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# Introduction

This contribution introduces a possible resource structure to manage AI/ML model in oneM2M.

### -----------------------Start of change 1-------------------------------------------

## 7.3 Use case #2 – Last Mile Delivery

### 7.3.1 Description

Last Mile is a term used in supply chain management and transportation planning to describe the last leg of a journey comprising the movement of people and goods from a transportation hub to a final destination. For example, when moving from your home (departure) to your office (destination), the travel between your home and your office through public transportation is First Mile, the short distance to your office is Last Mile [i.3].

In logistics, the first mile covers the area where the goods are sent from the provider, the hub terminal, and the sub terminal. Then, the last mile logistics service provider carries goods from the sub terminal to the consumer directly. Robots and autonomous vehicles are the ones that logistics companies are developing for the Last Mile delivery service.

IoT and AI/ML technologies are considered playing a pivotal role in this area, Last Mile Delivery. IoT platform controlling and managing robots for last mile delivery collcects billions of gigabytes of structured and unstructured data everyday. AI/ML technologies harness this dataset to make build a good model for various decisions, which performed by human being.

In the last mile delivery use case, a last mile robot picks up goods to deliver and navigates to the customer. The robot will need to learn to operate in more complex and varied environments with minimal or no human intervention. This requires extensive computing power and storages. This ranges from gathering data, defining object classes, labelling the data, and training a selected ML model in many environments and conditions.

In order to make ML models work as expected, continuous maintaining of trained models is essential. Typically data is going to change over time. Even in the same building for the last mile delivery, the number of people and objects located in the building are changed over time. This means that a ML model built a week ago may not provide accurate predictions for a last mile robot. Therefore, continuous training of a model using new updated data is an essential part of the last mile delivery service using AI/ML.

Therefore, such complex tasks are expected to be offloaded to an edge or cloud IoT platform where higher computing power and huge data storage can be supported. Also IoT platforms hold other data that can also be used for training. In this use case, IoT platform can provide the following functions:

* Manage structured and unstructured data for training
* Update trained model using new inputs everyday
* Classify AI/ML data into two parts, i.e., training and validating

### 7.3.2 Source

“Last Mile: The last leg of a journey” [i.3]

### 7.3.3 Actors

* Last mile delivery robot: a robot picks up and delivers goods
* Last mile delivery application: an application controls the last mile delivery robot, e.g., configuring locations for pick up and deliver
* AI-enabled IoT platform: An IoT platform stores data from the robot, classifies and manages data for training

### 7.3.4 Pre-conditions

* The last mile delivery robot is energy and computing power constrained so that heavy computational tasks should be performed in IoT platforms.
* The AI-enabled IoT platform holds a set of good quality training data for the last mile delivery service.

### 7.3.5 Triggers

* Last mile delivery application configures delivery information to the robot and requests to start delivery.

### 7.3.6 Normal Flow

Figure 7.3.9-1 illusrates the high-level flows of the last mile delivery use case, which consists of the following steps:

* Step 1: A new delivery order is digitally entered to an IoT platform
* Target location
* Pick up location
* Identifer of goods
* Goals to achieve (e.g., time, shortest path, security)
* Geo-fense information
* Step 2: The IoT platform selects a robot and notifies the order to deliver.
* Step 3: The last mile delivery robot retrieves the order and loads the goods from the pick up location.
* Step 4: The robot starts the delivery. While the robot routes to the destination, it capture data. The data is sent to the IoT platform for managing and processing for training. Such data can be used for updating the trained model to understand edges, many classes of fixed objects, path structures, etc.
* Step 5: The robot delivers the goods to the destination place correctly, then returns to the stand-by location.

### 7.3.7 Alternative Flow

None

### 7.3.8 Post-conditions

The AI-enabled IoT platform has data set for continuous training of the delivery AI/ML model.

### 7.3.9 High Level Illustration



Figure 7.3.9-1 Conceptual diagram of the last mile delivery

The following Figure 7.3.9-2 shows a possible resources structure that shows how AI/ML models can be managed in the oneM2M system. For example, available AI/ML models can be stored in the availableAIModel container. Trained AI/ML models after re-learning can be stored in the aiModel container resource.



Figure 7.3.9-2: A possible resource structure to manage AI/ML models in oneM2M

### 7.3.10 Potential Requirements

1. The oneM2M System shall be able to manage structured and unstructured data for training, for example, preprocessing data, describing data and inferring meaning.
2. The oneM2M System shall be able to update trained AI/ML model according to continuous measuring data e.g., location, time series and historical data.
3. The oneM2M System shall be able to provide a classification function (e.g., split data into two parts, training and validating) in supervised Machine Learning.

### -----------------------End of change 1-------------------------------------------