



# AED eScooter Bajaj

## Software Design Document

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**Revisions**

Ver.	Date	Changed by	Modifications
0.1	2018-08-10	D. Hedrich	Initial version
0.2	2018-08-17	D. Hedrich	Updated sequence diagrams
0.3	2018-09-17	D. Hedrich	Updated events in 3.1.1 and 3.1.2



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# 1 Introduction

## 1.1 Purpose

The purpose of this document is to describe the software design of the *AED* eScooter solution for customer Bajaj.

## 1.2 Document conventions

The following document will use the *italic* font style to highlight names of products, sub systems, components or classes. Links to other chapters will be highlighted with the underline font style.

## 1.3 Scope

The document will focus in the architectural aspects of the *AED* eScooter solution, containing the cloud architecture as well as the communication of backend and C-Box, Mobile APP and FOTA process.

## 1.4 Background

AED-ES/ENG is currently developing the AED eScooter as an electrical mobility solution. As a part of AED eScooter the C-Box is being used as the connectivity module of AED eScooter to establish connections to backend services and a user's Smartphone. On that base the C-Box can be controlled via Smartphone and is able to receive certain types of commands from backend.

In this document, CI is providing an architecture concept for the Cloud of BOSCH AED's eScooter. The focus of this concept targets on the B2C use case, whereby the Connectivity and Service back-ends are in one cloud environment. Communication relationships between C-Box, Connectivity and Service back-ends as well as pairing with a smartphone devices are part of this document. Security aspects of C-Box, Web browser, a user's smartphone and its connection with Service back-end are out of scope.

## 1.5 Definitions and acronyms

TBD	To be defined
HTTPS	Hypertext Transfer Protocol Secured
REST	Representational State Transfer
AMQP	Advanced Message Queuing Protocol
FOTA	Firmware update over the air

## 2 System Context

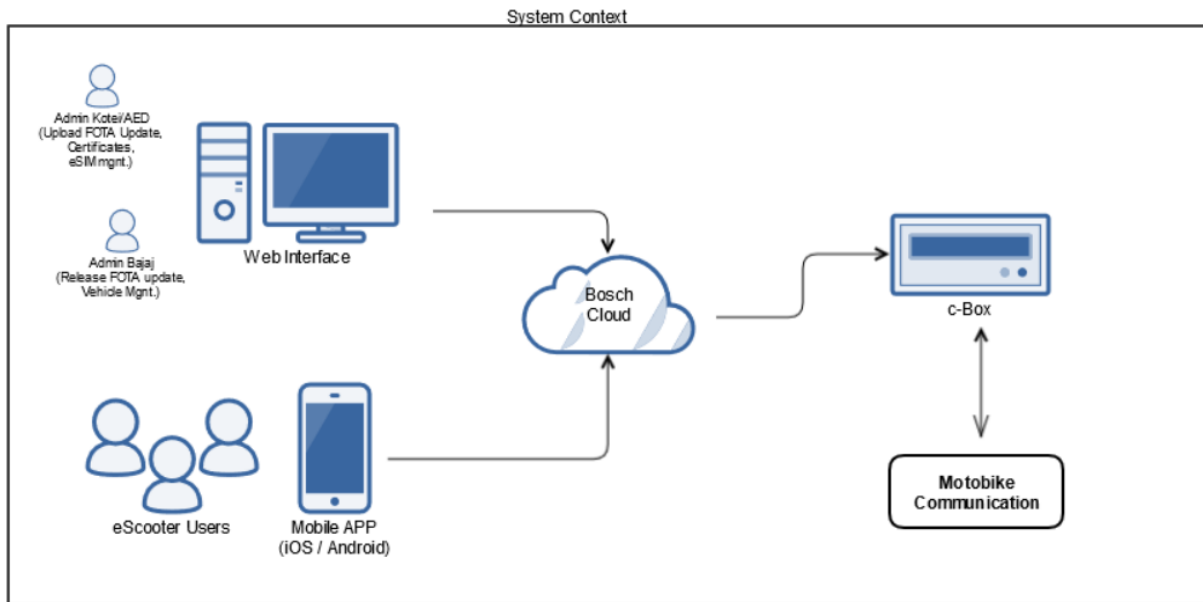


Figure 1: System Context AED eScooter Bajaj

## 3 Runtime View

### 3.1 Cloud <-> C-Box Communication

This communication model is used to send control commands to the C-Box to be executed in the eScooter.

The synchronous command interface ends with the response that the message is put onto the MQTT queue to be delivered to the C-Box.

