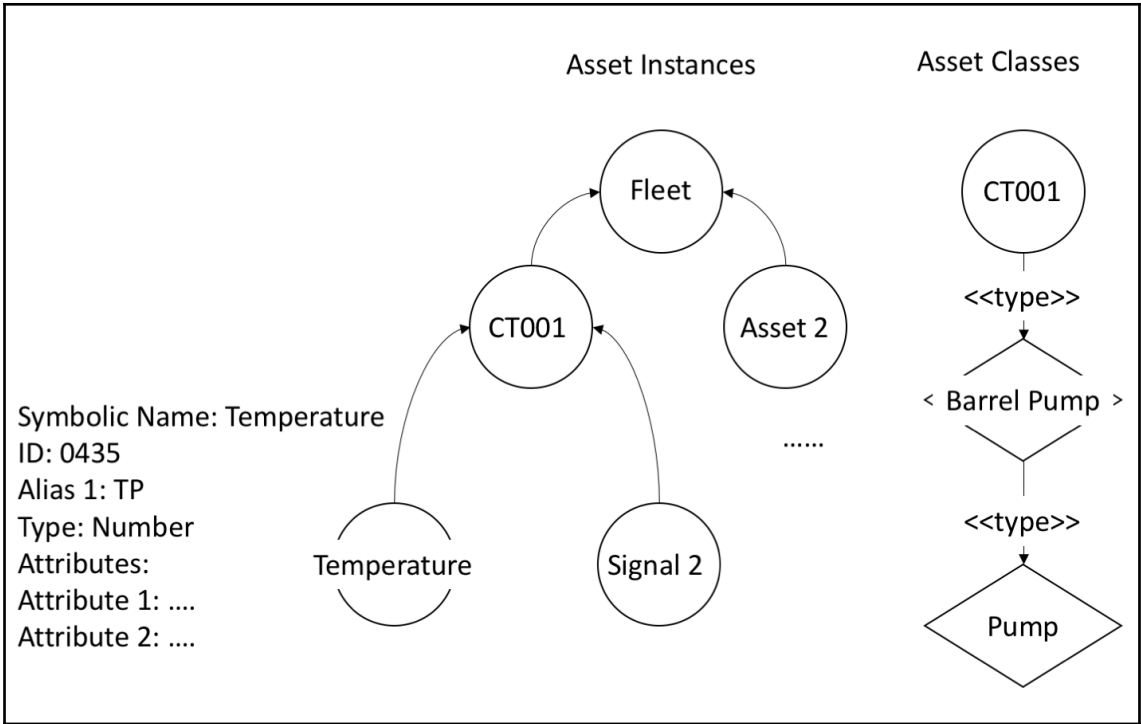
Aggregator:

Downsample

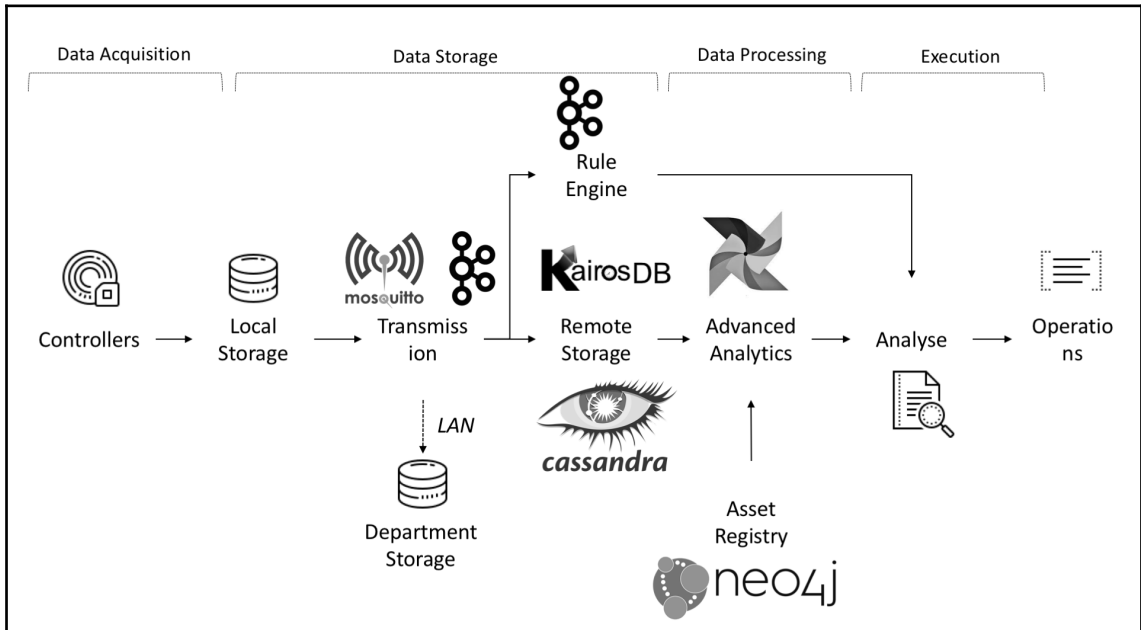
Axes
Key
Style

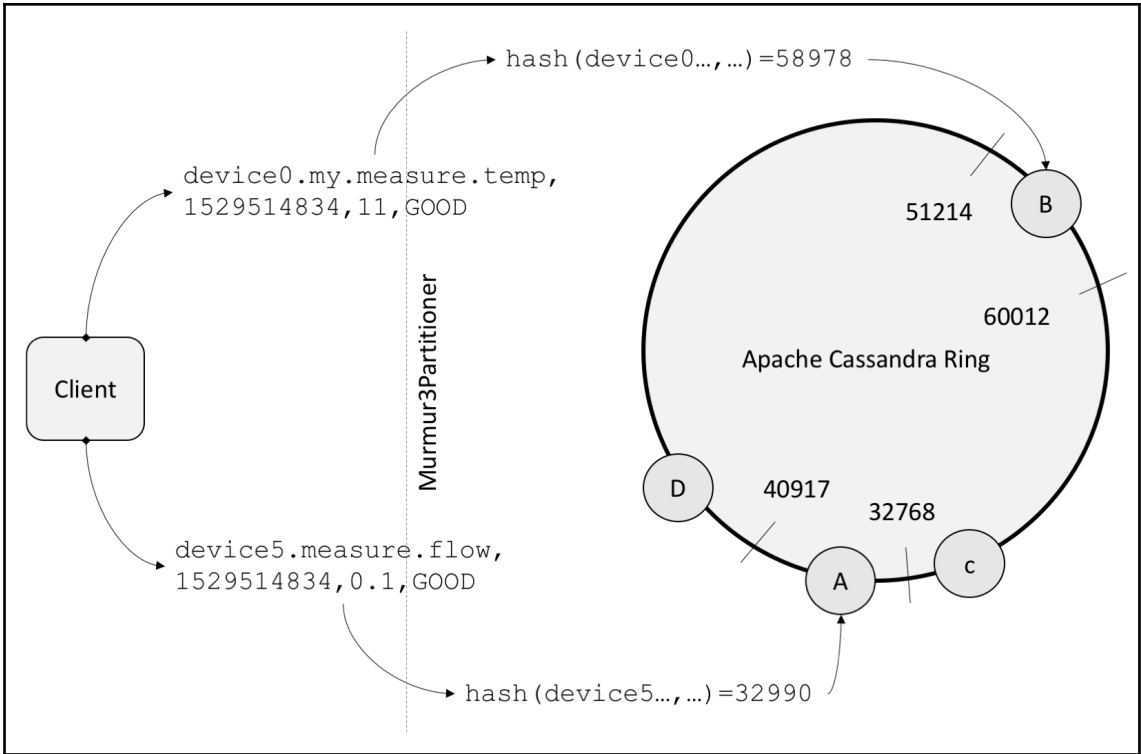
	Y	Y2
Label	<input type="text"/>	<input type="text"/>
Format	<input type="text"/>	<input type="text"/>
Range	<input type="text" value="[0:]"/>	<input type="text" value="[0:]"/>
Log scale	<input type="checkbox"/>	<input type="checkbox"/>

Please specify a start time.



Chapter 8: Implementing a Custom Industrial IoT Platform





Time Range

Absolute Relative Time Zone
From* 2016-08-01 06:13:00.732 pm or Hours 2 ago
To or Years 5 ago Default

Metrics

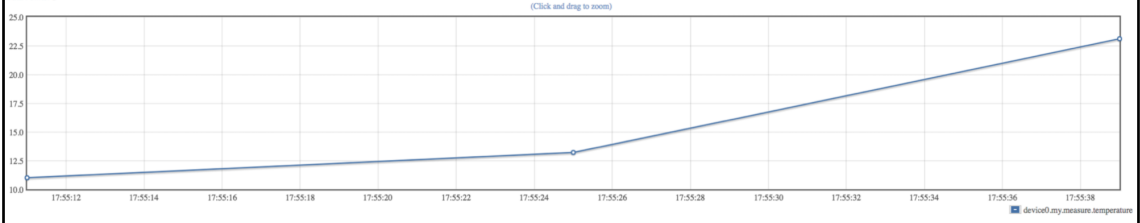
device0.my.measure.temperature *
Name* device0.my.measure.temperature
Limit
Group By
Aggregators SCALE Factor 1.0
Tags

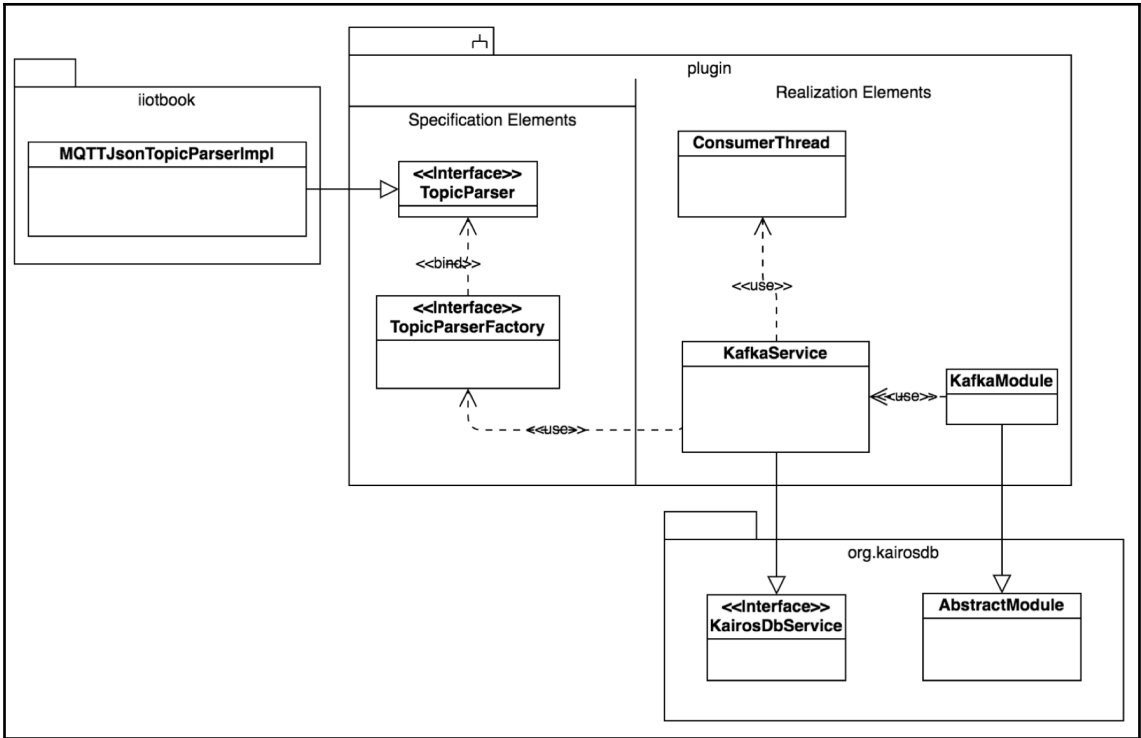
* Required Fields

- Graph
- Show Query
- Save
- Delete Data

Link to Graph

Query Time: 55 ms
Sample Size: 3
Data Points: 3





Time Range

Absolute Relative Time Zone

From* 2016-08-01 06:13:00.732 pm or Hours ago Default

To or Years ago

Metrics

device0.my.measure.temperature *

Name* device0.my.measure.temperature

Limit

Group By

Aggregators

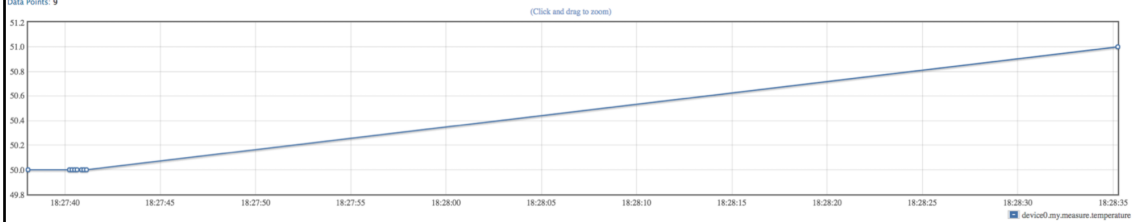
SCALE Factor 1.0

Tags

* Required Fields

[Link to Graph](#)

Query Time: 51 ms
Sample Size: 9
Data Points: 9



DAGs

Search:

<input type="checkbox"/>	DAG	Schedule	Owner	Recent Tasks	Last Run	DAG Runs	Links
<input type="checkbox"/>	example_bash_operator	0 0 ***	airflow	<input type="checkbox"/>		<input type="checkbox"/>	🔍 📊 📅 🔗 🗑️ 🔄
<input type="checkbox"/>	example_branch_dop_operator_v3	* * * * *	airflow	<input type="checkbox"/>		<input type="checkbox"/>	🔍 📊 📅 🔗 🗑️ 🔄
<input type="checkbox"/>	example_branch_operator	@daily	airflow	<input type="checkbox"/>		<input type="checkbox"/>	🔍 📊 📅 🔗 🗑️ 🔄
<input type="checkbox"/>	example_http_operator	1 day, 00:00	airflow	<input type="checkbox"/>		<input type="checkbox"/>	🔍 📊 📅 🔗 🗑️ 🔄
<input type="checkbox"/>	example_passing_params_via_test_command	* * * * *	airflow	<input type="checkbox"/>		<input type="checkbox"/>	🔍 📊 📅 🔗 🗑️ 🔄
<input type="checkbox"/>	example_python_operator	None	airflow	<input type="checkbox"/>		<input type="checkbox"/>	🔍 📊 📅 🔗 🗑️ 🔄
<input type="checkbox"/>	example_short_circuit_operator	1 day, 00:00	airflow	<input type="checkbox"/>		<input type="checkbox"/>	🔍 📊 📅 🔗 🗑️ 🔄
<input type="checkbox"/>	example_skip_dag	1 day, 00:00	airflow	<input checked="" type="checkbox"/> success		<input type="checkbox"/>	🔍 📊 📅 🔗 🗑️ 🔄
<input type="checkbox"/>	example_subdag_operator	Once	airflow	<input type="checkbox"/>		<input type="checkbox"/>	🔍 📊 📅 🔗 🗑️ 🔄
<input type="checkbox"/>	example_trigger_controller_dag	Once	airflow	<input type="checkbox"/>		<input type="checkbox"/>	🔍 📊 📅 🔗 🗑️ 🔄
<input type="checkbox"/>	example_trigger_target_dag	None	airflow	<input type="checkbox"/>		<input type="checkbox"/>	🔍 📊 📅 🔗 🗑️ 🔄
<input type="checkbox"/>	example_xcom	Once	airflow	<input type="checkbox"/>		<input type="checkbox"/>	🔍 📊 📅 🔗 🗑️ 🔄
<input type="checkbox"/>	hello_world		Airflow				🔄
<input type="checkbox"/>	latest_only	@00:00	Airflow	<input type="checkbox"/>		<input type="checkbox"/>	🔍 📊 📅 🔗 🗑️ 🔄
<input type="checkbox"/>	latest_only_with_trigger	@02:00	Airflow	<input type="checkbox"/>		<input type="checkbox"/>	🔍 📊 📅 🔗 🗑️ 🔄

Airflow DAGs Data Profiling Browse Admin Docs About 15:50 UTC

Connections

List (26) Create With selected-

- Pool
- Configuration
- Users
- Connections**
- Variables
- XComs

	Conn Id	Conn type	Host	Port	Is Encrypted	Is Extra Encrypted
<input type="checkbox"/>	airflow_ci	mysql	localhost		<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	airflow_db	mysql	localhost		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	aws_default	aws			<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	beeline_default	beeline	localhost	10000	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	bigquery_default	bigquery			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	databricks_default	databricks	localhost		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	druid_ingest_default	druid	druid-overlord	8081	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	emr_default	emr			<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	fs_default	fs			<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	google_cloud_default	google_cloud_platform			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	hive_cli_default	hive_cli			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	hiveserver2_default	hiveserver2	localhost	10000	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	http_default	http	https://www.google.com/		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	http_kairosdb	http	http://localhost:8080		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Conn Id

Conn Type

Host

Schema

Login

Password

Port

Extra

Airflow | DAGs | Data Profiling | Browse | Admin | Docs | About | 16:32 UTC

DAGs

Search:

	DAG	Schedule	Owner	Recent Tasks	Last Run	DAG Runs	Links
<input checked="" type="checkbox"/>	On mymean	****0	iiot-book	● ● ● ● ●	2018-06-17 23:58	● ● ●	<input type="button" value="Trigger Dag"/> <input type="button" value="Refresh"/> <input type="button" value="Log"/> <input type="button" value="Download"/> <input type="button" value="Share"/> <input type="button" value="Print"/> <input type="button" value="Close"/>

Showing 1 to 1 of 1 entries

« < 1 > »

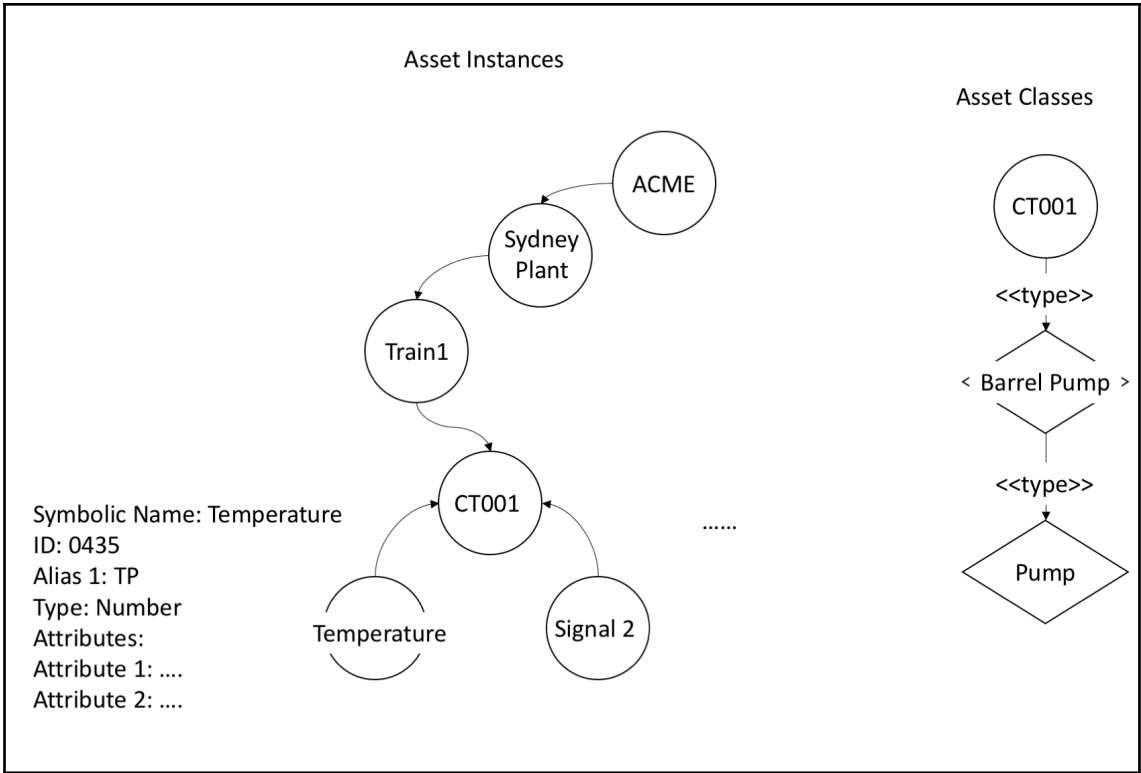
On DAG: mymean Simple Mean of the temperature from last year schedule: ****0

- Graph View
- Tree View**
- Task Duration
- Task Tries
- Landing Times
- Gantt
- Details
- Code
- Refresh

Base date: 2018-06-22 16:32:19 Number of runs: 25 Go

KairosDBOperator PythonOperator success running failed skipped retry queued no status





```

11 CREATE (TEMP01:Measure {name:'CT001.TEMPERATURE01', alias:'TEMP01', type:'TEMPERATURE', uom:'DEG'})
12 CREATE (FLOW01:Measure {name:'CT001.FLOW01', alias:'FLOW01', type:'FLOW', uom:'sm3/sec'})
13
14 CREATE
15 (TEMP01)-[:MEASURE_OF]->(CT001),
16 (FLOW01)-[:MEASURE_OF]->(CT001)
  
```

To enjoy the full Neo4j Browser experience, we advise you to use [Neo4j Browser Sync](#)

```

$ CREATE (CT001:Pump {name:'CT001', alias:'Pump-SN-993416776', model:'standard'}) CREATE (Train1:Section {name:'Product...
  
```

Added 6 labels, created 6 nodes, set 17 properties, created 5 relationships, completed after 3 ms.

