Project acronym: **IoTrust**

Project title: Secure trust bootstrapping and peer-to-peer network connections in

the Internet of Things

Third Party: **XXX**

[Insert LOGO of the Third Party]

Deliverable D1

IoTrust Architecture Design

|  |  |
| --- | --- |
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| **Dissemination level:** | Public / confidential |

Abstract: Please provide a brief description

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Nb: The deliverable structure below is only provided for guidance and you may adapt in a free form manner the structure to fit your needs.

# Introduction

The deliverable **D.1 IoTtrust Architecture Design** fulfils the objective **O1** which aims to design a human-centric and open IoTrust solution to increase the use trust and application of secure IoT networks in worldwide sectors like smart cities, industry 4.0 etc. The deliverable D.1 is the output of the task **T.1 IoTrust Architecture Design**. The task T.1 was completed in the duration of month M1 to M6. The DW was the leader of the task. The milestone **MS2 Enhanced final version of IoTrust architecture** was achieved by D.1. The milestone MS2 is the advanced version of the MS1.

# Activities carried out to complete the deliverable

The user-centric requirement analysis was performed in the task T.1 to deliver deliverable D.1. It was an iterative process in which requirements of end users and other stockholders such as internet developers were taken in to consideration in designing the IoTrust architecture.

The task T.1 was performed based on Agile SCRUM methodology. Each SCRUM sprint cycle was of 2 weeks. At the start of each sprint cycle requirements were gathered from end users and patterners. These requirements were analysed and an IoTrust architecture draft was designed and developed based on them. At the end of the cycle, this draft was verified and validated against the requirements. This process was performed iteratively throughout the lifecycle of the task T.1.

In a project like this where a final product is shaped according to the end user and external stakeholders' requirements, some unforeseen issues might arise in the areas such as requirement gathering, changing and unclear requirements, functional requirements verification and validation criterion etc. These problems were identified and solved using the iterative SCRUM cycle before they could occur and hinder the project. The requirement gathering and analysis were continuous process like the designing the architecture.

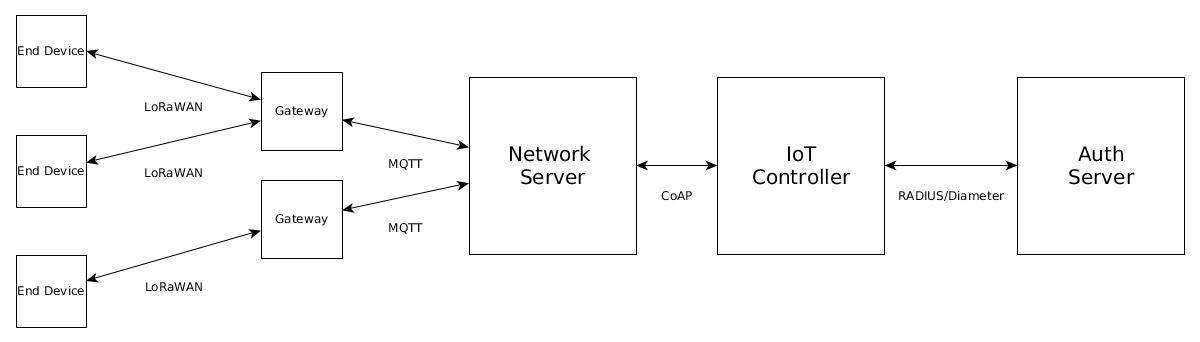
There were some unforeseen technical issues also addressed and fixed in the task T.1. The project is going to employ LoRaWAN[[1]](#endnote-30894) protocol to send data packets between a LoRa[[2]](#endnote-4875) node and gateway using radio communication in the 868 MHz ISM band. There are a large number of development boards available with different LoRa modems such as SX1276/77/78/79[[3]](#endnote-32725) from [Semtech](https://www.semtech.com/), RFM95/96/97[[4]](#endnote-15352) from [HopeRF](https://www.hoperf.com/), RN2483[[5]](#endnote-26488) from [Microchip](https://www.microchip.com/) etc. We identified early enough that some libraries used for SX127X chips can send a packet of maximum 51 bytes which is not desirable for this project. It would have been a blocker in the project if we had not identified it at the start of the project.

# Technical description

Describe briefly the key technical characteristics of the deliverable and explain how they are related to the final results expected to be achieved by the project.

You can choose to include or annex relevant documents, mock-up, weblinks, screenshots, etc).