Once the C-Box acknowledges the reception of the AED Cloud will publish an event to the customer message queue to notify about the delivery of the command message.

The command execution on the C-Box will result in a state change that eventually triggers an Ad-Hoc Event (see Ad-hoc events).

### 3.1.1 Control command (App to Cloud to C-Box)

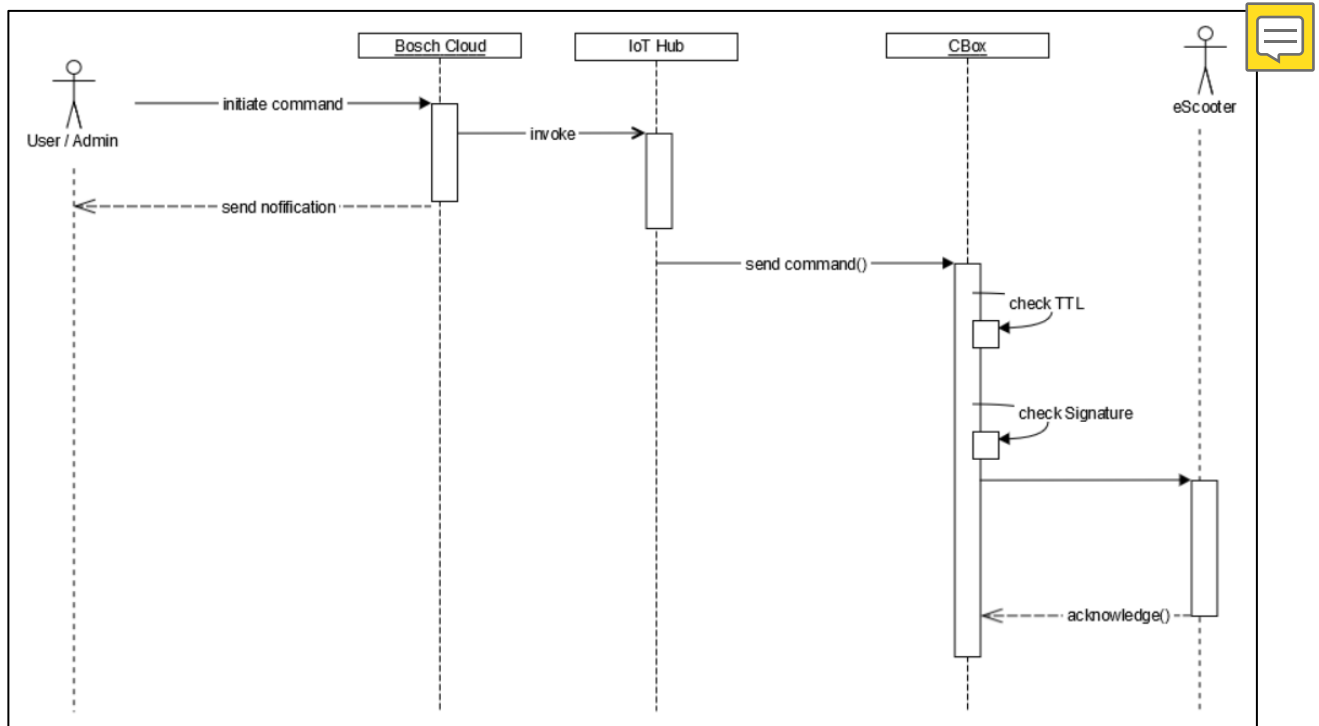


Figure 2: Control command (App to Cloud to C-Box)