Added 6 labels, created 6 nodes, set 17 properties, created 5 relationships, completed after 3 ms.

```
1 MATCH (:Section)-[:BELONGING_OF]-(EQ)-[:MEASURE_OF]-(M)
2 WHERE M.type='TEMPERATURE'
3 RETURN EQ.name, M.name, M.uom
```

To enjoy the full Neo4j Browser experience, we advise you to use [Neo4j Browser Sync](#)

```
$ MATCH (:Section)-[:BELONGING_OF]-(EQ)-[:MEASURE_OF]-(M) WHERE M.type='TEMPERATURE' RETURN EQ.name, M.name, M.u...
```

EQ.name	M.name	M.uom
"CT001"	"CT001.TEMPERATURE01"	"DEG"

Started streaming 1 records after 1 ms and completed after 2 ms.

```
neo4j -- bash -- 109x53
GC02VM13CHV2QE:neo4j giacomoveneri$ npm init
This utility will walk you through creating a package.json file.
It only covers the most common items, and tries to guess sensible defaults.

See `npm help json` for definitive documentation on these fields
and exactly what they do.

Use `npm install <pkg>` afterwards to install a package and
save it as a dependency in the package.json file.

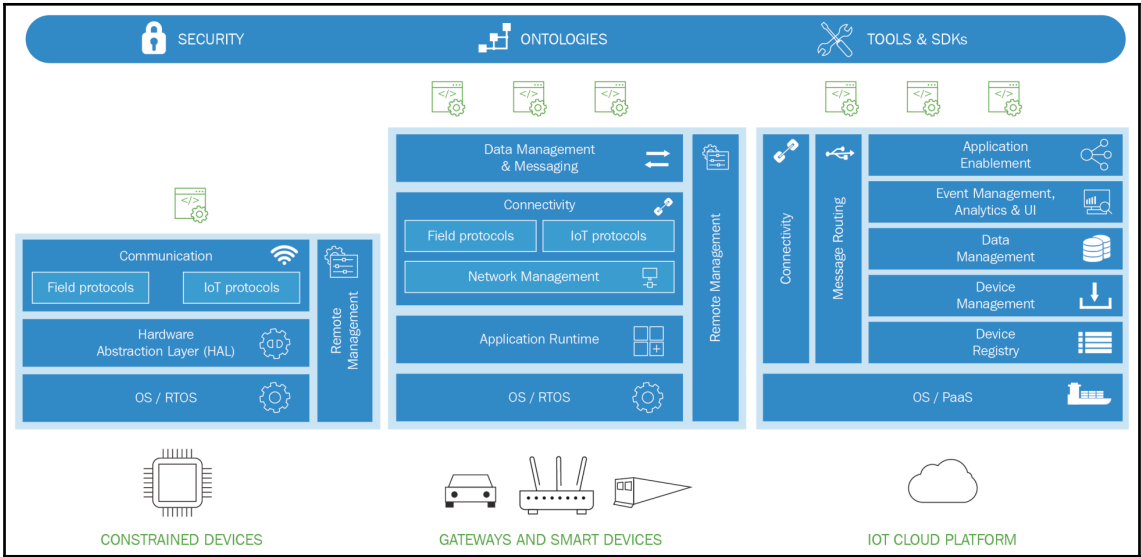
Press ^C at any time to quit.
package name: (neo4j)
version: (1.0.0)
description:
git repository:
keywords:
author:
license: (ISC)
About to write to /Users/giacomoveneri/Documents/workspace-iiot/neo4j/package.json:

{
  "name": "neo4j",
  "version": "1.0.0",
  "main": "ask_for_measure.js",
  "dependencies": {
    "neo4j-driver": "^1.6.1"
  },
  "devDependencies": {},
  "scripts": {
    "test": "echo \"Error: no test specified\" && exit 1"
  },
  "author": "",
  "license": "ISC",
  "description": ""
}

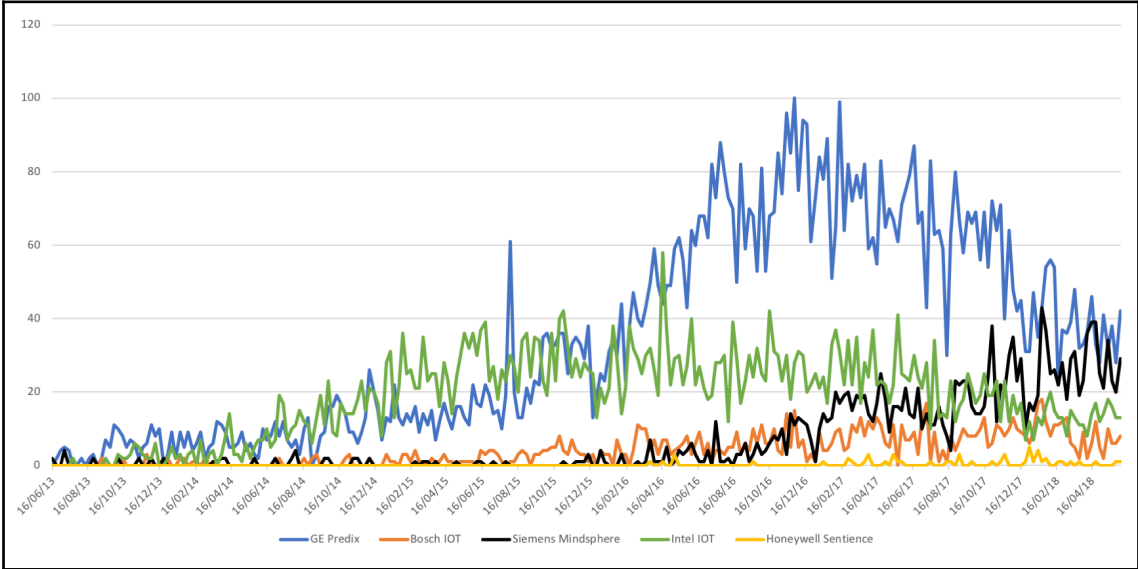
Is this OK? (yes)
GC02VM13CHV2QE:neo4j giacomoveneri$ npm install neo4j-driver
npm WARN neo4j@1.0.0 No description
npm WARN neo4j@1.0.0 No repository field.

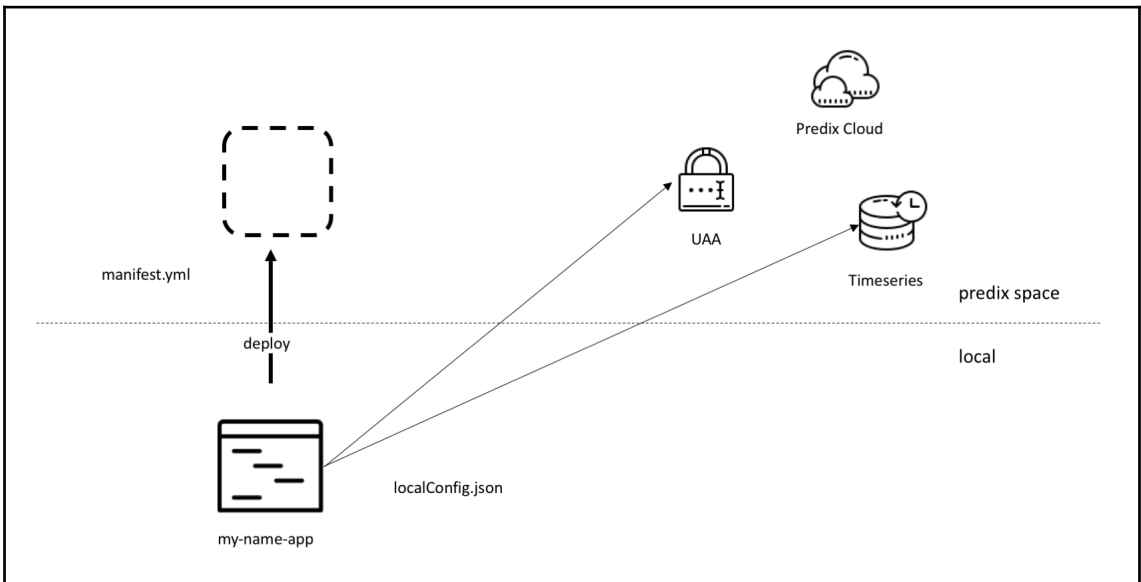
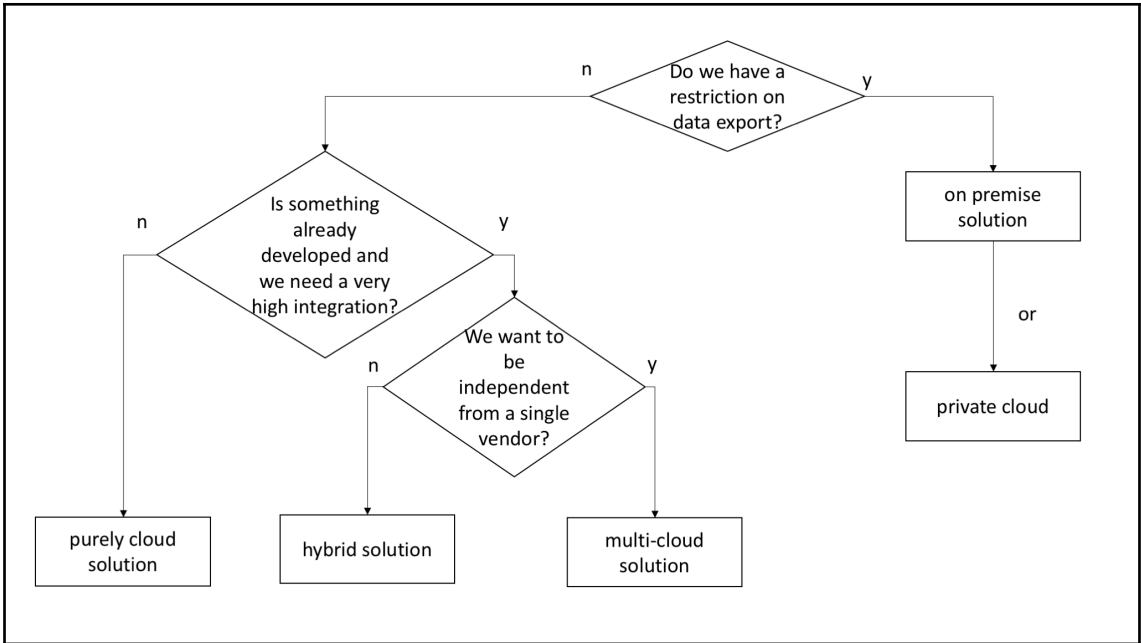
+ neo4j-driver@1.6.1
updated 1 package and audited 6 packages in 3.336s
found 0 vulnerabilities

GC02VM13CHV2QE:neo4j giacomoveneri$ node ask_for_measure.js
Record {
  keys: [ 'EQ.name', 'M.name', 'M.uom' ],
  length: 3,
  _fields: [ 'CT001', 'CT001.TEMPERATURE01', 'DEG' ],
  _fieldLookup: { 'EQ.name': 0, 'M.name': 1, 'M.uom': 2 } }
GC02VM13CHV2QE:neo4j giacomoveneri$
```



Chapter 9: Understanding Industrial OEM Platforms







CATALOG

Browse unique services and analytics by category, function, and utility, and combine them to build custom apps.

Services

Analytics

Apps

User Account and Authentication

Use this service for a full-featured OAuth 2.0 server.

PREDIX

Time Series

Quickly and efficiently manage, distribute, ingest, store, and analyze time series data.

PREDIX

New subscription

Service: predix-uaa

* Required fields

Region* 

Org* 

Space* 

Service instance name*

Service plan* 

Admin client secret*

Subdomain

New subscription

Service: predix-timeseries

* Required fields

Region*

US West



Org*



Space*

dev



User Account & Authentication (UAA)*

myname-UAA



or

[Subscribe to New UAA](#)

[Learn more](#)

[Use other UAA](#)

Service instance name*

myname-ts

Service plan*

Free



Space: **dev** 

Service Instances

Apps

Service instances

[View Catalog](#)

myname-UAA

Free, predix-uaa, 3 apps



myname-TS

Free, predix-timeseries, 3 apps



Overview

[Client Management](#)

[User Management](#)

[Identity Providers](#)

[Password Policy](#)

[Customization](#)

At-A-Glance

2

Clients

[Manage Clients](#)

1

Users

[Manage Users](#)

24

Groups

[Manage Groups](#)

1

Identity Providers

[Manage IdPs](#)

Your UAA

https://.predix-uaa.run.aws-usw02-pr.ice.predix.io

Client Info Edit
Generate Token

Authorized Grant Types

refresh_token
client_credentials
authorization_code

Scope

zones.read
idps.write
uaa.none
openid
zones.write

timeseries.zones. .user

Auto Approved Scope

uaa.none
openid

Authorities

timeseries.zones. .user

uaa.none

Allowed Providers

uaa

Redirect URI

http://localhost:5000

Authorized Services

myname-TS

Choose Service

Submit

Users
Filter by Origin ▼

 Create Group
 Manage Groups
 Create User

USER NAMES	ORIGIN	EMAIL	GROUPS	ACTIONS
myuser	uaa		<div style="margin-bottom: 5px;">▼ 8 groups</div> <div style="display: flex; flex-wrap: wrap; gap: 5px;"> approvals.me openid profile </div> <div style="display: flex; flex-wrap: wrap; gap: 5px; margin-top: 5px;"> user_attributes uaa.user </div> <div style="display: flex; flex-wrap: wrap; gap: 5px; margin-top: 5px;"> uaa.offline_token roles </div> <div style="display: flex; flex-wrap: wrap; gap: 5px; margin-top: 5px;"> password.write </div> <div style="margin-top: 5px; font-size: 0.8em;"> Add/Remove Groups </div>	 ✕

Home

Login as Admin

Create Client ID

Get Client ID

Update Client ID

Create User

Create Group

Add User To Group

User Authcode Login

User Password Login

Client ID Login

Log in as a client.

This is a demonstration of logging in as a client, with the grant type of "client_credentials". Token generated by this call is used to call Predix Industrial Services.

UAA URL:

Client ID:

Client Secret:

See cURL command

Submit

Predix Tool Kit

Security API Explorer

API Home

Login as Client

Login as User

Access Control Service

Analytics Framework

Asset

Data Exchange

Time Series Ingest

Time Series Query

Websocket Client

REST Client

Logout

WEBSOCKET

Request Headers

predix-zone-id

authorization Bearer View Token

Request Body

```
1 - {
2   "messageId": "1453338376222",
3   "body": [
4     {
5       "name": "IIOT-BOOK:CompressionRatio",
6       "datapoints": [
7         [
8           1528816251000,
9           10,
10          3
11        ],
12       [
13         1528816251000,
14         15,
15         3
16       ]
17     ]
18   },
19   "attributes": {
20     "host": "server1",
21     "customer": "Acme"
22   }
23 }
```

Open socket Send message Close socket

- API Home
- Login as Client
- Login as User

- Access Control Service
- Analytics Framework
- Asset
- Data Exchange
- Time Series Ingest
- Time Series Query

- Websocket Client
- REST Client

- Logout

Choose Request: Latest Datapoints R...

POST <https://time-series-store-predix.run.aws-usw02-pr.ice.predix.io/v1/datapoints/latest>

Request Headers

predix-zone-id

authorization Bearer

content-type application/json

Request Body

```
1 {
2   "tags": [
3     {
4       "name": "IIOT-BOOK:CompressionRatio"
5     }
6   ]
7 }
```

Type in a search term...

Home

Gallery

Release Notes

▼ Getting Started

About The System

Developing with the System

Design Starter Kit

Sample Application & Layouts

Additional Resources

▶ Design Guidelines

▶ Developer Guides

▶ CSS Modules

▶ Components

▶ Tools

Sample Application

Putting it together

It's super easy to create an application by combining components and design modules from the Predix Design System.

Coded versions of most of the [layout examples](#) provided in the [Design Starter Kit](#) are available here:

[Get the Layouts](#)

We've also created an holistic example application for you that combines branding, navigation, routing, asset selection, data visualization, and other components to illustrate several example layouts that are possible with the Predix components.

[View the Sample App](#)

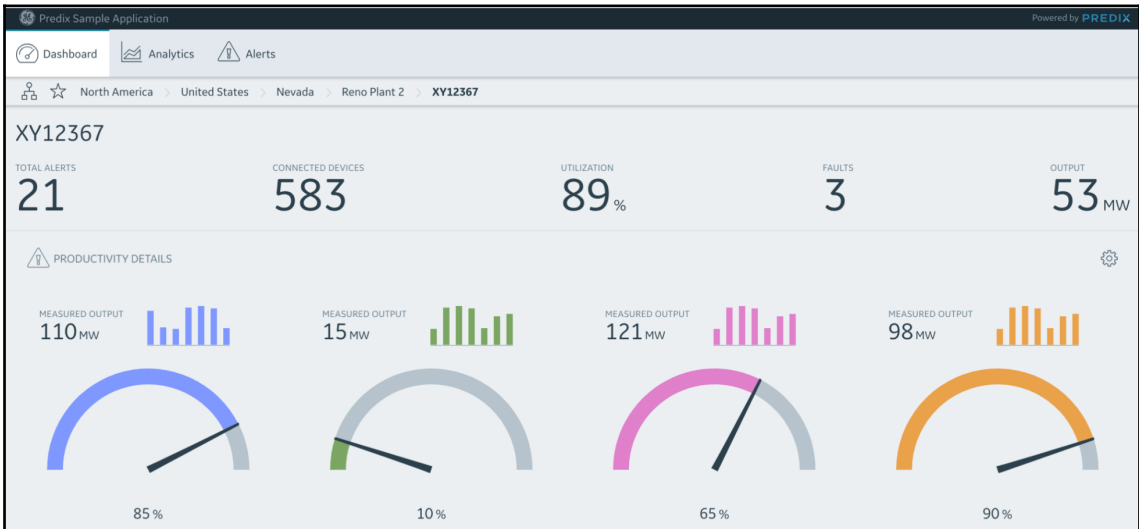
[Get the Code](#)

Use with other frameworks

Versions of the sample app have also been created to demonstrate the interoperation of Predix components with the following popular JavaScript frameworks:

[Angular](#)

[React](#)





Dashboard



Analytics



Alerts

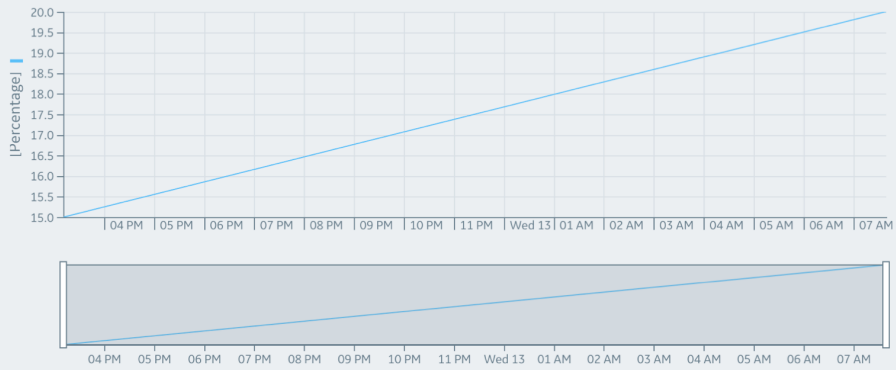


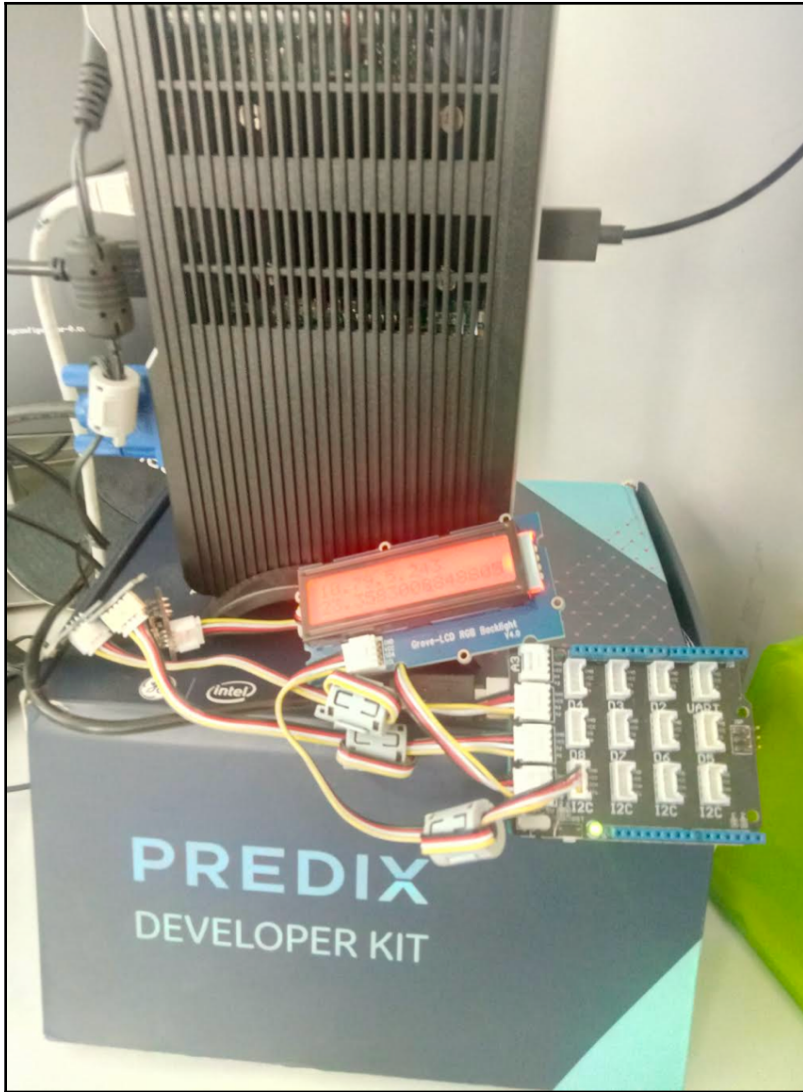
LIVE DATA

Compression ▾

05/01/2018 00:00 AM TO 06/14/2018 23:59 PM

Get Data





Customize Predix Machine



Point your device at a custom Predix Time Series and a custom Application URL. Later, you may use the *Reset Device* link to point everything back at the shared cloud app.

[Learn more about setting up a Predix Time Series instance.](#)

Enter Timeseries Secure Websocket Endpoint URL for Data Ingestion

Enter Instance ID of your Timeseries Service

Enter Issuer ID URL of the UAA service, ending with /oauth/token

Enter Client ID. Client ID is the UAA account with privileges to Time Series

Enter Secret. Secret is the password for the Client Id

Enter the url of your application and we will replace the url for the View in Cloud button

PREDIX Developer Kit

Update Packages

WR-IDP-F0F1
Connected

HOST NAME WR-IDP-F0F1
MODEL Intel(R) Atom(TM) CPU E3815 @ 1.46GHz
VERSION WR7.0.0.13
ETH0 10.79.5.243
WIFI SSID No Wireless
TIME Wed Jun 13 09:44:50 2018

UPTIME 0d 0h 3m
OS DRIVE 1.1/3.4
DEVHUB VERSION 1.0.4-r1.0.37
MEC STATUS Active

Sound

576
Decibel

Gauge

Temperature

100
80
60
40
20
0

Celsius

Local

rotary

371
angle

Local

Light

100
80
60
40
20
0

Lumen

Local

Predix Tool Kit

Security API Explorer

- API Home
- Login as Client
- Login as User
- Access Control Service
- Analytics Framework
- Asset
- Data Exchange
- Time Series Ingest
- Time Series Query**
- Websocket Client
- REST Client
- Logout

Make a few basic queries against your time series instance.