The core aim of the deliverable D.1 was to prepare an advanced IoTtrust architecture design with an iterative process. There are many aspects to the architecture design. We have analysed and prepared it with the details of hardware, software stack, communication protocols, DevOps, user interface, customer experience, API end points etc. This architecture design will serve as a reference for further deliverables. Although the core attributes of the architecture will going be same, there might be some minor changes as we reach to the next milestones. The Figure 1 illustrates the overall IoTrust architecture.



There are the following building blocks of the architecture.

## End Device

It is a small footprint hardware which sits on the edge of an IoT network. It consists of microcontroller, memory, input/output peripherals, communication protocol etc. These end devices are put in to work for a specialized task. They are more suitable than the conventional computing devices for small, repetitive tasks because of their small footprint and lower power consumption.

In the IoTrust architecture, an end device will be used to collect, format and send sensor data to a server. It is paramount to authenticate an end device before it connects to the server using a critical network. Because if the end device is compromised than it opens the flood gate to the critical network infrastructure. The authentication, authorization and key management tasks will be performed by a secure bootstrapping protocol, peer to peer and distributed ledger technologies.

The MC27561-LION[[6]](#endnote-24224) [[7]](#endnote-9966) development board will be employed as an end device for the IoTrust project. It is designed and developed by [Arrow](https://www.arrow.com/). It is packed with Atmel D21 microcontroller, Microchip RN2483 LoRa module, Telit Jupiter SE868-A GPS module, Microchip RN4871 BLE module, Atmel AT24C256C 32Kx8 Bits EEProm and Atmel ATECC508A crypto authentication chip. An end device will use LoRaWAN protocol for communication. It will send LoRa packets using radio channels.

## Gateway

A gateway is an intermediatory between an end device and cloud server. Basically, a gateway is a multi-channel high performance transceiver module which can receive, process and send several LoRa packets simultaneously using different spreading factors on various channels. An end device will send data using LoRaWAN protocol. The LoRa packets will be received by all gateways in its proximity. It is often called LoRa gateway. It can handle LoRa packets from thousands of devices in the range of 1 to 10 kms.

The Wirnet iStation[[8]](#endnote-2095) [[9]](#endnote-25484) [[10]](#endnote-13832) will be utilized as a gateway. It is designed and developed by [Kerlink](https://www.kerlink.com/). It comes with 4G connectivity module with 3G/2G fallback and Ethernet module with RJ45 port. It also houses fully integrated internal LoRa antenna with peak gain of 2.6dBi, and ARM Cortex A9 microprocessor. The gateways and end devices both will operate in the EU868 ISM band

## Network Server

## IoT Controller

lskdjflds

## Authentication Server

Lkdsjflkdjskf

# Conclusions and next steps

Outline any conclusions on the results achieved and any lessons learned for the next stage of the project.

Describe briefly the next steps in the project development and how you will build on this deliverable to complete the work.

Appendix

* E.g. mock-ups, screenshots
* References
* Etc.

1. https://lora-alliance.org/sites/default/files/2018-05/2015\_-\_lorawan\_specification\_1r0\_611\_1.pdf [↑](#endnote-ref-30894)
2. https://web.archive.org/web/20190718200516/https://www.semtech.com/uploads/documents/an1200.22.pdf [↑](#endnote-ref-4875)
3. https://semtech.my.salesforce.com/sfc/p/#E0000000JelG/a/2R0000001Rbr/6EfVZUorrpoKFfvaF\_Fkpgp5kzjiNyiAbqcpqh9qSjE [↑](#endnote-ref-32725)
4. https://www.hoperf.com/modules/lora/RFM95.html [↑](#endnote-ref-15352)
5. http://ww1.microchip.com/downloads/en/devicedoc/50002346c.pdf [↑](#endnote-ref-26488)
6. <https://static6.arrow.com/aropdfconversion/5ff647cd30f423703234cbf85de7f2e794f2b199/smarteverythingasmelionuserguide.pdf> [↑](#endnote-ref-24224)
7. https://lorawan-hackathon.readthedocs.io/en/latest/lion.html [↑](#endnote-ref-9966)
8. https://lora-alliance.org/sites/default/files/showcase-documents/Commercial\_leaflet\_Wirnet\_iStation\_2019-1.pdf [↑](#endnote-ref-2095)
9. https://www.kerlink.com/product/wirnet-istation/ [↑](#endnote-ref-25484)
10. https://www.thethingsnetwork.org/docs/gateways/kerlink/istation/ [↑](#endnote-ref-13832)