#### List of commands

- Get battery state
- FOTA begin request

### 3.1.2 Ad-hoc events

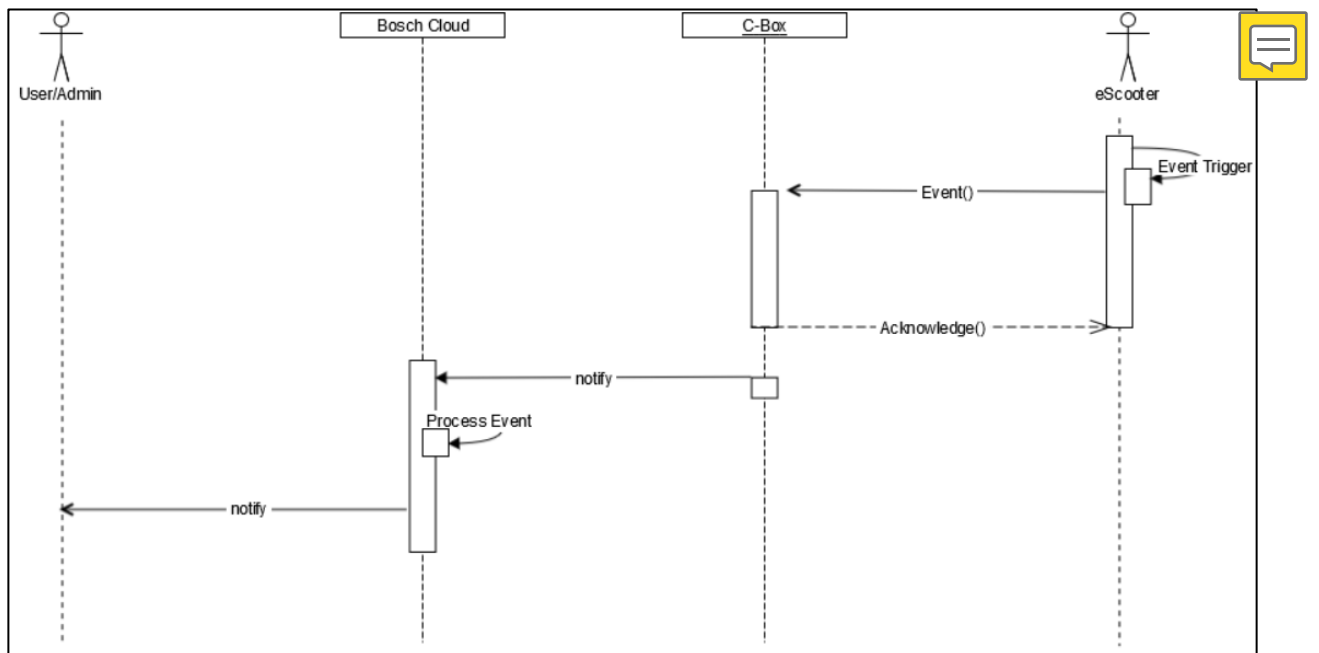


Figure 3: Ad-hoc events

#### List of events

- Battery state report
- FOTA begin response

- FOTA result
- Fault report
- Scooter State Cycling event
- Behaviour mode report
- Charge stats report

### 3.1.3 Interval Events

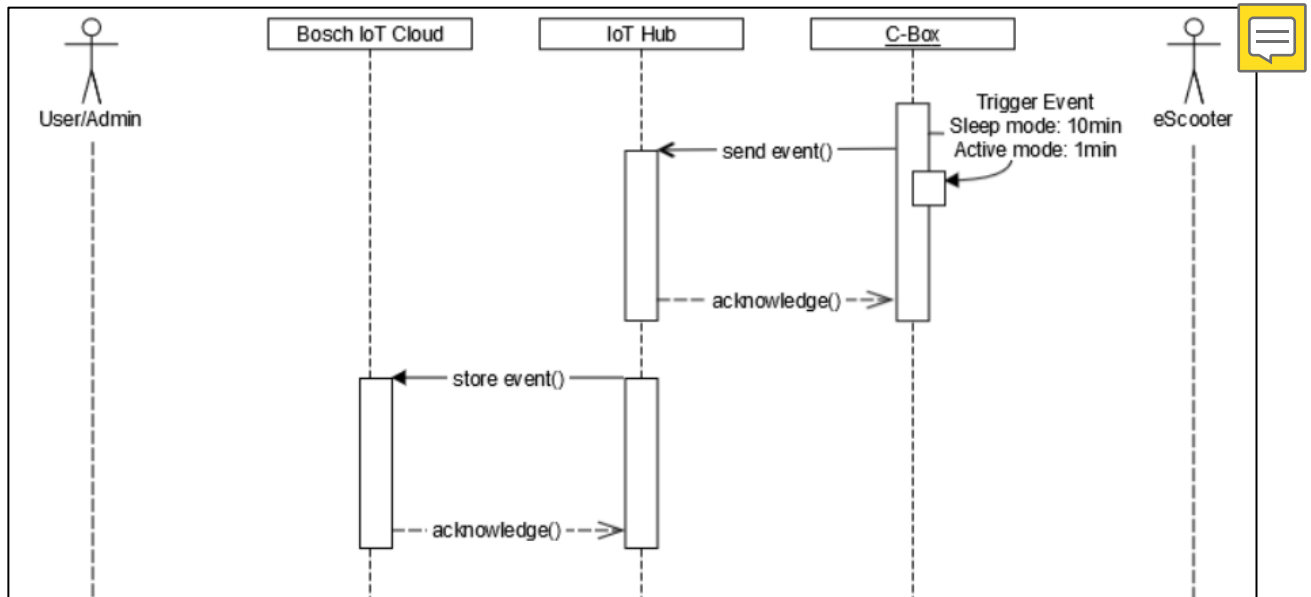


Figure 4: Interval Events

### 3.1.4 List of events

Currently there is one type of Interval Event defined; the interval depends on the eScooter lock state.