UAA URL: [https://\[redacted\].predix-uaa.run.aws-usw02-pr.ice.predix.io](https://[redacted].predix-uaa.run.aws-usw02-pr.ice.predix.io)

Choose Request: **Get Tags**

GET [https://\[redacted\]-store.predix.run.aws-usw02-pr.ice.predix.io/v1/tags](https://[redacted]-store.predix.run.aws-usw02-pr.ice.predix.io/v1/tags)

Request Headers

predix-zone-id [redacted]

authorization Bearer View Token

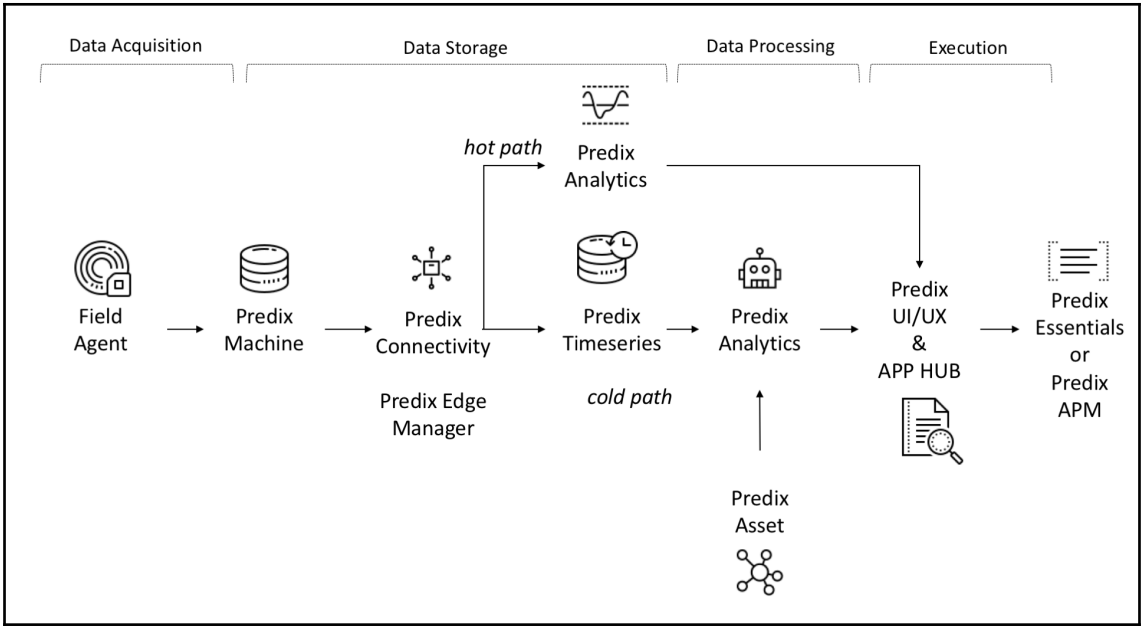
See cURL command Submit

HTTP Response Code: 200 OK

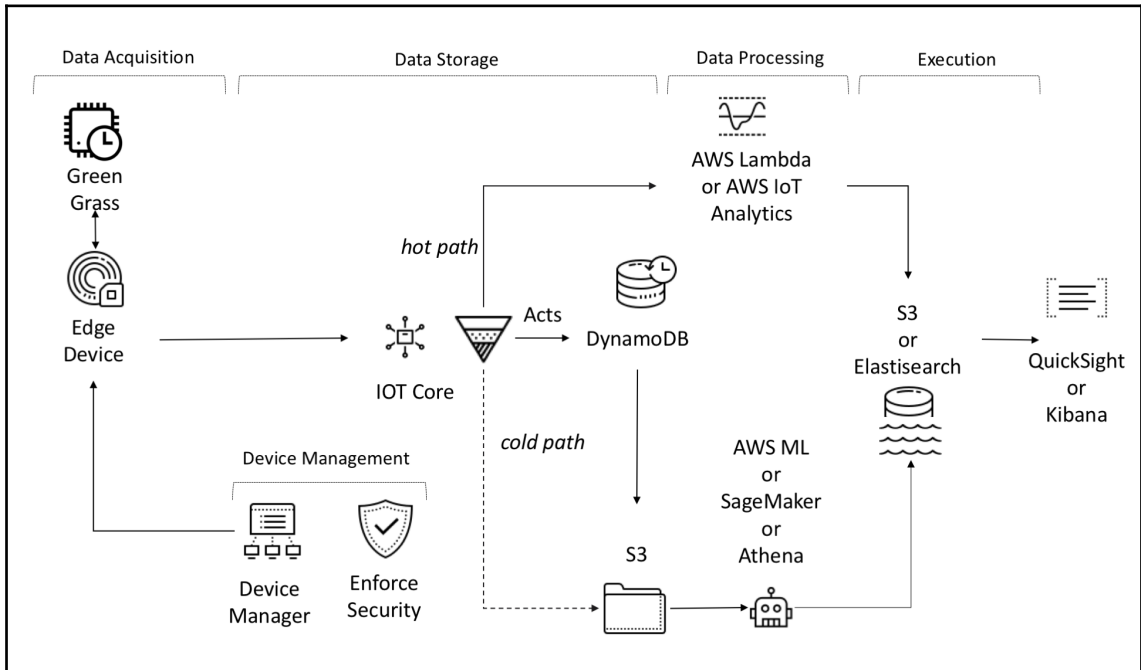
```

{
  "results": [
    "light",
    "rotaryangle",
    "sound",
    "temperature",
    "Compressor-2017:CompressionRatio",
    "IOT-BOOK:CompressionRatio",
    "L0001:TRH",
    "WRtest1",
    "WR-IDP-F0F1:light",
    "WR-IDP-F0F1:rotaryangle",
    "WR-IDP-F0F1:sound",
    "WR-IDP-F0F1:temperature"
  ]
}

```



Chapter 10: Implementing a Cloud Industrial IoT Solution with AWS



AWS Accounts Include 12 Months of Free Tier Access

Including use of Amazon EC2, Amazon S3, and Amazon
DynamoDB

Visit aws.amazon.com/free for full offer terms

Create an AWS account

Email address

Password

Confirm password

AWS account name ⓘ

Continue

[Sign in to an existing AWS account](#)

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[Privacy Policy](#) | [Terms of Use](#)

Add user

1 2 3 4

Set user details

You can add multiple users at once with the same access type and permissions. [Learn more](#)

User name*

[+ Add another user](#)

Select AWS access type

Select how these users will access AWS. Access keys and autogenerated passwords are provided in the last step. [Learn more](#)

Access type* **Programmatic access**
 Enables an **access key ID** and **secret access key** for the AWS API, CLI, SDK, and other development tools.

AWS Management Console access
 Enables a **password** that allows users to sign-in to the AWS Management Console.

* Required

[Cancel](#) [Next: Permissions](#)

Add user

1 2 3 4

Set permissions

[Add user to group](#) [Copy permissions from existing user](#) [Attach existing policies directly](#)

[Create policy](#) [Refresh](#)

Filter policies Showing 356 results

	Policy name	Type	Used as	Description
<input checked="" type="checkbox"/>	AdministratorAccess	Job function	Permissions policy (2)	Provides full access to AWS services and re...
<input type="checkbox"/>	AlexaForBusinessD...	AWS managed	None	Provide device setup access to AlexaForBu...
<input type="checkbox"/>	AlexaForBusinessF...	AWS managed	None	Grants full access to AlexaForBusiness reso...
<input type="checkbox"/>	AlexaForBusinessG...	AWS managed	None	Provide gateway execution access to Alexa...
<input type="checkbox"/>	AlexaForBusinessR...	AWS managed	None	Provide read only access to AlexaForBusine...
<input type="checkbox"/>	AmazonAPIGatewa...	AWS managed	None	Provides full access to create, edit, delete Am...

[Cancel](#) [Previous](#) [Next: Review](#)

Add user

1

2

3

4













Success

You successfully created the users shown below. You can view and download user security credentials. You can also email users instructions for signing in to the AWS Management Console. This is the last time these credentials will be available to download. However, you can create new credentials at any time.

Users with AWS Management Console access can sign-in at: <https://t. xxxxxxxxxxxxxxxx .signin.aws.amazon.com/console>

Download .csv


	User	Access key ID	Secret access key
▶	✓ myadmin	XXXXXXXXXXXXXXXXXX	***** Show

 <p>Database</p> <ul style="list-style-type: none"> RDS DynamoDB ElastiCache Neptune Amazon Redshift 	<ul style="list-style-type: none"> MediaConvert MediaLive MediaPackage MediaStore MediaTailor 	<p>SWF</p>  <p>Customer Engagement</p> <ul style="list-style-type: none"> Amazon Connect Pinpoint Simple Email Service
 <p>Migration</p> <ul style="list-style-type: none"> AWS Migration Hub Application Discovery Service Database Migration Service Server Migration Service Snowball 	 <p>Machine Learning</p> <ul style="list-style-type: none"> Amazon SageMaker Amazon Comprehend AWS DeepLens Amazon Lex Machine Learning Amazon Polly Rekognition Amazon Transcribe Amazon Translate 	 <p>Business Productivity</p> <ul style="list-style-type: none"> Alexa for Business Amazon Chime ↗ WorkDocs WorkMail
 <p>Networking & Content Delivery</p> <ul style="list-style-type: none"> VPC CloudFront Route 53 API Gateway Direct Connect 	 <p>Analytics</p> <ul style="list-style-type: none"> Athena EMR CloudSearch Elasticsearch Service Kinesis QuickSight ↗ Data Pipeline 	 <p>Desktop & App Streaming</p> <ul style="list-style-type: none"> WorkSpaces AppStream 2.0  <p>Internet of Things</p> <ul style="list-style-type: none"> IoT Core IoT 1-Click IoT Device Management IoT Analytics Greengrass Amazon FreeRTOS
 <p>Developer Tools</p> <ul style="list-style-type: none"> CodeStar 		

aws Services Resource Groups Giacomo Veneri

AWS IoT

- Monitor
- Onboard
- Manage
- Greengrass
- Secure**
- Certificates
- Policies**
- CAS
- Role Aliases
- Authorizers
- Act
- Test
- Software
- Settings
- Learn



You don't have any policies yet

AWS IoT policies give things permission to access AWS IoT resources (like other things, MQTT topics, or thing shadow).

[Learn more](#) [Create a policy](#)

Create a policy

Create a policy to define a set of authorized actions. You can authorize actions on one or more resources (things, topics, topic filters). To learn more about IoT policies go to the [AWS IoT Policies documentation page](#).

Name

iiot-book-policy-4-mqtt

Add statements

Policy statements define the types of actions that can be performed by a resource.

Advanced mode

Action

iot:*

Resource ARN

arn:aws:iot:eu-central-1:602032247067:topic/replaceWithATopic

Effect

Allow Deny

Remove

Add statement

Create

aws Services Resource Groups

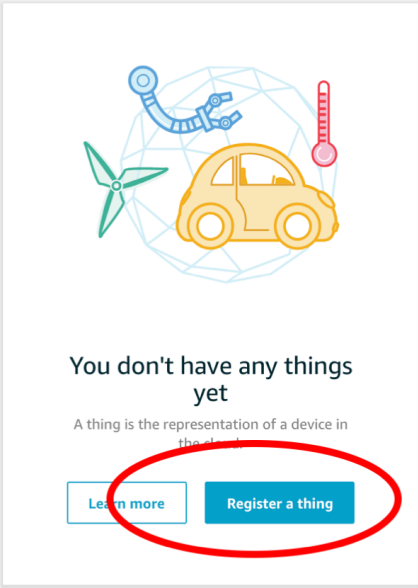
AWS IoT

- Monitor
- Onboard
- Manage**
- Things**
- Types
- Groups
- Jobs
- Greengrass
- Secure
- Act
- Test

Software

Settings

Learn



The main content area displays a message: "You don't have any things yet". Below this, it states "A thing is the representation of a device in the cloud". Two buttons are present: "Learn more" and "Register a thing".

This step creates an entry in the thing registry and a thing shadow for your device.

Name

my-iiot-book-device

Apply a type to this thing

Using a thing type simplifies device management by providing consistent registry data for things that share a type. Types provide things with a common set of attributes, which describe the identity and capabilities of your device, and a description.

Thing Type

simpletest

Create a type

Add this thing to a group

Adding your thing to a group allows you to manage devices remotely using jobs.

Thing Group

Groups / my-iiot-book-group /

Create group Change

Groups /

Create group Change

Certificate created!

Download these files and save them in a safe place. Certificates can be retrieved at any time, but the private and public keys cannot be retrieved after you close this page.

In order to connect a device, you need to download the following:

A certificate for this thing	58b5ac2b10.cert.pem	Download
A public key	58b5ac2b10.public.key	Download
A private key	58b5ac2b10.private.key	Download

You also need to download a root CA for AWS IoT:

A root CA for AWS IoT [Download](#)

[Deactivate](#)

[Cancel](#)

[Done](#)

[Attach a policy](#)

CREATE A THING

Add a policy for your thing

STEP
3/3

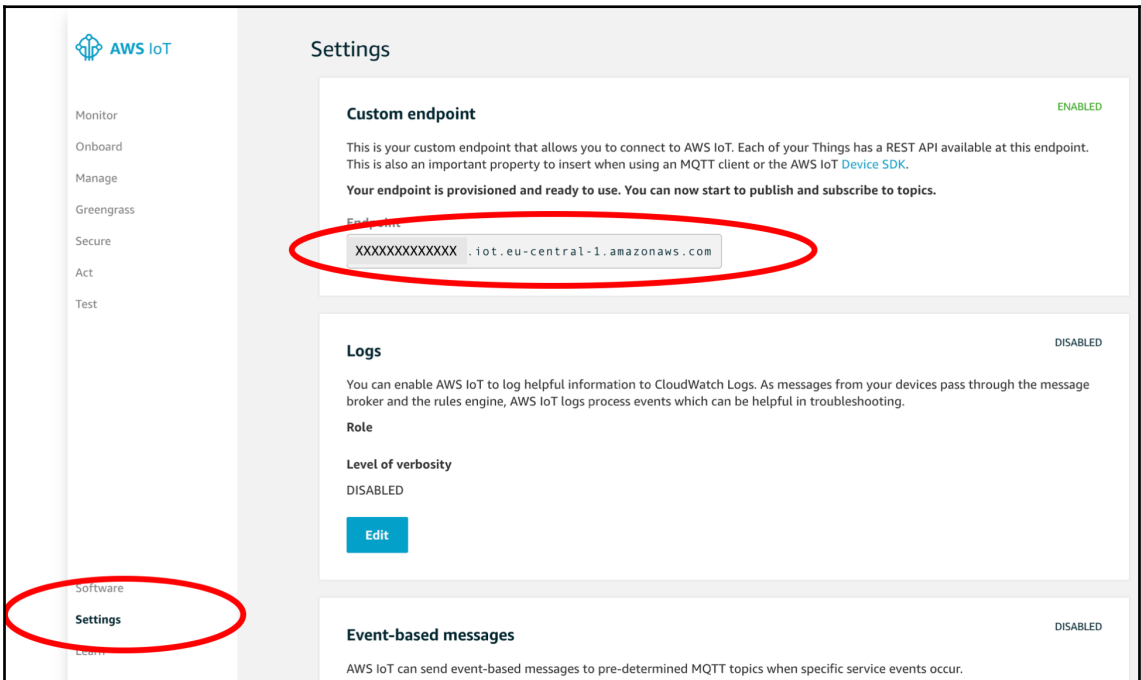
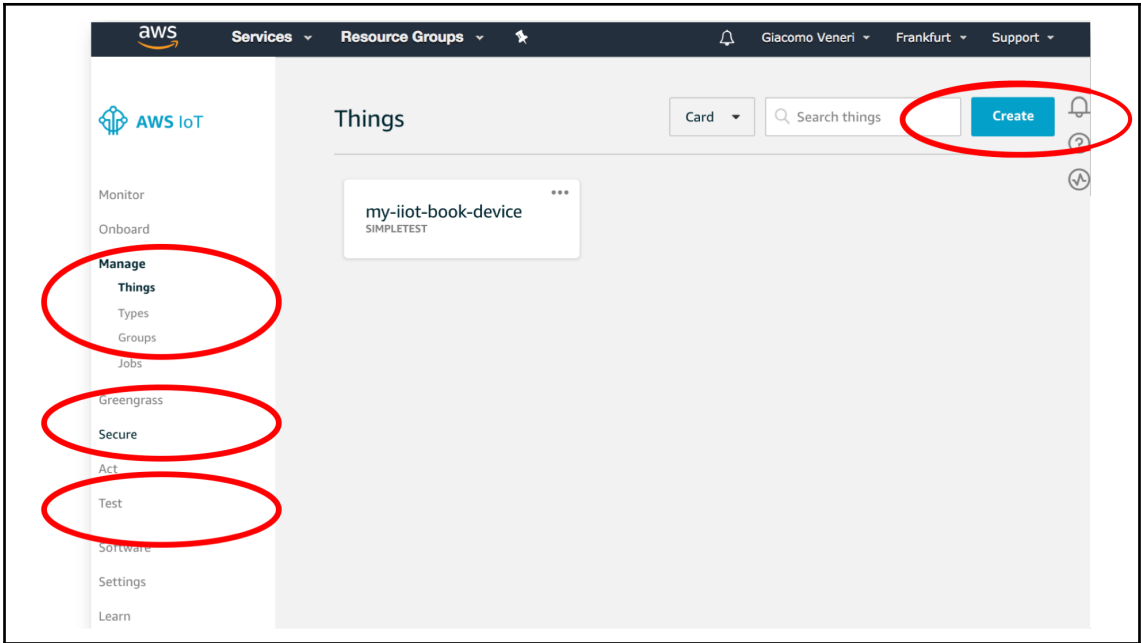
Select a policy to attach to this certificate:

[iiot-book-policy-4-mqtt](#)

[View](#)

1 policy selected

[Register Thing](#)



MQTT client ⓘ

Subscriptions | **signals/#** | [Export](#) | [Clear](#) | [Pause](#)

[Subscribe to a topic](#)
[Publish to a topic](#)

signals/#

Publish
Specify a topic and a message to publish with a QoS of 0.

[Publish to topic](#)

```
1 {
2   "message": "Hello from AWS IoT console"
3 }
```

signals/my-iiot-book-device Jul 23, 2018 11:04:37 AM +0200 [Export](#) [Hide](#)

```
{
  "temperature": 99
}
```

Test

Create DynamoDB table

Tutorial ?

DynamoDB is a schema-less database that only requires a table name and primary key. The table's primary key is made up of one or two attributes that uniquely identify items, partition the data, and sort data within each partition.

Table name* ⓘ

Primary key* Partition key

String ⓘ

Add sort key

String ⓘ

Table settings

Default settings provide the fastest way to get started with your table. You can modify these default settings now or after your table has been created.

- Use default settings
- No secondary indexes.
 - Provisioned capacity set to 5 reads and 5 writes.
 - Basic alarms with 80% upper threshold using SNS topic "dynamodb".
 - On-Demand Backup and Restore Enabled **NEW!**

ⓘ You do not have the required role to enable Auto Scaling by default.
Please refer to [documentation](#).

Additional charges may apply if you exceed the AWS Free Tier levels for CloudWatch or Simple Notification Service. Advanced alarm settings are available in the CloudWatch management console.

Cancel **Create**

Monitor

Onboard

Manage

Greengrass

Secure

Act

Test



You don't have any rules yet

Rules give your things the ability to interact with AWS and other web services. Rules are analyzed and actions are performed based on the messages sent by your things.

[Learn more](#)

[Create a rule](#)

Software

Settings

Name

sensor_data

Description

Message source

Indicate the source of the messages you want to process with this rule.

Using SQL version [?](#)

2016-03-23

Rule query statement

```
SELECT *, topic() as topic FROM 'signals/#'
```

Attribute [?](#)

*, topic() as topic

Topic filter [?](#)

signals/#

Insert a message into a DynamoDB table

DYNAMODB

The table must contain Hash and Range keys.

Table name: [Create a new resource](#)

*Hash key: *Hash key type: *Hash key value:

Range key: Range key type: Range key value:

Write message data to this column:

Operation:

Choose or create a role to grant AWS IoT access to the DynamoDB resource to perform this action.

*IAM role name: [Update role](#) [Create a new role](#)

DynamoDB Dashboard

Tables:
 current_signals

current_signals [Close](#)

Overview **Items** Metrics Alarms Capacity Indexes Global Tables Backups More

[Create item](#) [Actions](#)

Scan: [Table] current_signals: ts_date, ts_time Viewing 1 to 4 items

Scan: [Table] current_signals: ts_date, ts_time

<input type="checkbox"/>	ts_date	ts_time	my_payload
<input type="checkbox"/>	2018.07.23	10:12:08	{ "temperature": { "N": "0" }, "topic": { "S": "signals/my-iiot-book-d
<input type="checkbox"/>	2018.07.23	10:12:09	{ "temperature": { "N": "3" }, "topic": { "S": "signals/my-iiot-book-d
<input type="checkbox"/>	2018.07.23	10:12:10	{ "temperature": { "N": "7" }, "topic": { "S": "signals/my-iiot-book-d
<input type="checkbox"/>	2018.07.23	10:12:11	{ "temperature": { "N": "9" }, "topic": { "S": "signals/my-iiot-book-d

Author from scratch

Start with a simple "hello world" example.



Blueprints

Choose a preconfigured template as a starting point for your Lambda function.



Author from scratch [Info](#)

Name

Runtime

Role

Defines the permissions of your function. Note that new roles may not be available for a few minutes after creation. [Learn more](#) about Lambda execution

Lambda will automatically create a role with permissions from the selected policy templates. Note that basic Lambda permissions (logging to CloudWatch) automatically be added. If your function accesses a VPC, the required permissions will also be added.

Role name

Enter a name for your new role.

my_iiot_la...

Throttle

Qualifiers ▼

Actions ▼

Select a test event.. ▼

Test

Save

Configuration

Monitoring

▼ Designer

Add triggers

Click on a trigger from the list below to add it to your function.

API Gateway

AWS IoT

Alexa Skills Kit

Alexa Smart Home

CloudWatch Events



my_iiot_lambda_threshold



AWS IoT

Configuration required



Amazon CloudWat

Add triggers from the list on the left

Resources the function's role will be shown here

IoT type

Configure a custom IoT rule, or set up an IoT button.

Custom IoT rule

IoT Button

Rule

Pick an existing rule, or create a new one.

Create a new rule

Rule name

Enter a name to uniquely identify your IoT rule.

my_iiot_lambda_threshold_rule

Rule description

Provide an optional description for your rule.

Rule query statement

Create a SQL statement for this rule. For example, to set up your first dash button: `SELECT * FROM 'iotbutton/+'`.

```
SELECT * FROM 'signals/#'
```

Lambda will add the necessary permissions for AWS IoT to invoke your Lambda function from this trigger. [Learn more](#) about the Lambda permissions model.

Enable trigger

Enable the trigger now, or create it in a disabled state for testing (recommended).

my_iiot_lambda_threshold

Throttle Qualifiers Actions Select a test event.. Test Save

Add triggers
Click on a trigger from the list below to add it to your function.

- API Gateway
- AWS IoT
- Alexa Skills Kit
- Alexa Smart Home
- CloudWatch Events

my_iiot_lambda_threshold
Unsaved changes

AWS IoT Saved

Amazon CloudWatch Logs

Add triggers from the list on the left

Resources the function's role has access to will be shown here

Function code info

Code entry type: Edit code inline Runtime: Node.js 6.10 Handler: index.handler

```
File Edit Find View Goto Tools Window
Environment
  my_iiot_lambda_thresh@id
  index.js
  exports.handler = (event, context, callback) => {
  1 console.log(event);
  2
  3 if (event.temperature>20) console.log("Alert!")
  4   callback(null, 'Hello from Lambda');
  5 }
```

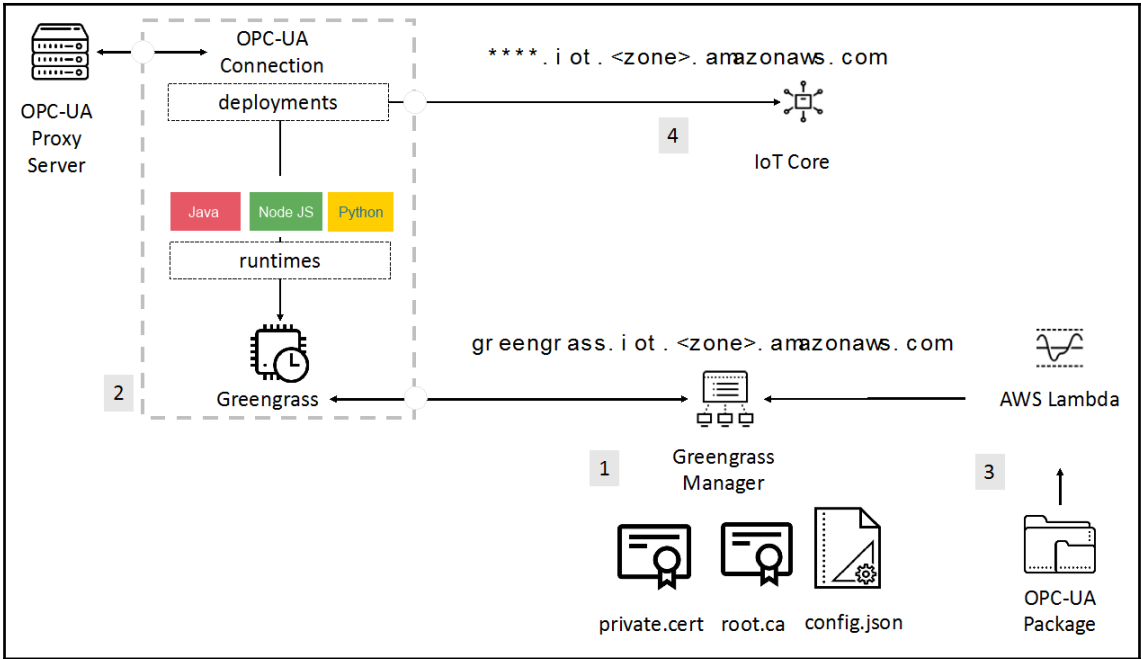
CloudWatch > Log Groups > /aws/lambda/my_iiot_lambda_threshold >

2018/07/23/[LATEST]be07d2c5a65d4146bb8e7ca63df917ca

Expand all Row Text

Filter events all 2018-07-22 (16:01:16)

Time (UTC +00:00)	Message
2018-07-23	
16:02:42	REPORT RequestId: d49f93fc-8e91-11e8-9a28-638b3ea8ef64 Duration: 0.65 ms Billed Duration:
16:02:42	START RequestId: d4c396f9-8e91-11e8-a219-ddaff63915c1 Version: \$LATEST
16:02:42	2018-07-23T16:02:42.662Z d4c396f9-8e91-11e8-a219-ddaff63915c1 { temperature: 30 }
16:02:42	2018-07-23T16:02:42.662Z d4c396f9-8e91-11e8-a219-ddaff63915c1 { temperature: 30 }
16:02:42	2018-07-23T16:02:42.662Z d4c396f9-8e91-11e8-a219-ddaff63915c1 Alert
16:02:42	2018-07-23T16:02:42.662Z d4c396f9-8e91-11e8-a219-ddaff63915c1 Alert
16:02:42	END RequestId: d4c396f9-8e91-11e8-a219-ddaff63915c1




AWS IoT

- Monitor
- Onboard
- Manage
- Greengrass**
- Groups
- Cores
- Devices
- Secure
- Defend
- Act
- Test
- Software
- Settings
- Learn

Welcome to AWS Greengrass

AWS Greengrass lets your devices process the data they generate locally, while still taking advantage of AWS services when an internet connection is available.

Get started today with Greengrass on a [Raspberry Pi](#), or read our [system requirements](#) and [list of compatible devices](#).




Define a Greengrass Group

A Group is a set of a Core and Devices that can work together locally.

Get Started

It takes as little as 5 minutes




Add a Greengrass Core

A Core processes data from your devices and securely routes messages.

Add a Core to new Group

It takes as little as 5 minutes



Add Devices to a Group

A Group contains up to 200 local IoT Devices, which can securely exchange messages.

Add Devices to a Group

It takes as little as 5 minutes

SET UP YOUR GREENGRASS GROUP

Name your Group

The Greengrass Group is a cloud-configured managed collection of local devices and Lambda functions that can be programmed to communicate with each other through a Core device. Groups can contain up to 200 local devices.

Group Name

[Cancel](#)

[Back](#)

[Next](#)

Connect your Core device

The final steps are to load the Greengrass software and then connect your Core device to the cloud. You can defer connecting your device at this time, but **you must download your public and private keys now as these cannot be retrieved later.**

Download and store your Core's security resources

A certificate for this Core	91bc24082e.cert.pem
A public key	91bc24082e.public.key
A private key	91bc24082e.private.key
Core-specific config file	config.json

Download these resources as a tar.gz

Download the current Greengrass Core software

To install Greengrass on your Core download the package and follow [Getting Started Guide](#).

Software configurations

Show all architectures

Show all distributions

Architecture	Distribution	OS	
x86_64	Amazon Linux	Linux	Download
ARMv8 (AArch64)	Ubuntu 14.04 - 16.04	Linux	Download
ARMv7l	Ubuntu Jessie	Linux	Download
x86_64	Ubuntu 14.04 - 16.04	Linux	Download

By downloading this software you agree to the [Greengrass End User License Agreement](#).

Finish

Run a scripted easy Group creation

In order to speed up and simplify Group creation AWS Greengrass will handle the following processes and use default settings. By proceeding to the next step, you are giving permission for us to complete the following steps.

AWS Greengrass will take these actions on your behalf using default settings:

Create a new Greengrass Group in the cloud	Learn more
Provision a new Core in the IoT Registry and add to the Group	Learn more
Generate public and private key set for your Core	Learn more
Generate a new security certificate for the Core using the keys	Learn more
Attach a default security policy to the certificate	Learn more

[Cancel](#)

[Create Group and Core](#)

AWS Greengrass Core SDK

About this Software Developer Kit

The AWS Greengrass Core SDK enables Lambda functions to interact with the Greengrass Core on which they run. This allows them to publish messages and interact with shadow data or invoke Lambda functions within the Greengrass Core.

Version 1.2.0

aws-greengrass-core-sdk-js-1.2.0.tar.gz

Node.js 6.10 version 1.2.0

[Download Greengrass Core SDK](#)

[Cancel](#)

[Download Greengrass Core SDK](#)

Add a Lambda to your Greengrass Group

Local Lambdas are hosted on your Greengrass Core and connected to each other and devices by Subscriptions, but they can also be deployed individually to your Group.

Create a new Lambda function

You will be taken to the AWS Lambda Console and can author a new Lambda function.

Create new Lambda

Use an existing Lambda function

You will choose from a list of existing Lambda functions.

Use existing Lambda

Cancel

Back

Use existing Lambda

Create function

Author from scratch

Start with a simple "hello world" example.



Blueprints

Choose a preconfigured template as a starting point for your Lambda function.



AWS Serverless Application Repository

Find and deploy serverless applications published by AWS, AWS partners, and other developers.



Author from scratch info

Name
my-iiot-book-opcua-lambda

Runtime
Node.js 6.10

Role
Defines the permissions of your function. Note that new roles may not be available for a few minutes after creation. [Learn more about Lambda execution roles.](#)

Choose an existing role

Choose an existing role

Create a new role from one or more templates.

Create a custom role

Cancel

Create function

aws Services ▾ Resource Groups ▾

AWS Lambda requires access to your resources

AWS Lambda uses an IAM role that grants your custom code permissions to access AWS resources it needs.

▼ Hide Details

Role Summary ?

Role Description Lambda execution role permissions

IAM Role

Role Name

▶ View Policy Document

my-iiot-book-opcua-lambda

Throttle Qualifiers **Actions** Select a test event... Test Save

- Publish new version
- Create alias
- Delete function
- Export function

Configuration Monitoring

▼ Designer

Add triggers
Choose a trigger from the list below to add it to your function.

- API Gateway
- AWS IoT
- CloudWatch Events
- CloudWatch Logs
- CodeCommit
- Cognito Sync Trigger

my-iiot-book-opcua-lambda Saved

Amazon CloudWatch Logs

Resources that the function's role has access to appear here

Function code info

The deployment package of your Lambda function "my-iiot-book-opcua-lambda" is too large to enable inline code editing. However, you can still invoke your function.

Code entry type

Runtime

Handler Info

Deployment package*

Files larger than 10 MB, consider uploading to Amazon S3.

Group-specific Lambda configuration

my-iiot-book-opcua-lambda

[View function in AWS Lambda](#)

Version 1 [Remove version](#)

Memory limit

16

MB

Timeout

3

Second

Lambda lifecycle

- On-demand function
- Make this function long-lived and keep it running indefinitely

Read access to /sys directory

- Disable
- Enable

Input payload data type

- JSON
- Binary

GREENGRASS GROUP

my-iiot-book-group-greengrass

● Successfully completed

Actions ▾

Deploy

Delete Group

Reset Deployments

Deployments

Lambdas

Subscriptions

Cores

Devices

Lambdas


Resources

Settings

my-iiot-book-opcua-lambda

LAMBDA FUNCTION

USING V1

 AWS IoT Analytics

Analyze

Prepare

Channels

Pipelines


Data stores

Settings

Learn

Collect device messages

You haven't created a channel just yet, but you can get started now.



Create a channel

Name

signals_channel ...

Create a pipeline from this channel

Delete

Set attributes of your messages

STEP 2/4

List the attributes expected in incoming messages to make the AWS IoT Analytics experience smarter and faster. Upload a JSON document of attributes or enter attributes manually.

Attributes

Action ▾

 Attribute name temperature

15

Back

Next

CREATE DATA SET

Set ID and source

Provide an ID and select a data store as a source for this data set. This cannot be changed later.

ID

Select data store source

signals_datastore [Clear](#) [Edit](#)

Tags

Key	Value	
<input type="text" value="Key"/>	<input type="text" value="Value"/>	Clear

[Add Tag](#)

[Cancel](#) [Next](#)

DATA SET

signals_dataset

SUCCEEDED

Actions ▾

- Run query now
- Delete

Details

CSV

Data set ARN

A data set Amazon Resource Name (ARN) uniquely identifies this data set.

```
arn:aws:iotanalytics:eu-west-1:602032247067:dataset/signals_dataset
```

Details

SQL query [Edit](#)

```
SELECT * FROM signals_datastore
```

Result preview

temperature	_dt
10.0	2018-07-24 00:00:00.000

QuickSight

Edition

QuickSight account name

You will need this for you and others to sign in.

Notification email address

For QuickSight to send important notifications.

QuickSight capacity region



EU (Ireland)

- Enable autodiscovery of data and users in your Amazon Redshift, Amazon RDS and AWS IAM services.
- Amazon Athena
Enables QuickSight access to Amazon Athena databases
- Amazon S3
Enables QuickSight to auto-discover your Amazon S3 buckets [Choose S3 buckets](#)
- Amazon S3 Storage Analytics
Enables QuickSight to visualize your S3 Storage Analytics data
- Amazon IoT Analytics
Enable QuickSight to visualize your IoT Analytics data

[Finish](#)

QuickSight

Data sets

-  Snowflake
-  AWS IoT Analytics

signals_dataset analysis Autosave ON

Add Undo Redo

Visualize

Data set: **SPICE** signals_dataset 100%

Fields list

- _dt
- # temperature**

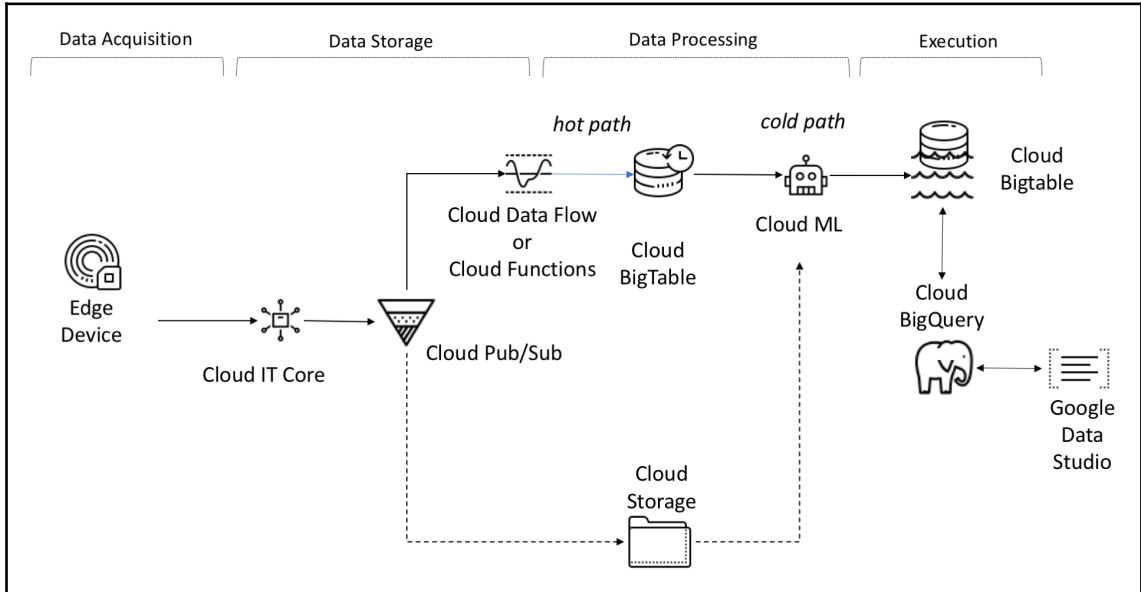
Visual types

Field wells: Value **# temperature (Sum)** Target value Trend group

Sum of Temperature

185.5

Chapter 11: Implementing a Cloud Industrial IoT Solution with Google Cloud



New Project

Project Name *

iiot-book



Project ID: iiot-book. It cannot be changed later. [EDIT](#)

Location *



No organisation

[BROWSE](#)

Parent organisation or folder

CREATE

CANCEL



Google Cloud Platform



Home page



Dataflow



IoT Core



Bigtable



Datastore



Pub/Sub



Cloud Functions

The screenshot shows the Google Cloud Platform console interface. The top navigation bar includes the Google Cloud Platform logo, the user profile 'iiot-book', and a search icon. A left-hand navigation menu is open, listing various services: Home, BigQuery, Pub/Sub, Dataproc, Dataflow, ML Engine, IoT Core, Composer, Genomics, Job Discovery, and Dataprep. The 'IoT Core' menu item is highlighted with a red circle. The main content area displays a graph for 'API APIs' showing 'Requests (requests/sec)' over time, with a data point at 10:30 showing a value of 0.033. Other panels on the right show 'Google Cloud Platform status' (All services normal), 'Billing' (Estimated charges EUR €0.00), and 'Error Reporting'.

The screenshot shows the IoT Core console page. The header includes the IoT Core logo and the text 'IoT Core'. The main content area displays a message box with the following text: 'IoT Core API Disabled', 'Reliable real-time messaging', and 'The Cloud IoT API must be enabled before you can view Cloud IoT in the console.' Below the message is a blue button labeled 'Enable API', which is circled in red.



IoT Core

Device registries

A device registry allows you to group devices and set properties that they all share, such as connection protocol, data storage location and Cloud Pub/Sub topics. To start connecting devices to Cloud IoT, first create a device registry to place them in. [Learn more](#)

Create a device registry



create your registry, you can start adding devices to it. [Learn more](#)

Registry ID

Permanent identifier for your registry. Start with a letter.

iioot-book-registry

Region

Determines where data is stored for devices in this registry. Choice is permanent.

europa-west1

Protocol

Select the protocols that your devices will use to connect to Cloud IoT Core. [Learn more](#)

- MQTT
- HTTP

Cloud Pub/Sub topics

Cloud IoT Core routes device messages to Cloud Pub/Sub for aggregation. You can route messages to different topics and subfolders in Cloud Pub/Sub based on the type of data in the messages. [Learn more](#)

Default telemetry topic

Device telemetry events will be published to this topic by default. Add more topics if you want these events to be published to separate topics.

projects/iioot-book/topics/signals

⌵ Add more telemetry topics

Device state topic (Optional)

Device state data will be published to your selected topic on a best-effort basis, as well as to the default MQTT state topic (if your devices use MQTT protocol). [Learn more](#)

projects/iioot-book/topics/statuses

⌵ Add CA certificate

Create

Cancel

Google Cloud Platform | iiot-book | IoT Core | Registries | CREATE A REGISTRY | HIDE INFO PANEL

Filter registries

<input type="checkbox"/>	Registry ID	Region	Protocol	Telemetry Pub/Sub topics
<input type="checkbox"/>	iiot-book-registry	eu-rope-west1	M...	projects/iiot-book/topics/signals

No registries selected

PERMISSIONS

Please select at least one resource.

Add a device to registry with `back-registry`.

Device ID

my-iiot-device

Device communication

- Allow
- Block

Authentication (Optional)

Input method

- Enter manually
- Upload

Public key format

- RS256
- ES256
- RS256_X509
- ES256_X509

Public key value

```
-----BEGIN PUBLIC KEY-----
MIIBIjANBgkqhkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEAt664rGMS1SzNthYioYHJ
0Mnu+Yo17Ns3nNgLyr9qXBA6nrsSeksV4z/0yEfw5x4UBRbYu3+vYHwM0gUa6e6H
C6onP+G0wTlJspYQcvoLDZ+ky6Ssw9/7InojppxfhggGcABUbtvEx5JXuyieBZm
g0JwkHSyW0hzoKQV+8aQzohypKjALX20CzzErVBMYu3i9HADROQufrB/7nvIa8HY
ZVUnhjj+JdyRa4rJmDazRLPVJbwnuJnm0ZrYtdAigeCb5ITKM31V7eMEhk693cM1
j71hJ8DYQhQc42gQl6Yupozm2qqAS5kYyKnpuIVfh1DsZEW49RqT/A/2e0Pq8GKH
hwIDAQAB
-----END PUBLIC KEY-----
```

Public key expiry date (Optional)

Expires on:

11/07/2019, 14:06 CEST

Device metadata (Optional)

Key must contain only letters, numbers, hyphens and underscores, and be no longer than 128 characters

Key	Value

+ Add attribute

Add

Cancel

Google Cloud Platform **iiot-book**

IoT Core Registry details

Registry ID: iiot-book-registry

Region	europa-west1
Protocol	MQTT HTTP

[Pub/Sub topics for telemetry and device state](#)

[View in Stackdriver](#)

Devices Certificates

[Add device](#)

Enter exact device IDs separated by commas

Device ID	Communication	Last seen
my-iiot-device	✓ Allowed	11 Jul 2018, 15:12:05

[Cloud IoT Core documentation](#)

```
mqtt_example — node cloudiot_mqtt_example_nodejs.js --projectId=iiot-book --cloudRegion=europe-west1 --registryId=iiot-book-regist...
$ node cloudiot_mqtt_example_nodejs.js \
> --projectId=iiot-book \
> --cloudRegion=europe-west1 \
> --registryId=iiot-book-registry \
> --deviceId=my-iiot-device \
> --privateKeyFile=../../certificates/device_private.pem \
> --algorithm=RS256
Google Cloud IoT Core MQTT example.
connect
Publishing message: my-iiot-device,signal1,1,1531556749577,GOOD
message received:
Publishing message: my-iiot-device,signal1,2,1531556750582,GOOD
Publishing message: my-iiot-device,signal1,3,1531556751584,GOOD
Publishing message: my-iiot-device,signal1,4,1531556752591,GOOD
Publishing message: my-iiot-device,signal1,5,1531556753594,GOOD
Publishing message: my-iiot-device,signal1,6,1531556754598,GOOD
Publishing message: my-iiot-device,signal1,7,1531556755604,GOOD
Publishing message: my-iiot-device,signal1,8,1531556756607,GOOD
Publishing message: my-iiot-device,signal1,9,1531556757611,GOOD
Publishing message: my-iiot-device,signal1,10,1531556758614,GOOD
Publishing message: my-iiot-device,signal1,11,1531556759617,GOOD
Publishing message: my-iiot-device,signal1,12,1531556760622,GOOD
Publishing message: my-iiot-device,signal1,13,1531556761628,GOOD
```



Bigtable

Cloud Bigtable

Cloud Bigtable instances

Cloud Bigtable is a fully managed NoSQL database that supports the popular open-source Apache HBase 1.0 API. You can provision Cloud Bigtable instances for your workload, then use the Bigtable HBase client to develop applications using the standard open-source Big Data tools you're familiar with.

[Create instance](#)

or

[Learn more](#)



Instance name

For display purposes only

iiot-book-storage

Instance ID

ID is permanent

iiot-book-storage

Instance type ?

- Production (recommended)**
Minimum of 3 nodes. High availability. Cannot downgrade later.
- Development**
Low-cost instance for development and testing. Does not provide high availability or replication. Can upgrade to Production later.

Storage type ?

Choice is permanent. Applies to all clusters. Affects cost.

- SSD**
Lower latency and higher read QPS. Typically used for real-time serving use cases, such as ad serving and mobile app recommendations.
- HDD**
Higher latency for random reads. Good performance on scans and typically used for batch analytics, such as machine learning or data mining.