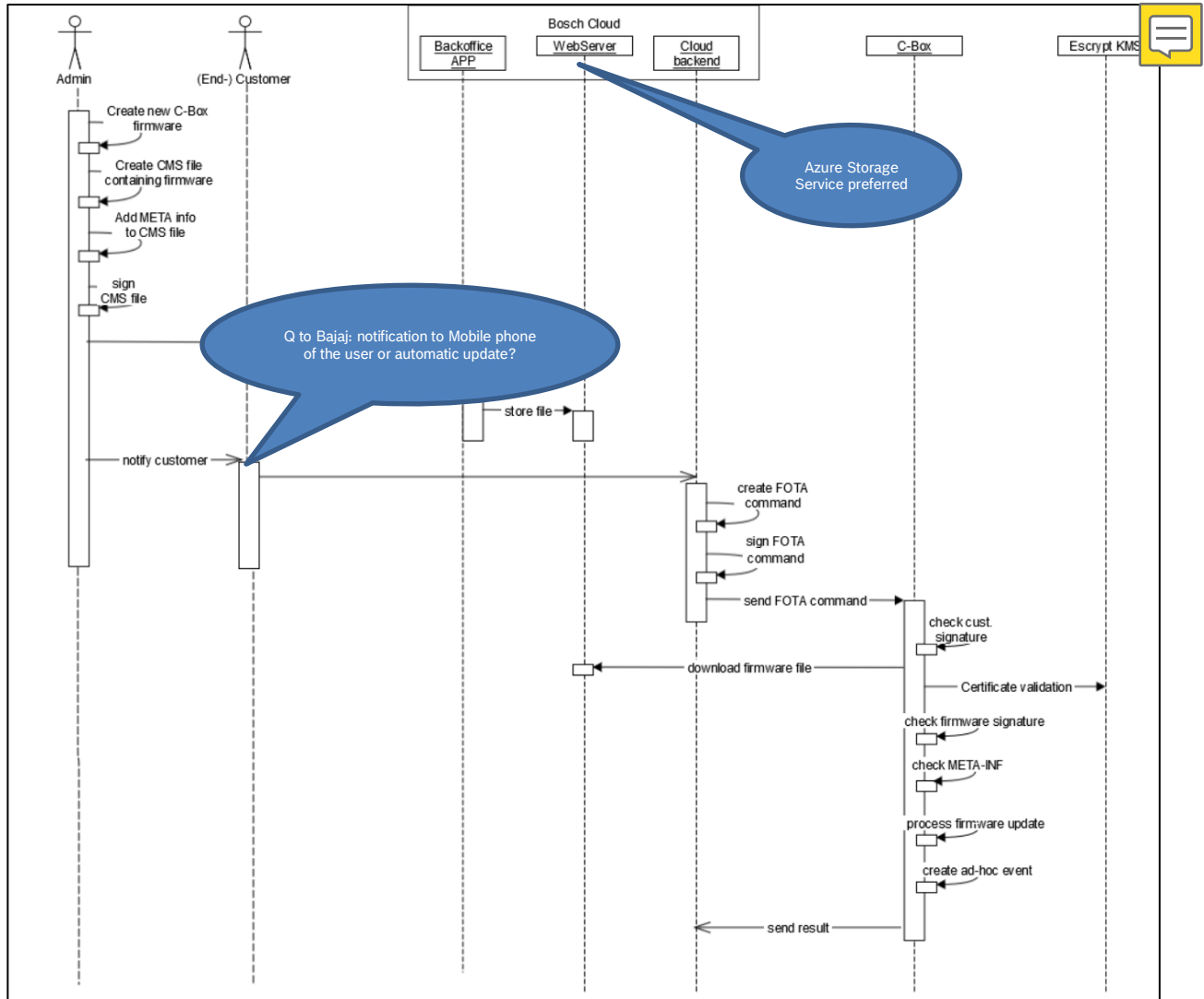
- When eScooter is locked, the event will be sent every 10 minutes.
- When eScooter is unlocked, the event will be sent every minute.

#### Status Queue

- Scooter State Cycling event



### 3.2 FOTA (Cloud to C-Box)

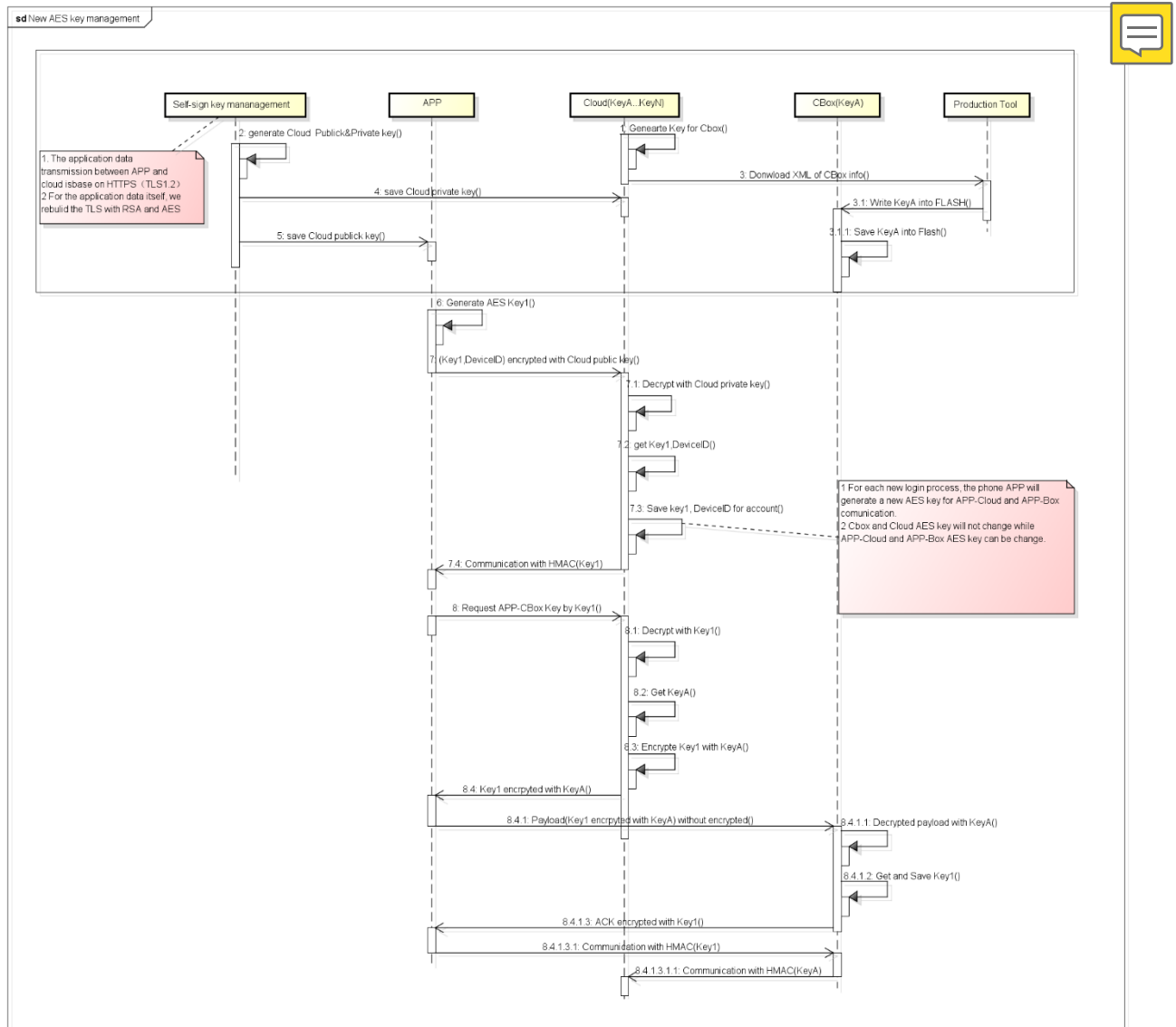


**Figure 5: FOTA process**



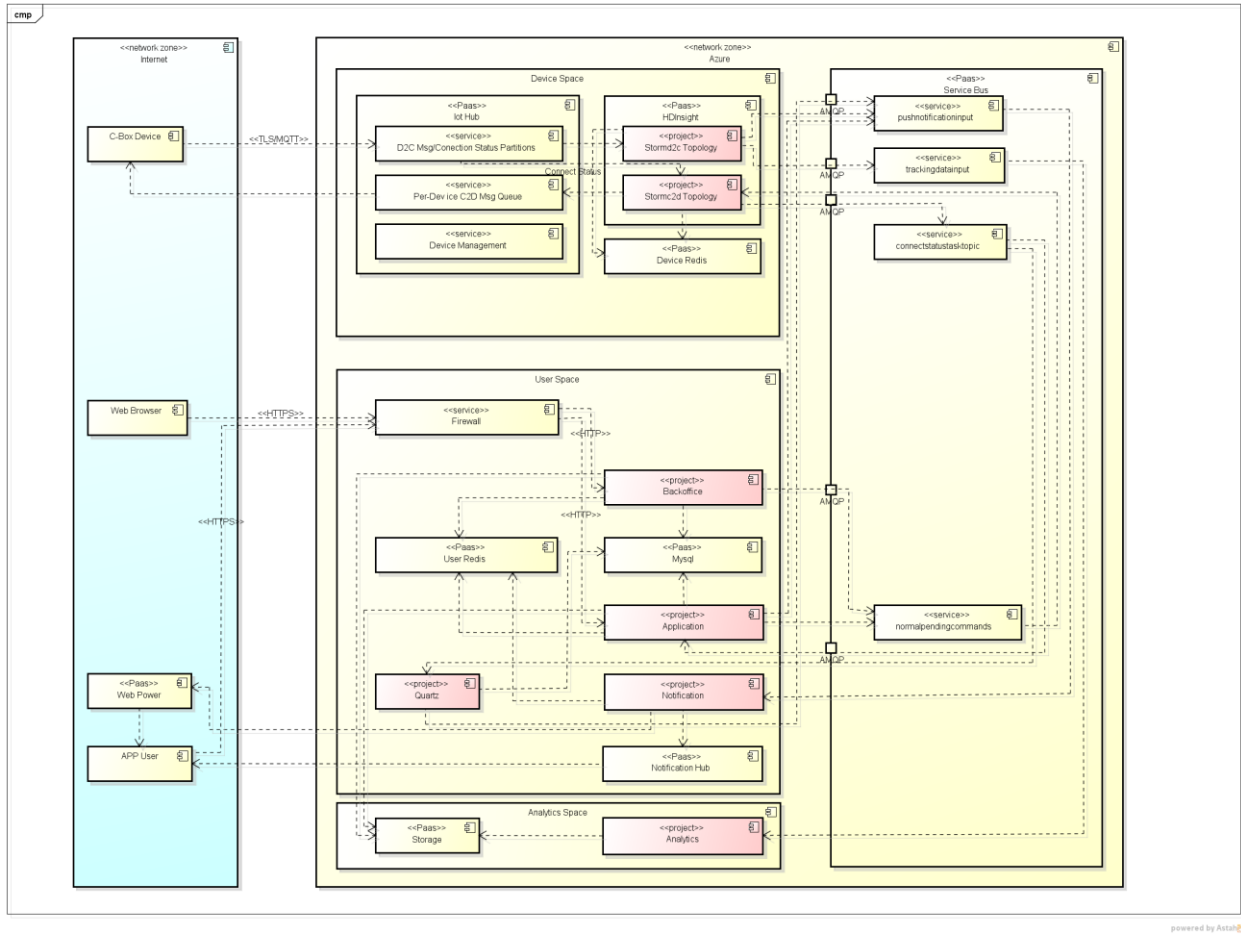


### 3.3 Cloud <-> Mobile APP



**Figure 6: Communication between Cloud and Mobile APP**

## 4 Physical View



**Figure 7: AED eScooter Bajaj Deployment Diagram**

The deployment of the system is shown in Figure 7. It contains the following components:

Zone	Description
<b>Internet</b>	Public Internet
<b>Device</b>	Handles all relevant communication to the C-Box
<b>User</b>	The backend for all user specific requests
<b>Analytics</b>	Space for future data analytics
<b>Service Bus</b>	Broker between User space and Device space

The deployment in Figure 7 contains the following interfaces:

#	Interface name	Description	Reference
1	<b>HTTPS/REST</b>	REST communication interface of the AED eScooter Bajaj services to access the backend system	
2	<b>TLS/MQTT</b>	Secure communication of C-Box with the cloud backend	
3	<b>AMQP</b>	Binary communication for queueing between Service Bus, Device Space and User space	