Clusters

Edit item



Cluster ID

ID is permanent.

iiot-book-storage-c1

Zone

Choice is permanent. Determines where cluster data is stored. To reduce latency and increase throughput, store your data near the services that need it.


europa-west2-b



Cloud Functions

Google Cloud Functions BETA

Google Cloud Functions is a lightweight, event-based, asynchronous compute solution that allows you to create small, single-purpose functions which respond to cloud events, without the need to manage a server or a runtime environment.

 Cloud Functions API not enabled

[Enable API](#)



Name ?

iiot-book-function-1

Memory allocated

128 MB ▼

Trigger

Cloud Pub/Sub ▼

Topic

signals ▼

Source code

- Inline editor
- ZIP upload
- ZIP from Cloud Storage
- Cloud Source repository

Google Cloud Platform | iiot-book

Cloud Functions | Overview | CREATE FUNCTION | REFRESH | DELETE | COPY | HIDE INFO PANEL

Filter functions | Columns

<input type="checkbox"/>	Name ^	Region	Trigger	Memory allocated	Executed function
<input type="checkbox"/>	✓ iiot-book-function-1	us-central1	topic: signals	128 MB	helloPubSub

Select a function

LABELS

Labels help to organise your resources (e.g. cost_centre:sales or env:prod).

No functions selected.

Google Cloud Platform iiot-book

Cloud Functions Function details

iiot-book-function-2
Memory allocated
128 MB

Trigger
Cloud Pub/Sub

signals

Source code

- Inline editor
- ZIP upload
- ZIP from Cloud Storage
- Cloud Source repository

[index.js](#) [package.json](#)

```
1 const digitalTwin = {};
2
3 digitalTwin['signall'] = {upperLimit: 40, lowerLimit: 10};
4
5 exports.helloPubSub = (event, callback) => {
6   const pubsubMessage = event.data;
7
8   const str = Buffer.from(pubsubMessage.data, 'base64').to
9   console.log(str);
10
11  const data= str.split(',');
12  console.log({
13    'device': data[0],
14    'tag': data[1],
15    'value': data[2],
16    'ts': data[3],
17    'quality': data[4]
18  });
19
20
21  const deviceId=data[0];
22  const tag=data[1];
23  const value=data[2];
24  const timestamp = data[3];
25
```

Function to execute ?
helloPubSub

[More](#)

[Save](#) [Cancel](#)

**Job name**

Must be unique among running jobs. Use lowercase letters, numbers and hyphens (-).

Cloud Dataflow template

A pipeline that reads from a Pub/Sub topic and writes messages text files stored in GCS. Note that this pipeline assumes no newlines in the body of the Pub/Sub message and thus each message becomes a single line in the output file.

Required parameters**Regional endpoint**

Choose where to deploy Cloud Dataflow workers and store metadata for the job.

Input Cloud Pub/Sub topic

Cloud Pub/Sub topic to read the input from. The topic name should be in the format of

Output Cloud Storage directory

Path and filename prefix for writing output files (ex: gs://bucket-name/path/). This value must end in a slash.

Output filename prefix

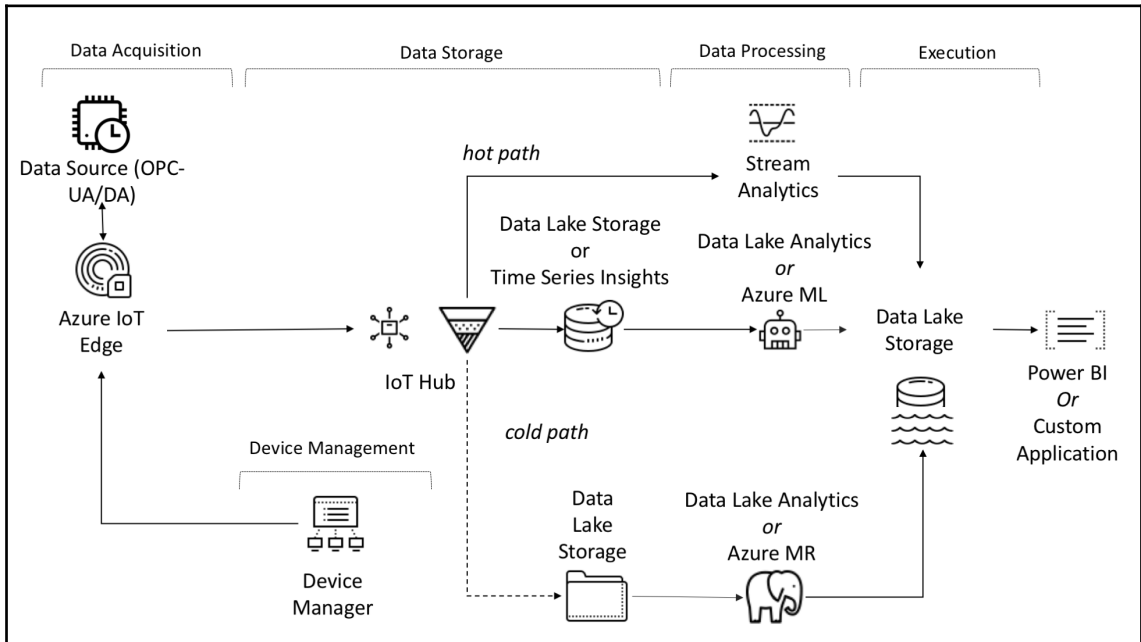
The prefix to place on each windowed file (e.g. output-).

Temporary Location

Path and filename prefix for writing temporary files. e.g.: gs://MyBucket/tmp

 Optional parameters

Chapter 12: Performing a Practical Industrial IoT Solution with Azure



The screenshot shows the Microsoft Azure portal interface. At the top left, the 'Microsoft Azure' logo is circled in red. To its right is a search bar containing the text 'IoT'. In the top right corner of the portal, a red circle highlights a search icon. The main content area is titled 'IoT Hub' and displays a message: 'No IoT hub to display'. Below this message is a blue button labeled 'Create IoT hub'. The interface also includes a left-hand navigation menu with various service categories and a top navigation bar with options like 'Add', 'Edit columns', 'Refresh', and 'Assign tags'.

Microsoft Azure

IoT

Home > IoT Hub

IoT Hub

+ Add Edit columns Refresh Assign tags

Subscriptions: All 2 selected – Don't see a subscription? Open Directory + Subscription settings

Filter by name... All subscriptions All resource groups All locations No grouping

0 items

NAME	TYPE	RESOURCE GRO...	LOCATION	SUBSCRIPTION
------	------	-----------------	----------	--------------

No IoT hub to display

Try changing your filters if you don't see what you're looking for

Create IoT hub

Create an IoT Hub to help you connect, monitor, and manage billions of your IoT assets. [Learn More](#)

PROJECT DETAILS

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

* Subscription ⓘ ▾

* Resource Group ⓘ Create new Use existing
 ✓

* Region ⓘ ▾

* IoT Hub Name ⓘ ✓

[Automation options](#)

Home > iiot-book-hub - IoT devices

iiot-book-hub - IoT devices

IoT Hub

Search (Ctrl+/) **+** Add Refresh Delete

+ You can use this tool to view, create, update, and delete devices of

Query **?**
SELECT * FROM devices WHERE
optional (e.g. tags.location='US')

Execute

DEVICE ID	STATUS	LAST ACTIVITY	LAS
No results			

Add Device

Learn more about creating devices

* Device ID

Authentication type **?**
Symmetric Key X.509 Self-Signed X.509 CA Signed

* Primary Key **?**

* Secondary Key **?**

Auto Generate Keys **?**

Connect device to IoT Hub **?**
Enable **Disable**

Save

Home > iiot-book-hub - IoT devices > Device Details

Device Details

my-iiot-device

Save Regenerate keys Device Twin Message To Device Direct Method **+** Add Module Identity Refresh

Device Id **?**

Primary key **?**

Secondary key **?**

Connection string (primary key) **?**

Connection string (secondary key) **?**

Home > iiot-book-hub - Metrics

iiot-book-hub - Metrics

Search (Ctrl+F)

MESSAGING

- File upload
- Endpoints
- Routes

RESILIENCY

- Manual failover (preview)

MONITORING

- Metrics**
- Metrics (preview)
- Diagnostics settings
- Alerts (classic)

SUPPORT + TROUBLESHOOTING

- Resource health
- New support request

Diagnostics settings + Add metric alert (classic)

* Subscription: Versione di valutazione gratuita

* Resource group: iiot-book-resources

Resource type: (IoT Hubs)

* Resource: iiot-book-hub ()

Available metrics

Filter metrics...

You can only select metrics of the same unit (Count)

- Successful calls to list jobs
- Successful creations of method invocation jobs
- Successful creations of twin update jobs
- Successful direct method invocations
- Successful job cancellations
- Successful job queries
- Successful twin queries
- Successful twin reads from back end
- Successful twin reads from devices
- Successful twin updates from back end
- Successful twin updates from devices
- Telemetry message send attempts
- Telemetry messages sent**
- Total device data usage (preview)
- Total devicedata usage (deprecated)

Chart type: Line

Time range: Custom

Absolute Relative

Days: 0

Hours: 0

Minutes: 20

Seconds: 0

Pin to dashboard

Time	Telemetry Messages S...
3:25 PM	0
3:30 PM	0
3:35 PM	0
3:40 PM	280

TELEMETRY MESSAGES S...
824

Alerts

Search within displayed alerts...

NAME	STATUS	CONDITION	LAST FIRED
No results to display			

Microsoft Azure

Home > Data Lake Storage Gen1 > New Data Lake Storage Gen1

Data Lake Storage Gen1

Filter by name...

NAME

No data lake storage gen1 to display
Try changing your filters if you don't see what you're looking for

[Create data lake storage gen1](#)

Data Lake

* Name
iiotstore

iiotstore.azuredatalakestore

* Subscription
Free Trial

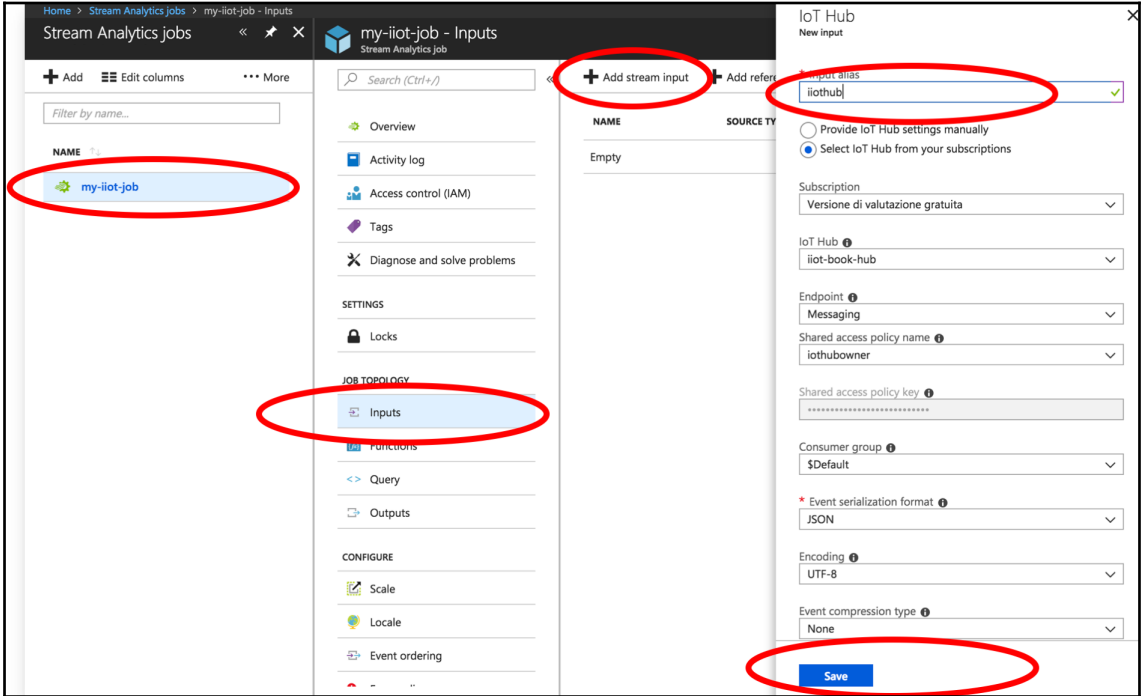
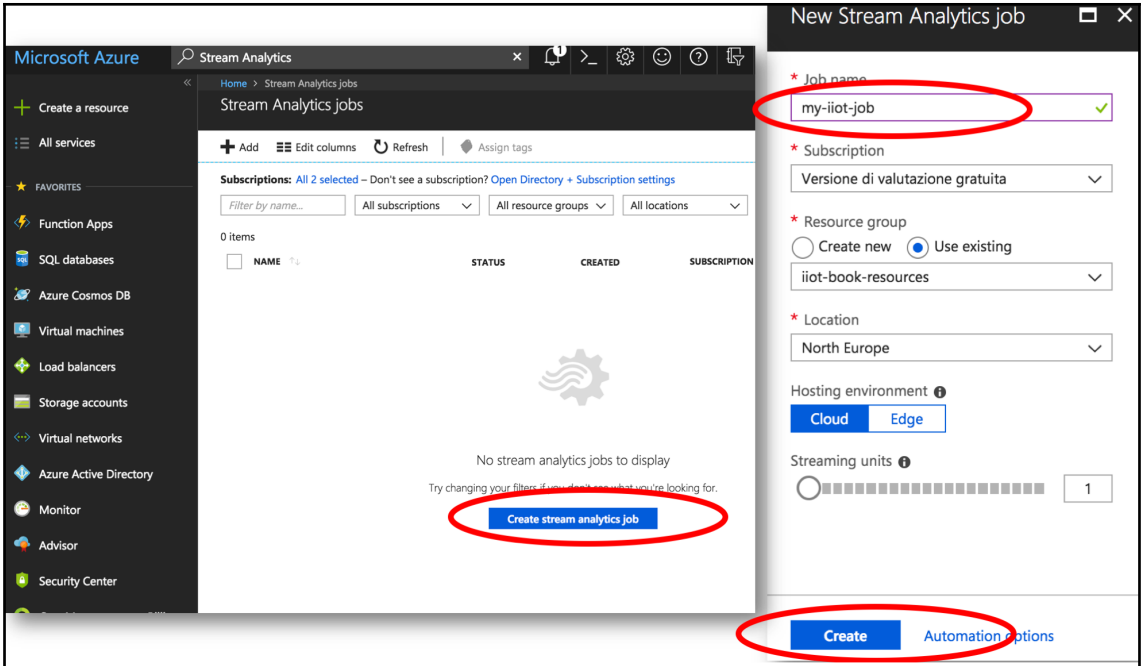
* Resource group
 Create new Use existing
iiot-book-resources

* Location
North Europe

Pricing package
 Pay-as-You-Go
 Monthly commitment

Encryption settings
Enabled

[Create](#) [Automation options](#)



Home > Stream Analytics jobs > my-iiot-analytic - Functions > Javascript function

Javascript function

New function

* Function alias
efficiency ✓

Output Type ⓘ
float

```
1 // Sample UDF which returns sum of two values.  
2 function main(temperature, flow) {  
3   return (flow -60)/temperature;  
4 }
```

Save

Home > Stream Analytics jobs > my-iiot-job - Outputs

Stream Analytics jobs

my-iiot-job - Outputs

Filter by name...

NAME

- my-iiot-job

Overview

- Activity log
- Access control (IAM)
- Tags
- Diagnose and solve problems

SETTINGS

- Locks

JOB TOPOLOGY

- Inputs
- Functions
- Query
- Outputs

CONFIGURE

- Scale
- Locale
- Event ordering

« + Add

NAME
Empty

Data Lake Store

New output

* Output alias
efficiencyoutput ✓

Provide Data Lake Store settings manually
 Select Data Lake Store from your subscriptions

Subscription
Versione di valutazione gratuita

Account name
iiotstore

* Path prefix pattern ⓘ
out/logs/(date)/(time) ✓
Example: cluster1/logs/(date)/(time)

Date format
YYYY/MM/DD

Time format
HH

* Event serialization format ⓘ
CSV

Delimiter ⓘ
tab

Encoding ⓘ
UTF-8

Save

Stream Analytics jobs > my-iiot-job

my-iiot-job

Stream Analytics job

Start job

my-iiot-job

Job output start time

Now Custom

Created

Resource group (change)
iiot-book-resources

Status
Created

Location
North Europe

Subscription (change)
Versione di valutazione gratuita

Subscription ID
1a762dd0-458b-4598-95ea-2f

Inputs

1

Query Start

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

LOCKS

Locks

Filter by name...

NAME

my-iiot-job

Search (Ctrl+)

Start Stop

Data Lake Storage Gen1 > iiotstore - Data explorer

iiotstore - Data explorer

Data Lake Storage Gen1

iiotstore

out

logs

2018

07

30

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

SETTINGS

Encryption

Firewall

Pricing tier

Properties

Locks

Automation script

DATA LAKE STORAGE GEN1

Quick start

Data explorer

Filter by name...

NAME

iiotstore

Search (Ctrl+)

my-iiot-job - Query
Stream Analytics Job

Save Discard Test

Inputs (1)
iiiothub

Outputs (1)
iiiotoutput

Need help with your query? Check out some of the most common Stream Analytics query patterns [here](#).

max(flow) AS temperature,
(temperature, flow) AS efficiency

9 FROM
10 iiiothub
11 TIMESTAMP BY ts
12 GROUP BY TumblingWindow(second,5), deviceId
13

Your query could be put in logs that are in a potentially different geography.
Missing some language constructs? [Let us know!](#) (Powered by [UserVoice](#) - [Privacy Policy](#))

Results
iiiotoutput

Generated the Following:

- iiiotoutput with 10 rows.

[Download results](#)

DEVICE	MAX	TEMPERATURE	FLOW	EFFICIENCY
"my-iiot-device"	"2018-07-30T09:19:54.639000Z"	20.262983079546814	76.05785742539547	0.7924725279765967
"my-iiot-device"	"2018-07-30T09:19:58.645000Z"	22.205749725008307	70.03991982548449	0.4448527699628635
"my-iiot-device"	"2018-07-30T09:20:04.655000Z"	23.34216663857835	77.93808349966606	0.7680190603947662
"my-iiot-device"	"2018-07-30T09:20:08.657000Z"	21.361508134146895	62.886206736494536	0.13175974443320923

Microsoft Azure

Home > Data Lake Analytics > New Data Lake Analytics account > Select Data Lake Storage Gen1

New Data Lake Analytics account

Name: ✓

iiotbookdla.azuredatalakeanalytics.net

* Subscription: ▾

* Resource group: Create new Use existing

▾

* Location: ▾

* Data Lake Storage Gen1 ⓘ [Configure required settings](#) >

Pricing package ⓘ

Pay-as-You-Go Monthly commitment

[Authentications](#)

Select Data Lake Storage Gen1

Subscriptions: 1 of 2 selected – Don't see a subscription? [Open Directory + Subscription settings](#)

▾

Create new Data Lake Storage G...

iiotstore
North Europe

Home > Data Lake Analytics > iiotbookdla - New job

Data Lake Analytics

Filter by name...

NAME

- iiotbookdla

Automation script

GETTING STARTED

- Add user wizard
- Quick start
- Sample scripts
- Interactive tutorials
- Tools

DATA LAKE ANALYTICS

- New job**
- Job management
- Job insights

MONITORING

- Metrics
- Diagnostics logs

SUPPORT + TROUBLESHOOTING

Data explorer

Job name: my-dla-efficiency-job

Submitter: User

Estimated cost: EURO.03/minute

Submit

```

1 DECLARE @now DateTime = DateTime.Now;
2 DECLARE @outputfile = "/out/reports/"+@now.ToString("yyyy/MM/dd")
  +"-efficiency.csv";
3
4 @d =
5     EXTRACT device string,
6             ts string,
7             temperature float,
8             flow float,
9             efficiency float,
10            date DateTime,
11            filename string
12 FROM "/out/logs/{date:yyyy}/{date:MM}/{date:dd}/{filename}.csv"
13 USING Extractors.Tsv(skipFirstNRows:1);
14
15
16 @result = SELECT
17     AVG(efficiency) AS efficiency,
18     device,
19     date
20 FROM @d
21 GROUP BY device, date;
22
23 // The OUTPUT s
24 OUTPUT @result
25 TO @outputfile
26 USING Outputters.Text();
  
```

Home > Stream Analytics jobs > my-iiot-vis-job - Outputs

Stream Analytics jobs

Filter by name...

NAME

- my-iiot-job
- my-iiot-vis-job**

Overview

- Activity log
- Access control (IAM)
- Tags
- Diagnose and solve problems

SETTINGS

- Locks

JOB TOPOLOGY

- Inputs
- Functions
- Query
- Outputs**

CONFIGURE

- Scale

Power BI

New output

Output alias: iiotpowerbi

Group workspace: Authorize connection to load workspaces

Dataset name: myiiotdevices

Table name: myiiotdevicectb

Authorize connection

You'll need to authorize with Power BI to configure your output settings.

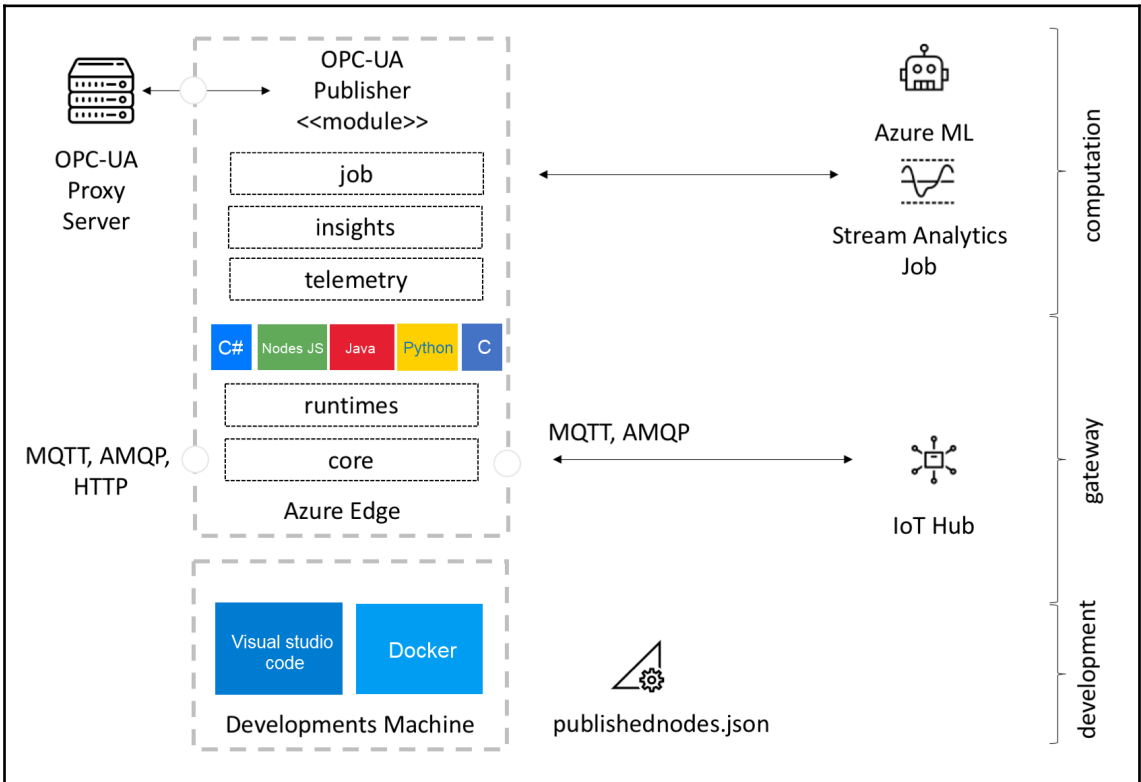
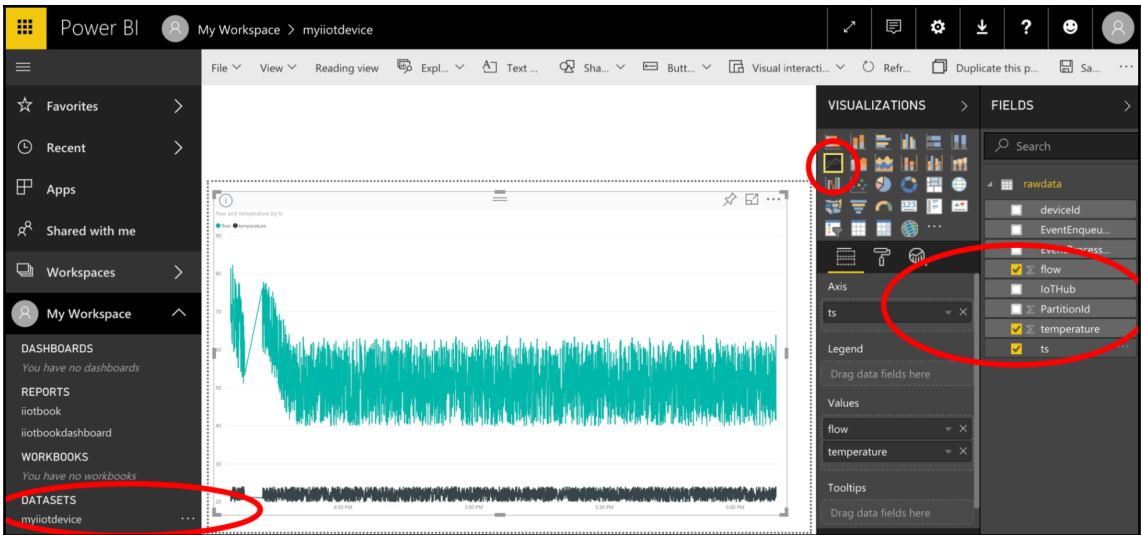
Authorize

Don't have a Microsoft Power BI account yet? Sign up

Note: You are granting this output permanent access to your Power BI dashboard. Should you need to revoke this access in the future you can do one of the following:

1. Change the user account password.
2. Delete this output.
3. Delete this job.

Save



Home > iiot-book-hub - Shared access policies

IoT Hub

Search (Ctrl+/)

Shared access policies

IoT Hub uses permissions to grant access to each IoT hub endpoint. Permissions limit the access to an IoT hub endpoint.

POLICY	PERMISSIONS
iothubowner	registry write, service connect, device connect, registry read, registryReadWrite
service	service connect
device	device connect
registryRead	registry read
registryReadWrite	registry write

iothubowner

Access policy name: iothubowner

Permissions:

- Registry read
- Registry write
- Service connect
- Device connect

Shared access keys:

Primary key: QoPhKqHiuHhncGgypH6UJA607E243...

Secondary key: VQlSKV777ES...EMSL4D3DFCQlv...

Connection string—primary key: HostName=iiot-book-hub-2.azure-devic...

Connection string—secondary key: HostName=iiot-book-hub-2.azure-devi...

Microsoft Azure

Home > iiot-book-hub

IoT Hub

Search (Ctrl+/)

IoT device configuration

Messaging

File upload

Message routing

Resiliency

Monitoring

Alerts

Metrics

Diagnostic settings

Logs

Support + troubleshooting

Resource health

New support request

```

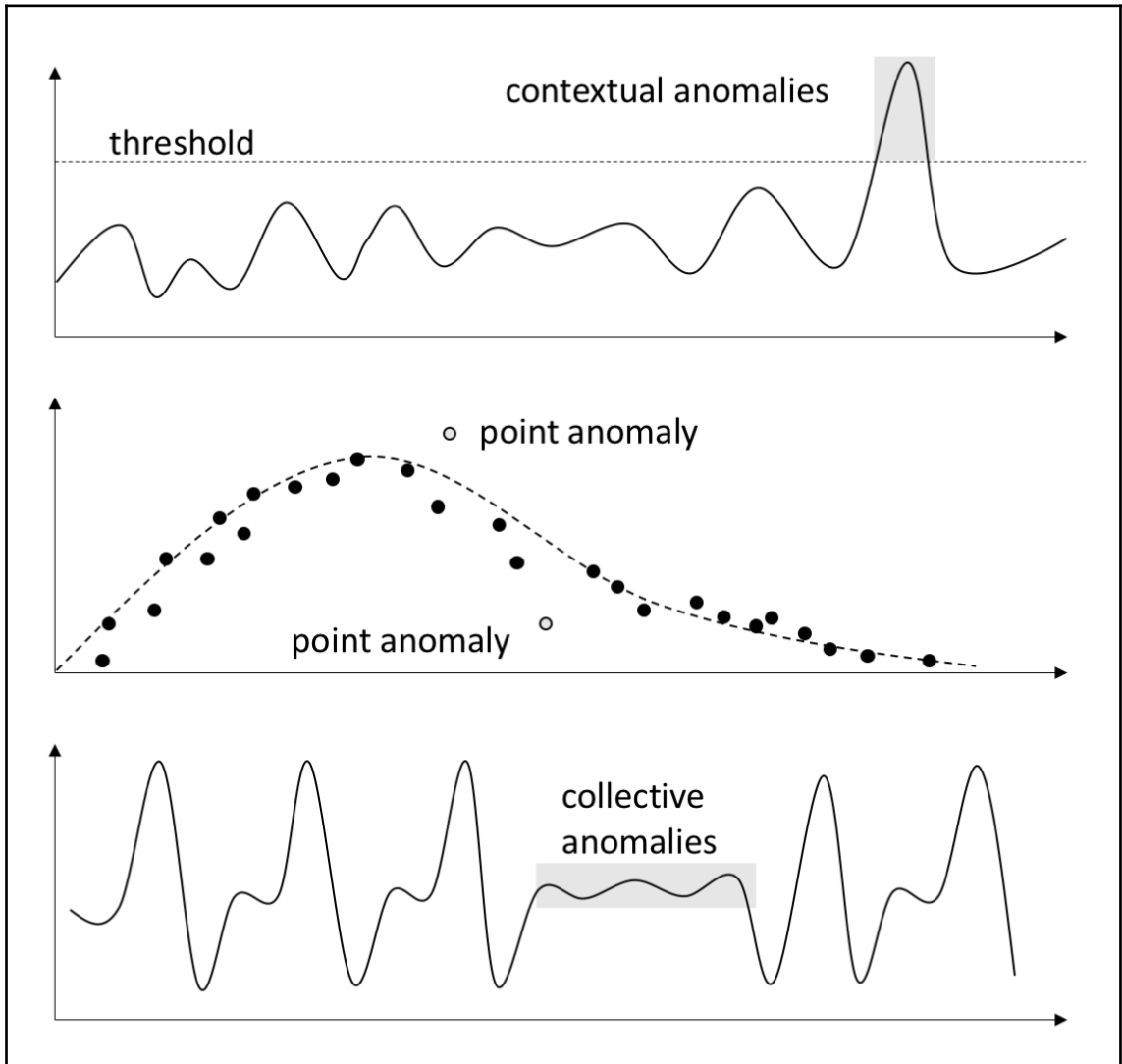
10/12/2018 11:02:37: Namespace index 1: urn:DESKTOP-8P3H8SD_mshome.net:OPCUA:SimulationServer
10/12/2018 11:02:37: Namespace index 2: http://www.prosysopc.com/OPCUA/SampleAddressSpace
10/12/2018 11:02:37: Namespace index 3: http://www.prosysopc.com/OPCUA/ComplianceNonUaNodes
10/12/2018 11:02:37: Namespace index 4: http://www.prosysopc.com/OPCUA/ComplianceNonUaNodes
10/12/2018 11:02:37: Namespace index 5: http://www.prosysopc.com/OPCUA/ComplianceNonUaNodes
10/12/2018 11:02:37: Namespace index 6: http://www.prosysopc.com/OPCUA/SampleBigAddressSpace
10/12/2018 11:02:37: The server on endpoint 'opc.tcp://opcuserver:53530/OPCUA/SimulationServer' supports a minimal sampling interval of 0 ms.
10/12/2018 11:02:37: Created subscription with id 2 on endpoint 'opc.tcp://opcuserver:53530/OPCUA/SimulationServer'
10/12/2018 11:02:37: Create subscription on endpoint 'opc.tcp://opcuserver:53530/OPCUA/SimulationServer' requested OPC publishing interval is 5000 ms. (revised: 5000 ms)
10/12/2018 11:02:37: Start monitoring items on endpoint 'opc.tcp://opcuserver:53530/OPCUA/SimulationServer'. Currently monitoring 0 items.
10/12/2018 11:02:37: Created monitored item for node 'ns=5;s=MyDevice.Pump_01.Pressure' in subscription with id '2' on endpoint 'opc.tcp://opcuserver:53530/OPCUA/SimulationServer'
10/12/2018 11:02:37: Now monitoring 1 items in subscription with id '2'
10/12/2018 11:02:37: Done processing unmonitored items on endpoint 'opc.tcp://opcuserver:53530/OPCUA/SimulationServer'

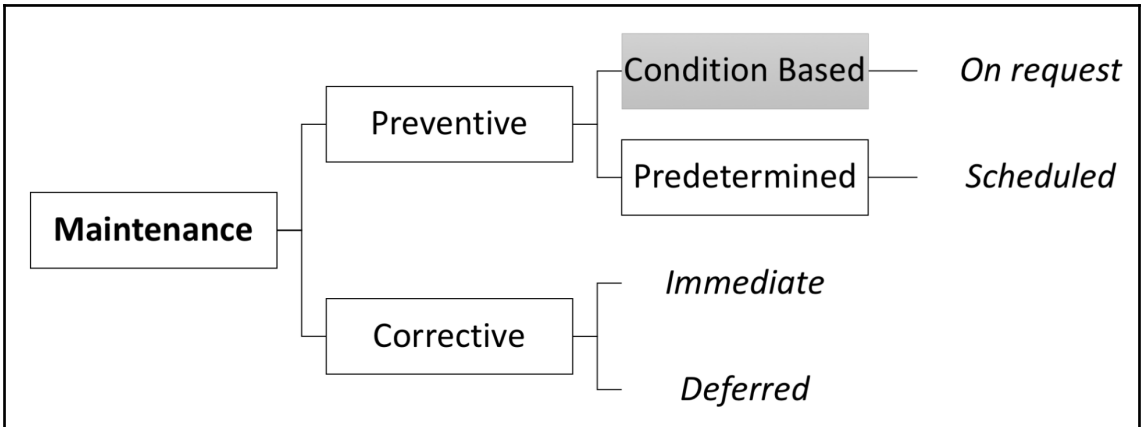
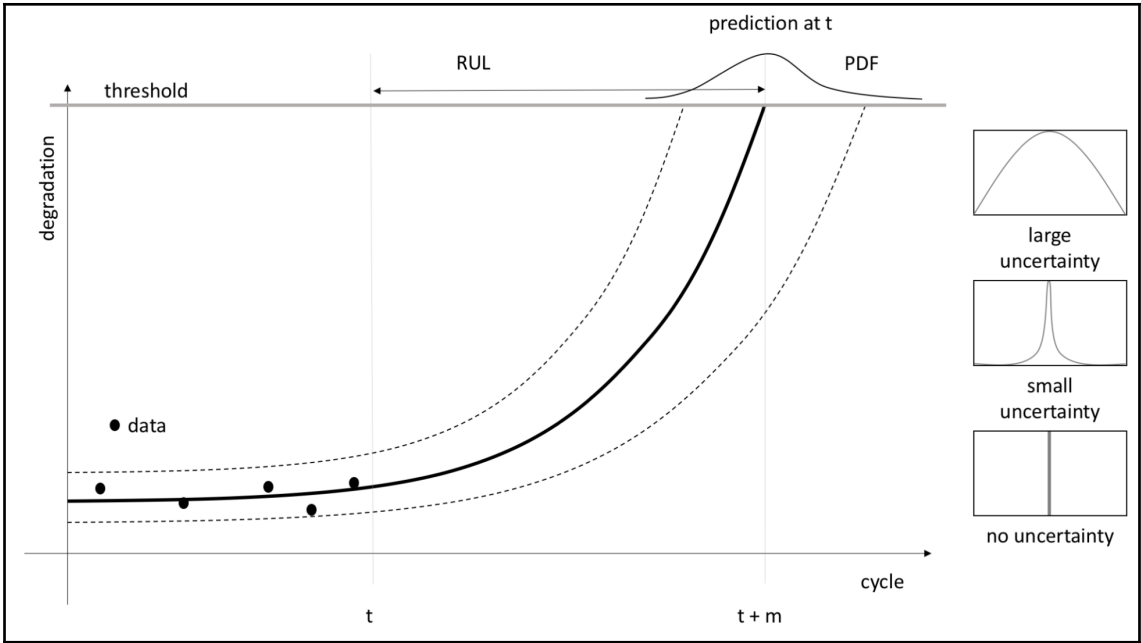
```

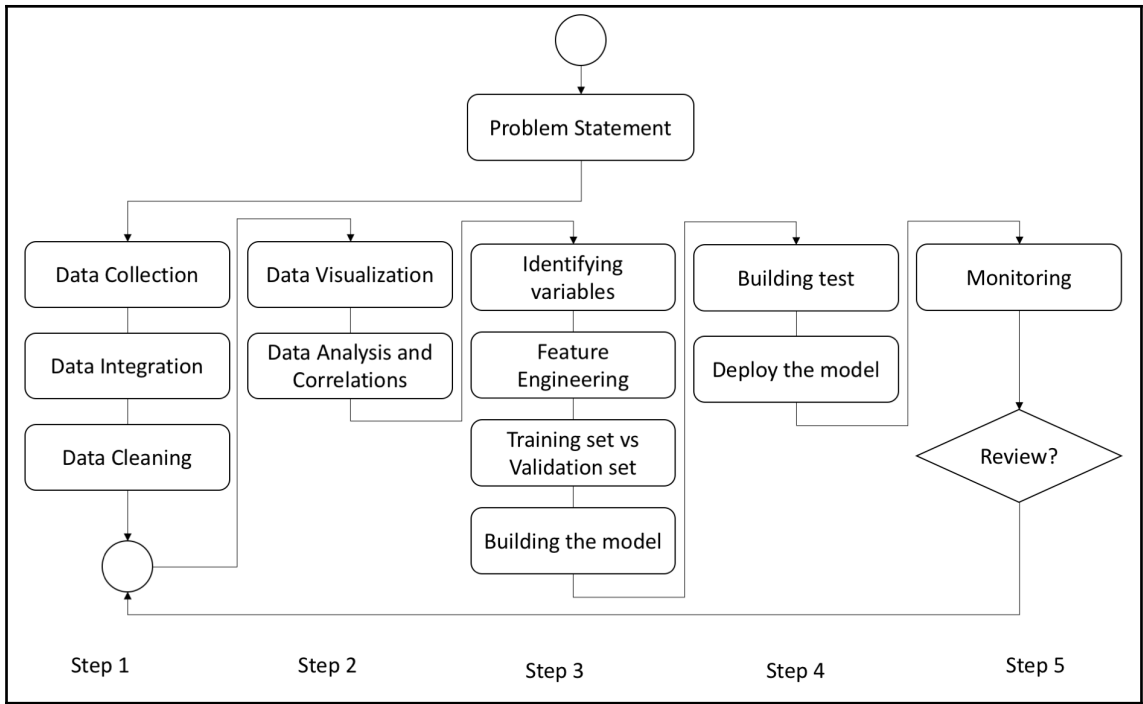
iiot-book-hub-2, Telemetry messages sent, Sum

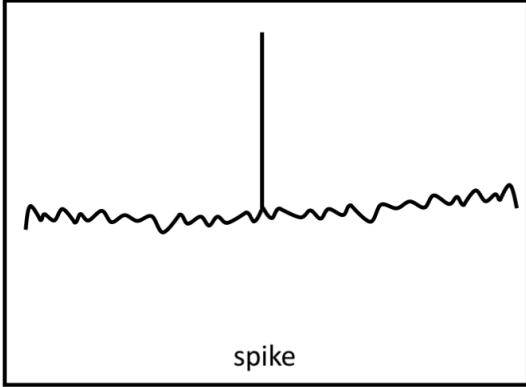
Telemetry messages sent (Sum)
iiot-book-hub-2
40

Chapter 13: Understanding Diagnostics, Maintenance, and Predictive Analytics

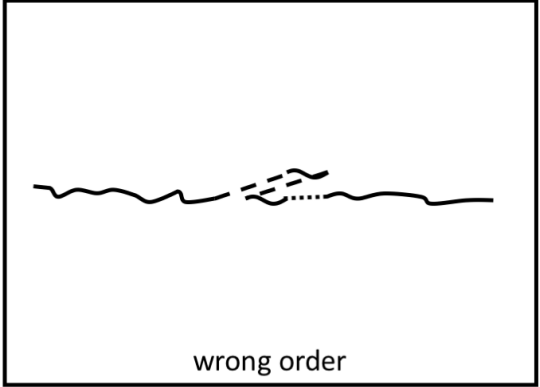




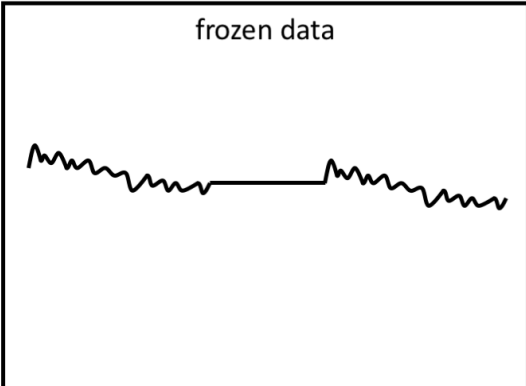




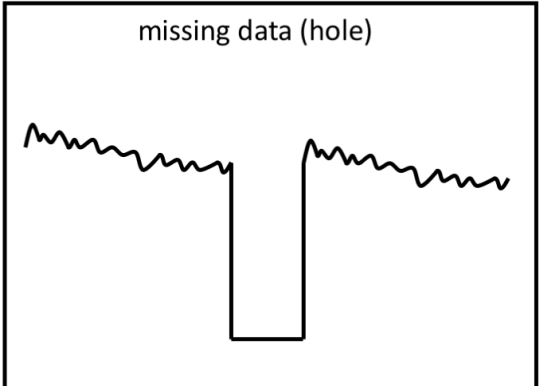
spike



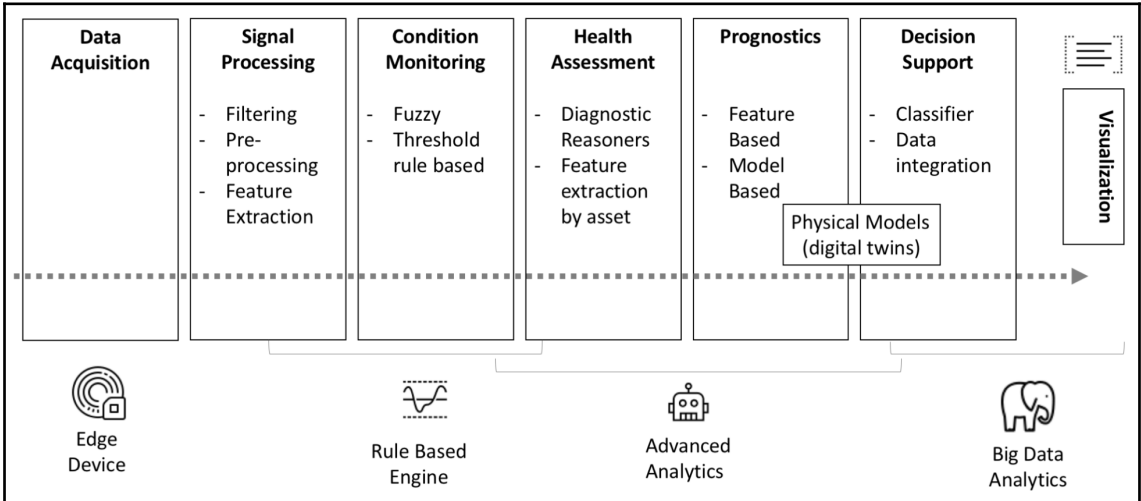
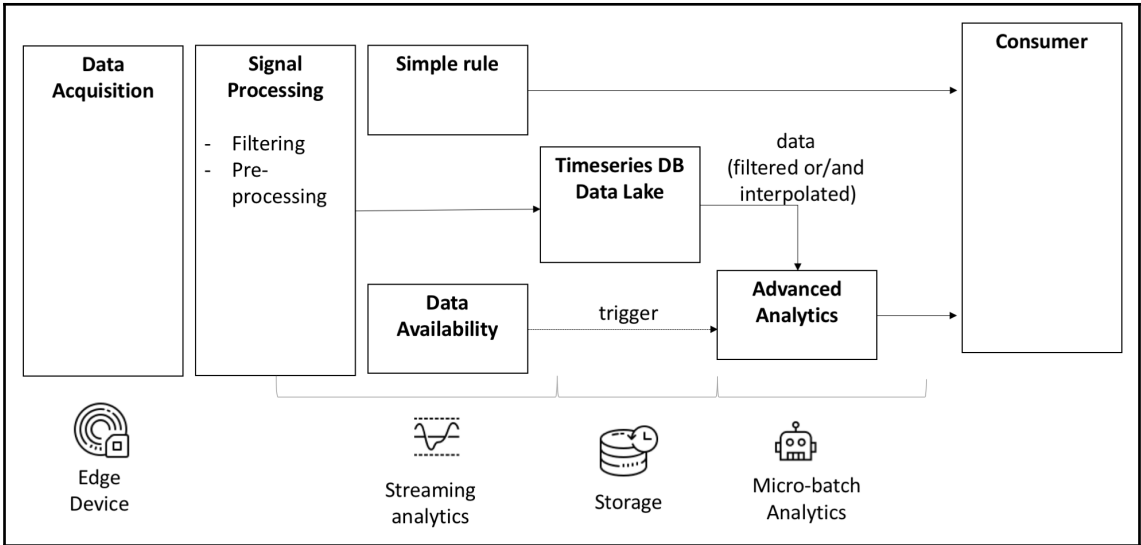
wrong order

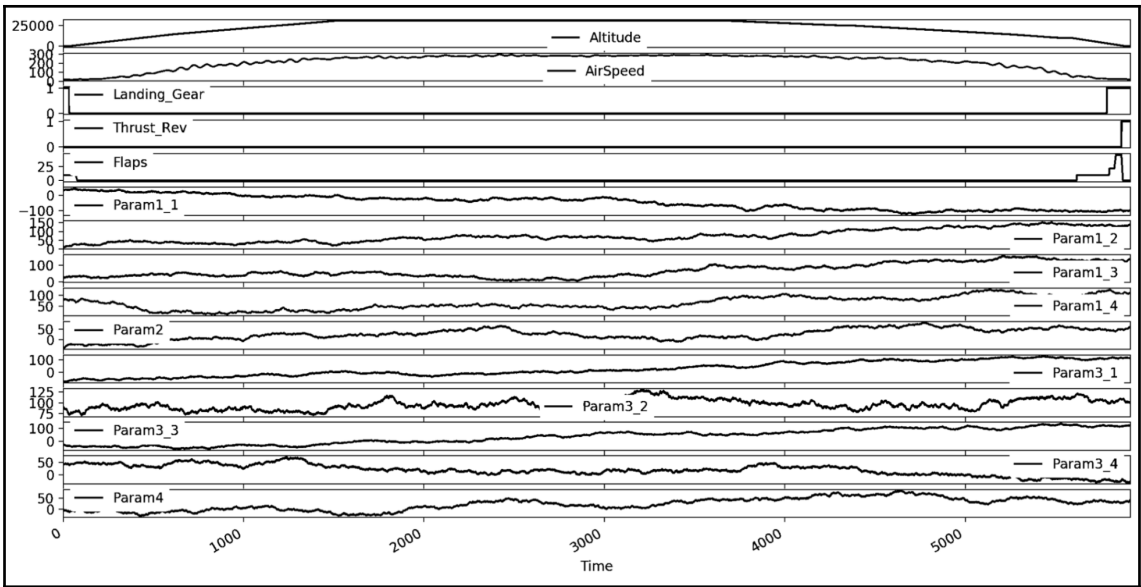


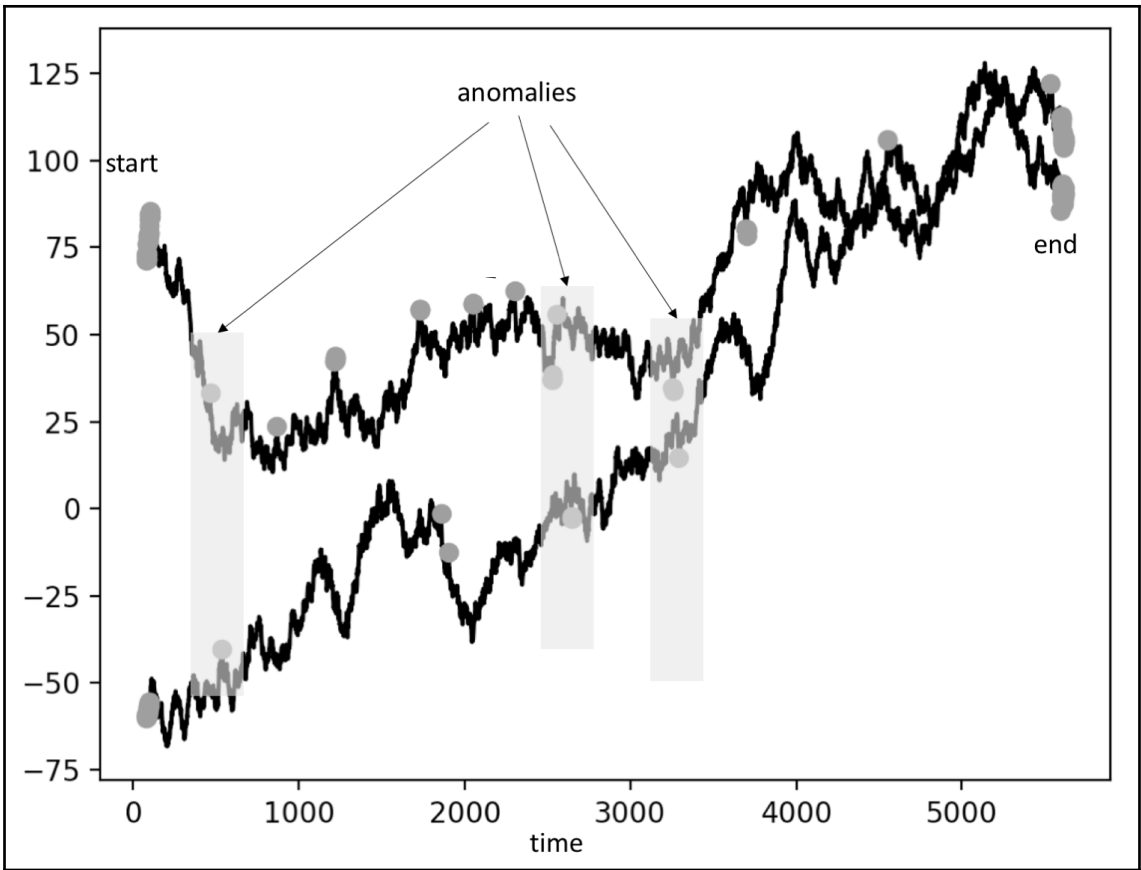
frozen data

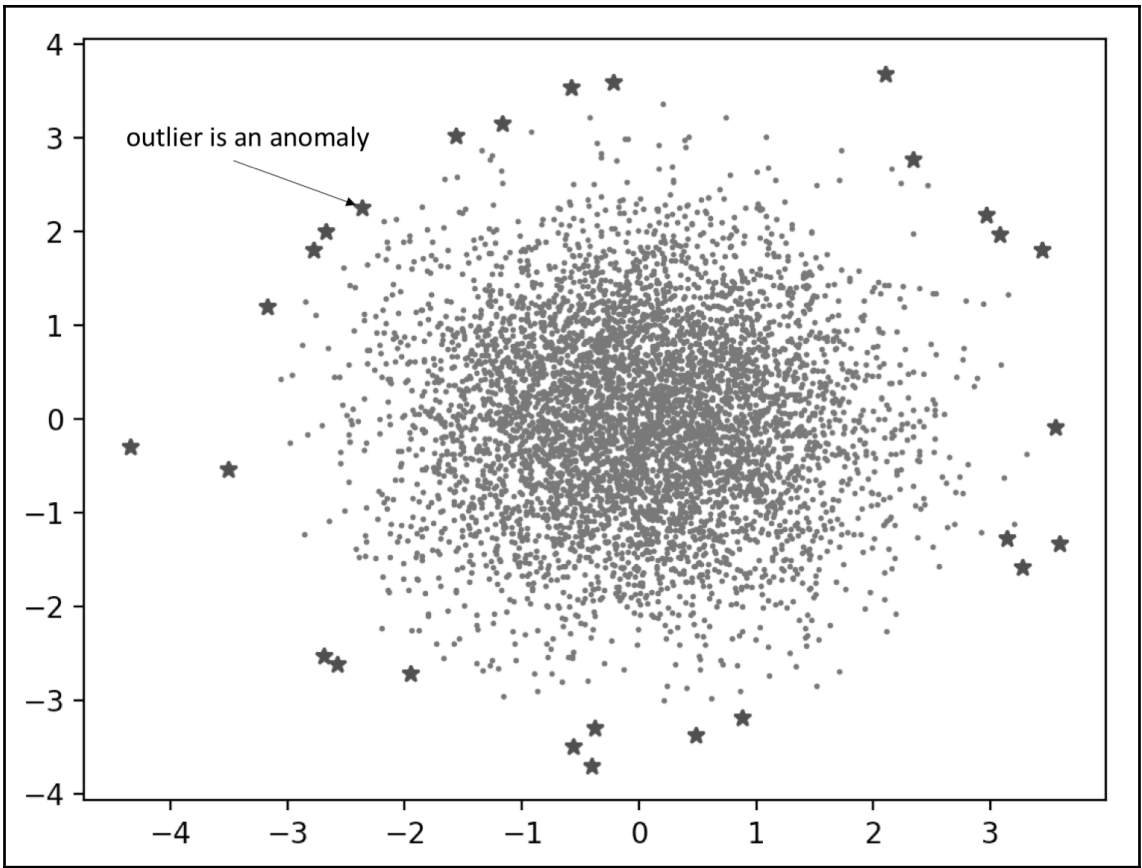


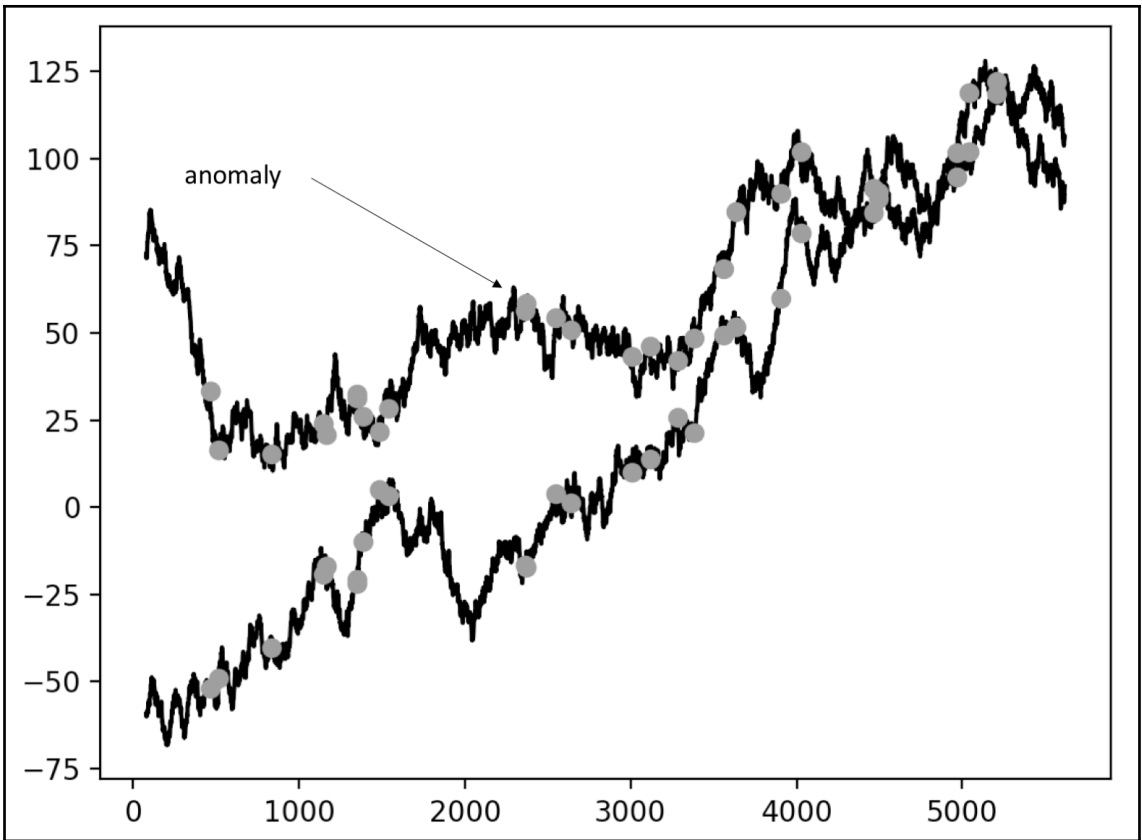
missing data (hole)

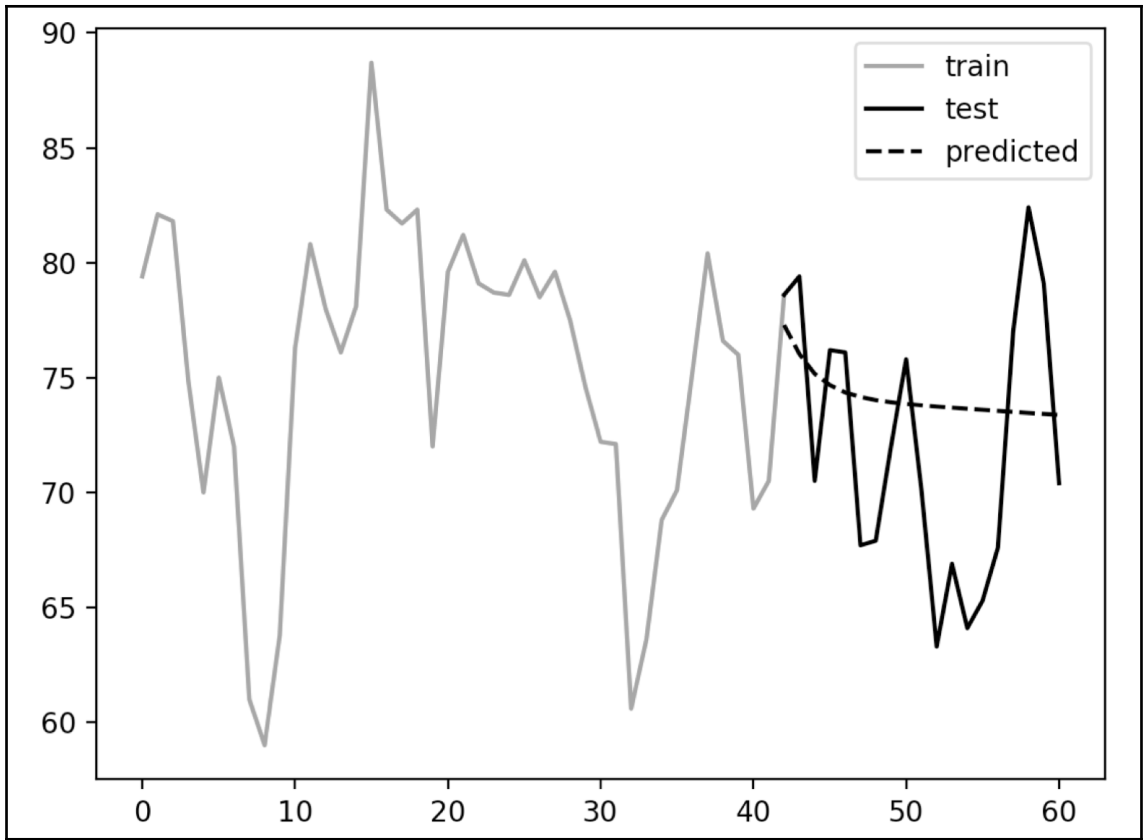




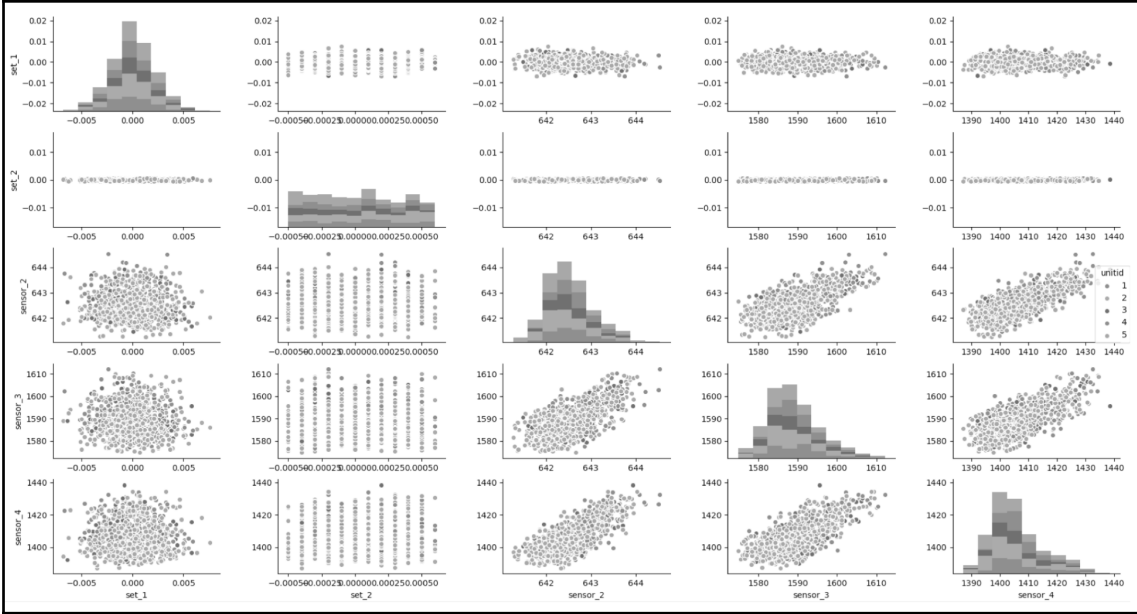


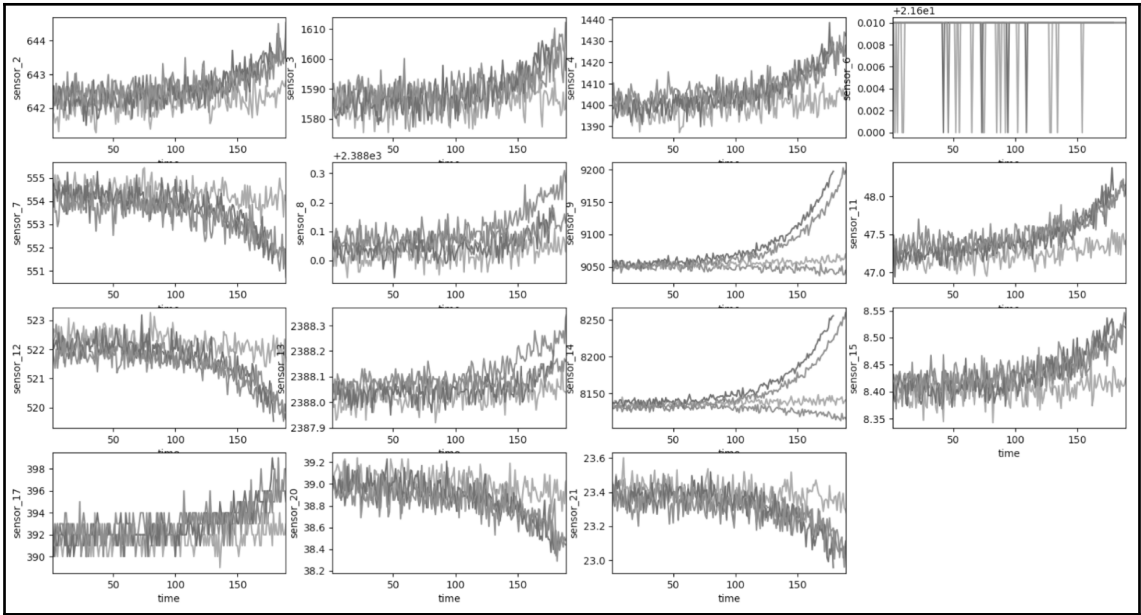


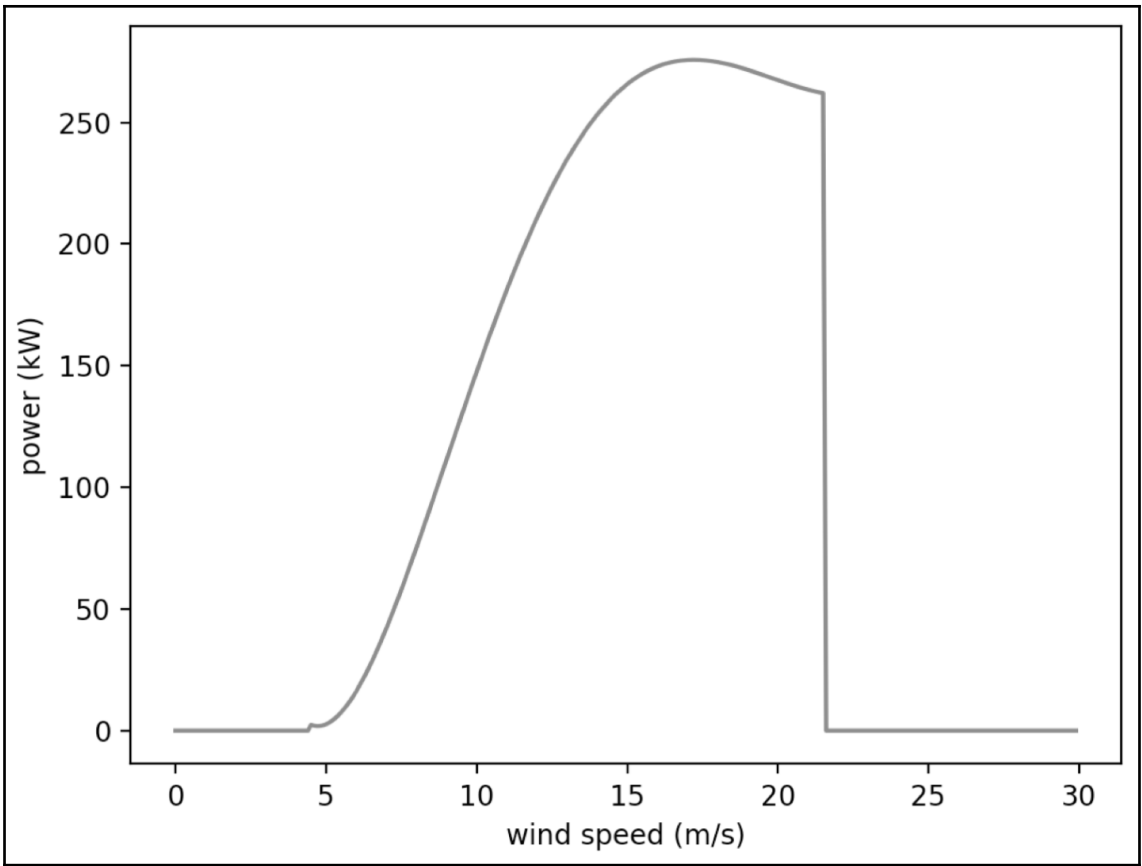


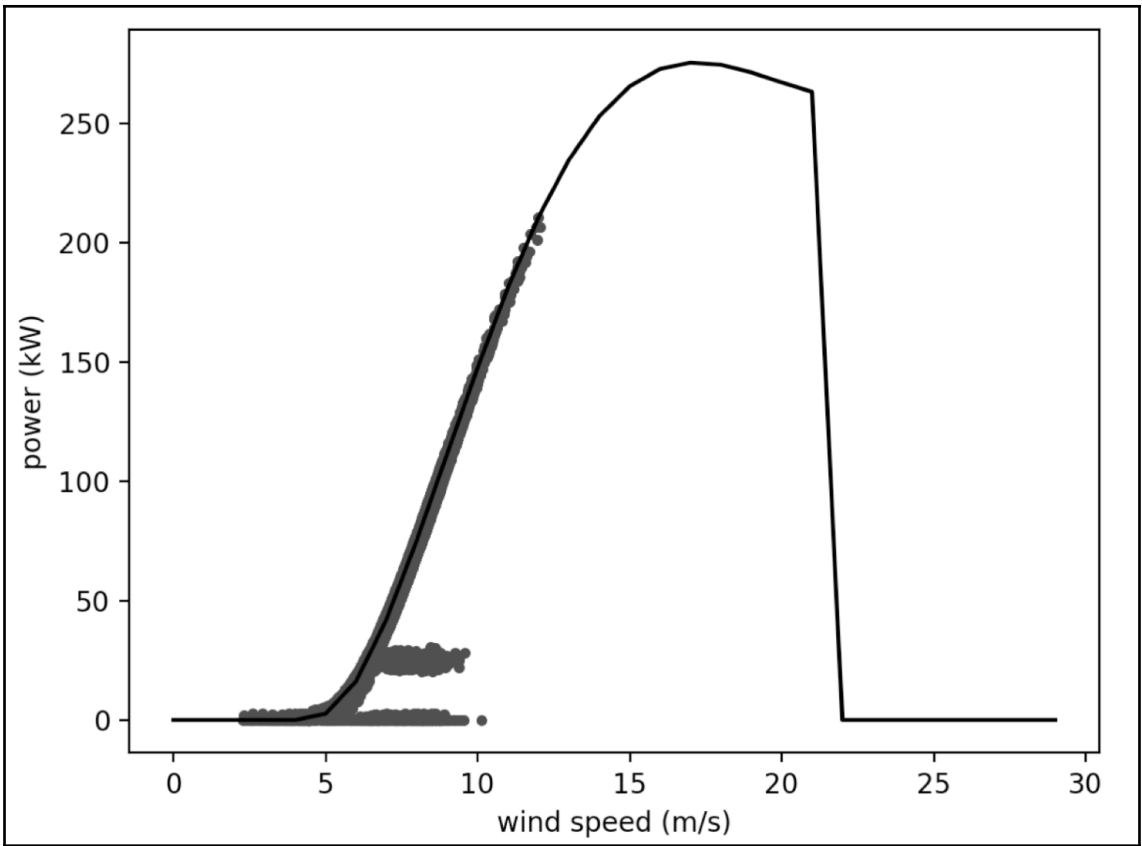


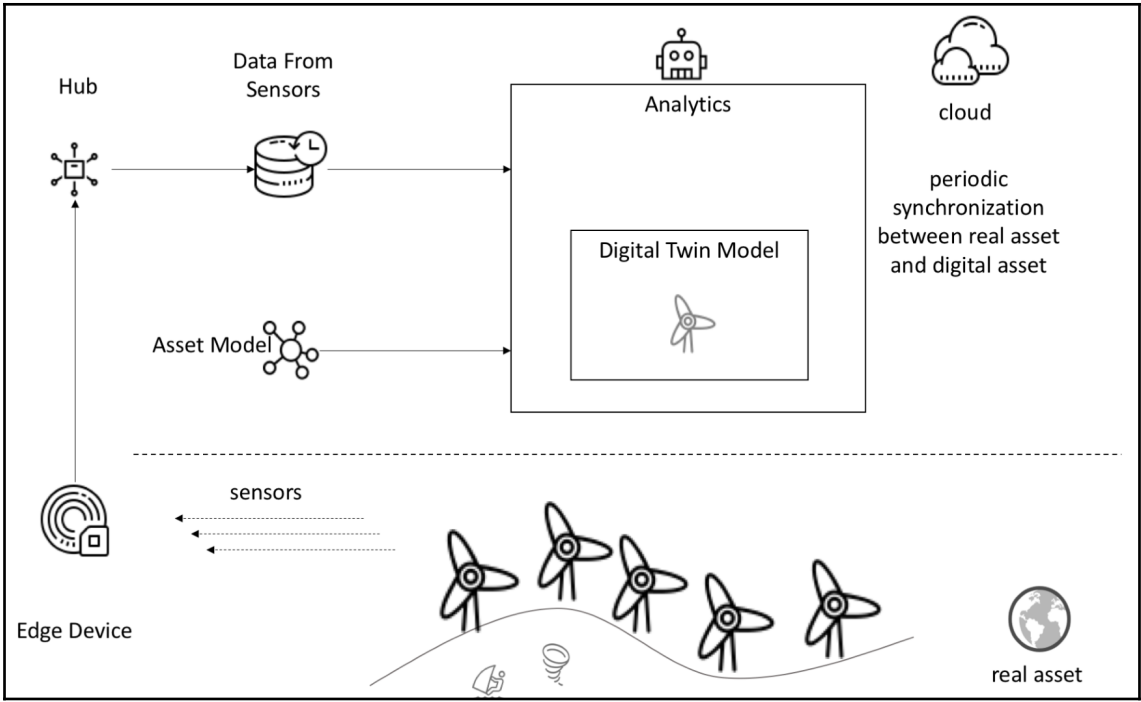
Chapter 14: Implementing a Digital Twin – Advanced Analytics



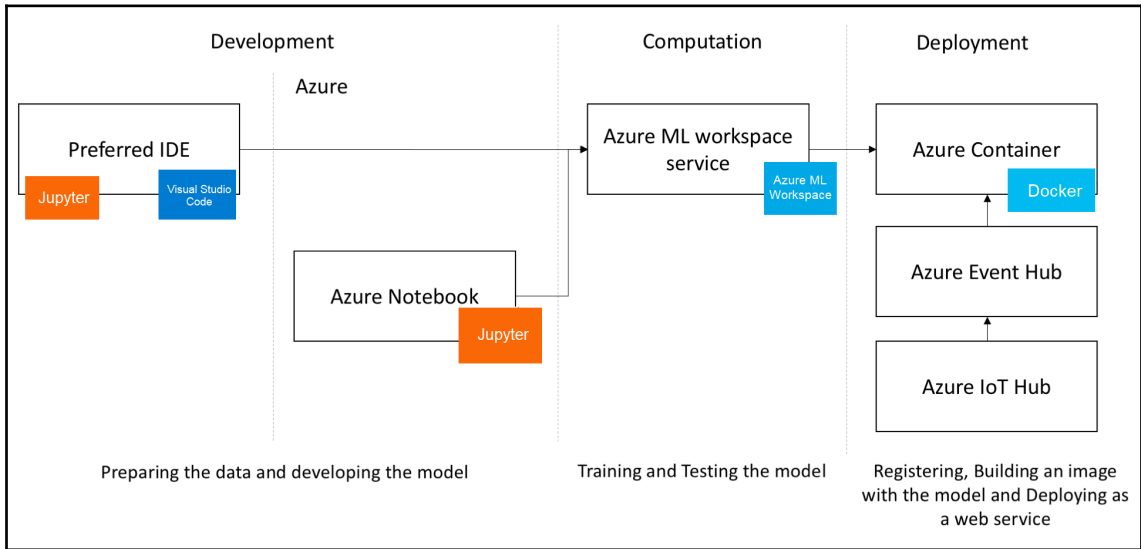








Chapter 15: Deploying Analytics on an IoT Platform



Microsoft Azure

Home > ML service workspace

ML service workspace

Machine Learning service workspace

* Workspace name
iiot-book-ml-workspace

* Subscription
Free Trial

* Resource group
iiot-book-res

* Location
East US 2

Create new

For your convenience, the resources are added automatically to the workspace, if region available: [Azure Container Registry](#), [Azure storage](#), [Azure Application Insights](#) and [Azure Key Vault](#).

Create Automation options

machine learning

RESOURCES 0 results

RESOURCE GROUPS 0 results

SERVICES

- HDInsight clusters
Keywords: Machine Learning Server
- Machine Learning** Studio web service plans
- Machine Learning** Model Management (Retiring)
- Machine Learning** Experimentation (Retiring)

MARKETPLACE All 4 results

- Machine Learning** Model Management (Retiring)
- Machine Learning** service workspace
- Machine Learning** Studio Workspace
- Machine Learning** Experimentation (Retiring)

DOCUMENTATION All 4 results

- [What is Azure Machine Learning service? | Microsoft Docs](#)
Machine learning is a data science technique that allows computers to use existing data to foreca...
- [Azure Machine Learning Documentation – Tutorials, API ...](#)
Azure Machine Learning service (preview) Learn how this service empowers data scientists to dev...
- [A simple experiment in Machine Learning Studio | Microsoft ...](#)
Machine learning algorithm cheat sheet and How to choose algorithms for Microsoft Azure Mach...
- [How to choose machine learning algorithms | Microsoft Docs](#)
The Microsoft Azure Machine Learning Algorithm Cheat Sheet helps you choose the right machin...

Searching all subscriptions. [Change](#)

Microsoft Azure

Home > All resources > iiot-book-ml-workspace - Experiments

All resources
Default Directory

- Filter by name...
- NAME
- iiot-book-hub-2
- iiotbookmlwork0370290581
- iiotbookmlwork2678941280
- iiotbookmlwork4120798671
- iiotbookmlwork9083728313
- iiot-book-ml-workspace**

iiot-book-ml-workspace - Experiments
Machine Learning service workspace

Experiments Compute Models Images Deployments Activities

Welcome to your new Workspace

- Getting started
Create your first experiment in Azure Notebooks to be able to view and track metrics.
- Done getting started?
Once you run the Azure Notebook, you will be able to view the data from the experiment in the Experiments page.

[Open Azure Notebooks](#) [View Experiments](#)

What's possible with AML?
Using Azure Machine Learning service, you can track your models as you build, train, deploy, and manage them at cloud scale.

[Run & Monitor Experiments](#) [Register Models](#) [Build](#)

Microsoft Azure

subscriptions

Home > Subscriptions

Subscriptions

Default Directory

[Add](#)

Showing subscriptions in Default Directory. Don't see a subscription? [Switch directories](#)

My role 7 selected 3 selected

[Apply](#)

Show only subscriptions selected in the [global subscriptions filter](#)

SUBSCRIPTION	SUBSCRIPTION ID	MY ROLE
Free Trial	XXXXXXXX-XXXX-XXX-XXXXXXX	Account admin

iiot-book-ml-workspace
Machine Learning service workspace

Search (Ctrl+/)

Experiments Compute Models Images Deployments Activities

Overview
Activity log
Access control (IAM)
Tags
Diagnose and solve problems

Settings
Locks
Automation script
Properties

Application
Experiments
Compute
Models
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Deployments

ATTRIBUTES

Status	Completed
Created	18/10/2018, 13:2...
Duration	0:03:04
Target	sdk
Run Id	54888b62-257a-...
Run Number	2

CHARTS

Turbine Model

Index

Home > All resources > iiot-book-ml-workspace - Deployments

iiot-book-ml-workspace - Deployments
Machine Learning service workspace

All resources
Default Directory

Filter by name...

NAME

- iiotbookacreefyidv
- iiotbookbatchai_njleqix
- iiotbookinsightspeueregeg
- iiotbookkeyvaultxapimuzr
- iiot-book-ml-workspace
- iiotbookstoragefteewoey
- wind-turbine

Overview
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wind-turbine

Back to Deployments Edit Delete

Details Models Images

Attributes

Description	Wind turbine power
State	Healthy
Compute Type	ACI
Service ID	wind-turbine
Tags	
Creation date	10/19/2018, 10:32:28 AM UTC
Last updated	10/19/2018, 10:32:37 AM UTC
Image ID	wind-turbine:1
Scoring URI	http://137.117.234.139:80/score

- Overview
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 - Activities

Experiments Compute Models Images Deplc

Duration	0:08:12
Target	traincluster-w3
Run Id	wind-turbine-experim...
Run Number	4
Script Name	train.py
Tags	

TRACKED METRICS	
Regularization Rate	0.8
Accuracy	0.8

All resources
Default Directory

iot-stream - Functions
Stream Analytics job

Filter by name...

NAME

- iiotbookacrmnqtirs
- iiotbookbatchal_qcvqerbt
- iiot-book-hub2
- iiotbookinsightszmxwqpxc
- iiotbookkeyvaultygtogfzx
- iiot-book-ml-workspace-2
- iiotbookstrongsimkxasx
- iot-stream**
- wind-turbine

FUNCTIONS

- Javascript UDF
- Azure ML**
- Javascript UDA

PARAMETERS

New function

* Function alias
wind-turbine ✓

Provide Azure Machine Learning function settings manually
 Select Azure Machine Learning function from your subscriptions

Subscription
Subscription information not needed

* URL
http:// <wind turbine > ✓

Key

Save

If the chosen resource and the stream analytics job are located in different regions, you will be billed to move data between regions.

aws Services Resource Groups

Amazon Glacier now offers expected performance

Amazon S3

Search for buckets

+ Create bucket Delete bucket

Bucket name

elasticbeanstalk-eu-central-1-80

* Objects might still be publicly accessible due to

Create bucket

1 Name and region 2 Configure options 3 Set permissions 4 Review

Name and region

Bucket name ⓘ
iiot-book-data

Region
EU (Ireland)

Copy settings from an existing bucket

Select bucket (optional) 1 Buckets

Create **Cancel** **Next**

aws Services Resource Groups Giacomo Veneri

Amazon S3 > iiot-book-data

Overview







Upload Create folder

Upload

1 Select files 2 Set permissions 3 Set properties 4 Review

3 Files Size: 5.5 MB Target path: iiot-book-data

+ Add more files

	RUL_FD001.txt - 429.0 B	
	test_FD001.txt - 2.1 MB	
	train_FD001.txt - 3.4 MB	

Upload Next

Buckets are globally unique
store in Amazon S3.

aws Services Resource Groups

Amazon SageMaker

- Dashboard
- Notebook
- Notebook instances
- Lifecycle configurations
- Training
 - Training jobs
 - Hyperparameter tuning jobs
- Inference
 - Models
 - Endpoint configurations
 - Endpoints
 - Batch transform jobs

Create notebook instance

Amazon SageMaker provides pre-built fully managed notebook instances that run Jupyter notebooks. The notebook instances include example code for common model training and hosting exercises. [Learn more](#)

Notebook instance settings

Notebook instance name
iiot-book-notebook
Maximum of 63 alphanumeric characters. Can include hyphens (-), but not spaces. Must be unique within your account in an AWS Region.

Notebook instance type
ml.t2.medium

IAM role
Notebook instances require permissions to call other services including SageMaker and S3. Choose a role or let us create a role with the [AmazonSageMakerFullAccess](#) IAM policy attached.
Choose an option...

VPC - optional
Your notebook instance will be provided with SageMaker provided internet access because a VPC setting is not specified.
No VPC

Lifecycle configuration - optional
Customize your notebook environment with default scripts and plugins.
No configuration

Encryption key - optional
Encrypt your notebook data. Choose an existing KMS key or enter a key's ARN.
No Custom Encryption

Volume Size In GB - optional
Your notebook instance's volume size in GB. Minimum of 5GB. Maximum of 16384GB (16TB).
5

► Tags - optional

Cancel Create notebook instance

Create an IAM role

Passing an IAM role gives Amazon SageMaker permission to perform actions in other AWS services on your behalf. Creating a role here will grant permissions described by the [AmazonSageMakerFullAccess](#) IAM policy to the role you create.

The IAM role you create will provide access to:

- S3 buckets you specify - *optional*
 - Specific S3 buckets
 -
 - Comma delimited. ARNs, "*" and "/" are not supported.
 - Any S3 bucket
 - Allow users that have access to your notebook instance access to any bucket and its contents in your account.
 - None
- Any S3 bucket with "sagemaker" in the name
- Any S3 object with "sagemaker" in the name
- Any S3 object with the tag "sagemaker" and value "true" [See Object tagging](#)
- S3 bucket with a Bucket Policy allowing access to SageMaker [See S3 bucket policies](#)

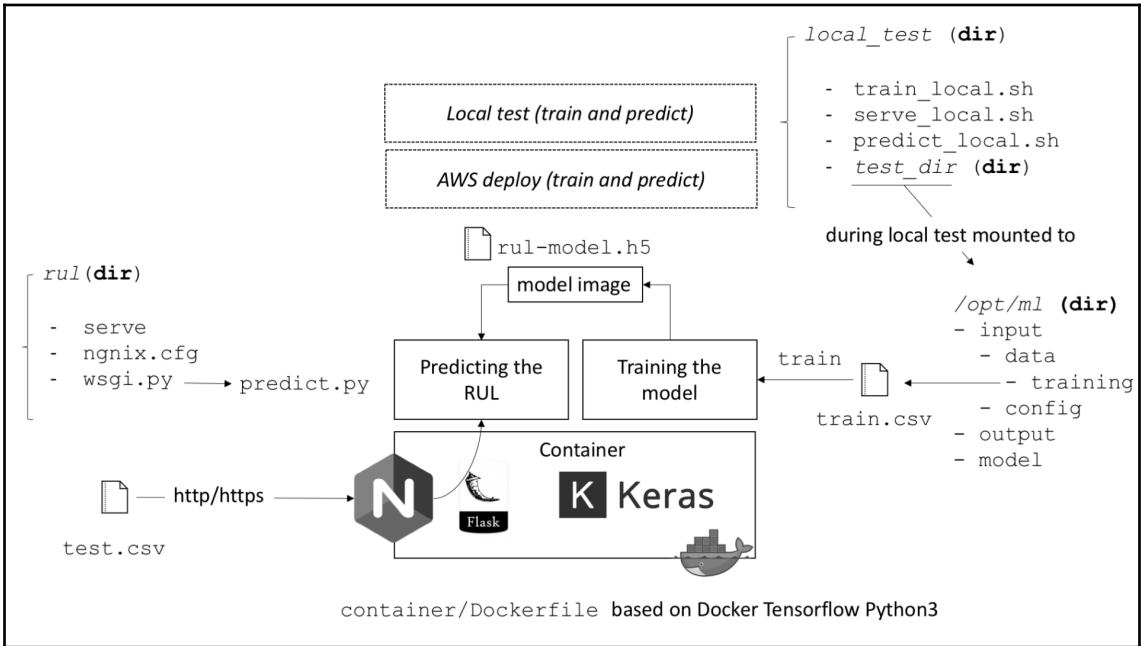
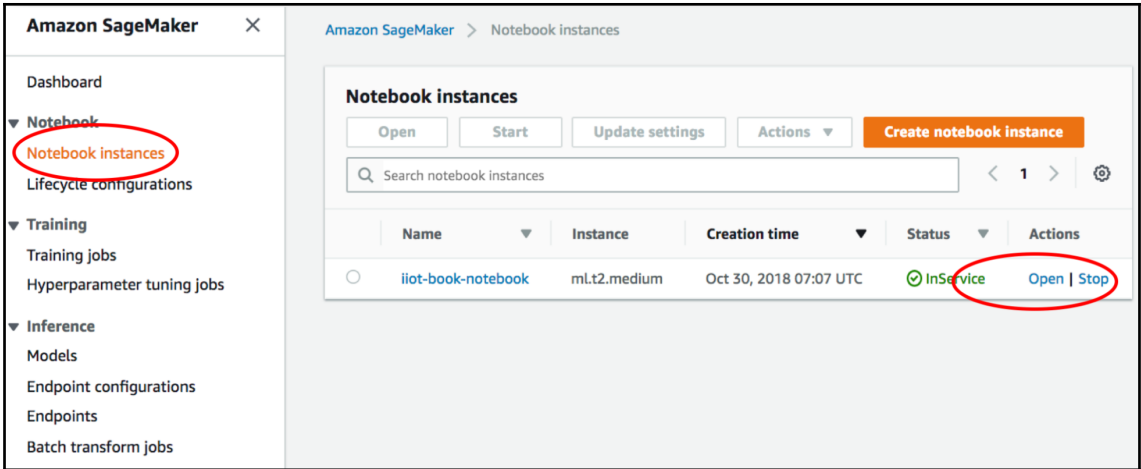
Permissions | Trust relationships | Access Advisor | Revoke sessions

▼ Permissions policies (3 policies applied)

[+ Add inline policy](#)

Policy name	Policy type	
▶ AmazonEC2ContainerRegistryFullAccess	AWS managed policy	✕
▶ AmazonSageMaker-ExecutionPolicy-20181030T072476	Managed policy	✕
▶ AmazonSageMakerFullAccess	AWS managed policy	✕

▶ Permissions boundary (not set)



```
----> ba91ef212451
Step 16/18 : ENV PATH="/opt/program:${PATH}"
----> Using cache
----> d321fb8965c1
Step 17/18 : COPY rul /opt/program
----> Using cache
----> 0f4af1438ed2
Step 18/18 : WORKDIR /opt/program
----> Using cache
----> b59d16d1d4f9
Successfully built b59d16d1d4f9
Successfully tagged rul-estimator:latest
docker tag with ${image} ${fullname}
docker push ${fullname}
The push refers to repository [266996497855.dkr.ecr.eu-west-1.amazonaws.com/rul-estimator]
f2f4fbfd11a: Pushed
291d045f31ef: Pushed
e5a72264e6de: Pushed
0c1704c944ba: Pushed
992472c57b43: Pushed
92e1fe18f3b2: Pushed
6b784d62b19a: Pushed
11c953150b00: Pushed
9f7c348e67ce: Pushed
85dfaa394e51: Pushed
7b95db99b76a: Pushed
b5bf47360f2b: Pushed
788a01b9cb70: Pushed
4331257a069e: Pushed
a6a13fd7a75f: Pushed
9ff6cd787adb: Pushed
32e1e1d8a456: Pushed
9a0f96301e7d: Pushed
fde791900dd4: Pushing [=====>] ] 266.2MB/371.5MB
fa8678ba5abc: Pushed
f157c6afd0c0: Pushing [=====>] ] 175.6MB/346.9MB
75b79e19929c: Pushed
4775b2f378bb: Pushed
883eafdbe580: Pushed
19d043c86cbc: Pushed
8823818c4748: Pushed
```

