

Security and Trust in IoT Data Streams using Tangle Distributed Ledger and Node-RED Technology

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Aim

- ▶ Our main goal is to construct a **secure data transactions platform**, which is able to transfer power-systems data and IoT-devices signal, at the end of this research project by using **Tangle distributed ledger** and **Node-RED** technology.
- ▶ By providing a concept in combining these two innovative ideas, we also hope to **set an feasible example** for other researchers to follow in the future.

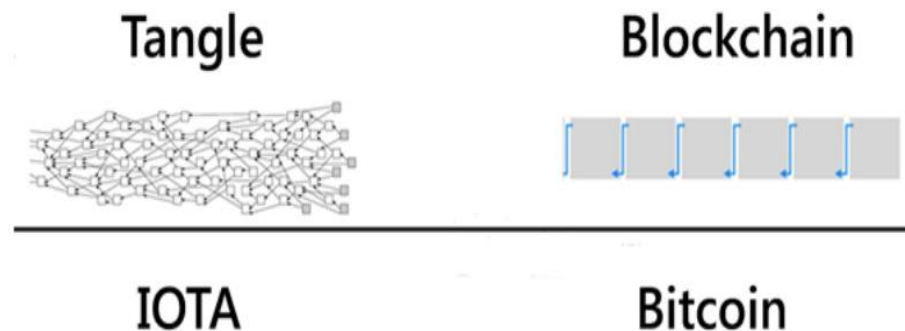
Outline

- ▶ Introduction Tangle distributed ledger technology.
- ▶ Tangle vs. Blockchain.
- ▶ Introduction of Node-RED technology.
- ▶ Project Environment.
- ▶ Development Process - From IOTA Tangle to Node-RED.
- ▶ Project Result.
- ▶ Contributions & Conclusion.

Introduction of Tangle distributed ledger technology

- ▶ **Who** : David Sønstebø, Sergey Ivancheglo, Dominik Schiener, and Dr. Serguei Popov
- ▶ **When** : 2015
- ▶ **What** : **IOTA Tangle distributed ledger** is a revolutionary data transaction structure **specially designed** for solving the low computational resource problem that faces by **most of the IoT-based equipment**.

Figure 1 : Data transaction structure of Tangle and Blockchain (IOTA Support, 2020)



Introduction of Tangle distributed ledger technology

- ▶ **Applications** : Tangle distributed ledger technology can be used in not only transfer **cryptocurrency**, but also in **healthcare**, **automotive**, and **smart city development** (Silvano & Marcelino, 2020).
- ▶ **Advantages** :
 - ▶ **Transaction** within Tangle **does not require a transmitting fee**.
 - ▶ **Every transaction node** will be **validated by two previous transaction nodes**.
 - ▶ **Multiple transactions** are **allowed** at the same time.

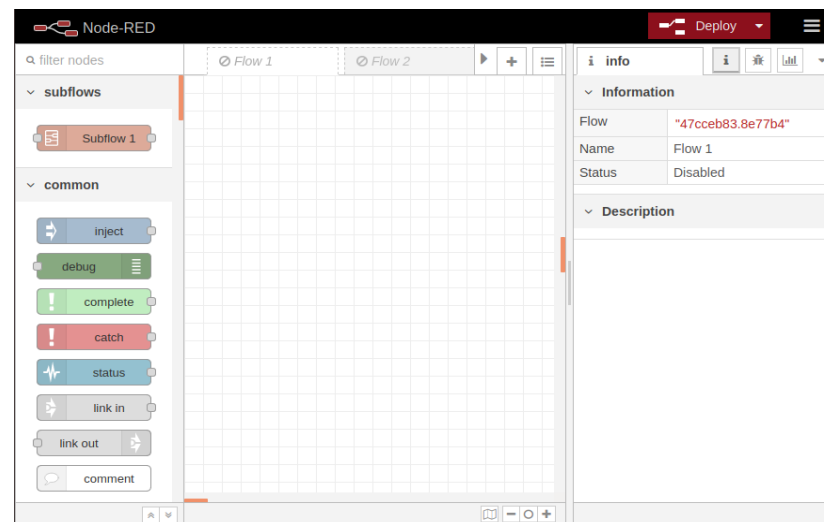
Tangle vs. Blockchain

	Tangle	Blockchain
Relationship between users	Equal WIN	Competitive
Validation time	Shorter WIN	Longer (redundancy copy)
Transaction fee	No WIN	Yes

Introduction of Node-RED technology

- ▶ **Who** : IBM's Emerging Technology Services team
- ▶ **When** : 2013
- ▶ **What** : **Node-RED** is a **flow-based programming tool** and it has a **web-based interface** that can easily transfer physical devices structure into a visualized workflow.

Figure 2 : The user interface of Node-RED



Introduction of Node-RED technology

► Applications :

- Lekic & Gardasevic (2018) used Node-RED to **transfer Raspberry Pi data to Cloud server**.
- Blackstock & Lea (2014) used Node-RED as a platform to **solve the connection problem in Web of Thing (WoT)**.
- Rajalakshmi & Shahnasser (2017) combined Node-RED with **Amazon Alexa** to create a **Human-Computer Interaction (HCI) application**.

► Advantages :

- User-friendly interface.
- Support multiple programming languages and customized functions.

Project Environment

- ▶ **Virtual Machine Environment** : Linux Ubuntu 18.04
- ▶ **Programming Language** : Python



ubuntu



pythonTM

Development Process - Private Tangle Network

- ▶ **Why using a Private Tangle Network ?**
 - ▶ For users to experience and understand this technology.
 - ▶ To allow the transmission faster.
 - ▶ Good for developers in testing applications.
 - ▶ Will not affect the real-world business transactions.

Development Process - Installation

► Install Docker

- A set of lightweight Platform as a Service (PaaS) that uses OS-level virtualization to deliver software in packages.

► Install Git

- A distributed version control software, can be used to clone resources from websites.

► Initiate by terminal

- Start up the Private Tangle Network.

Development Process - Testing

- ▶ Install IOTA wallet
 - ▶ It has **built in digital currency** that can be used **for testing**.
- ▶ Test your Private Tangle Network
 - ▶ Using open-source **Python** code to **test the Private Tangle Network**.

Development Process - Node-RED

► Install Node-RED

- Different OS requires different installation method.

► Install IOTA function

- Install IOTA function into Node-RED panel.

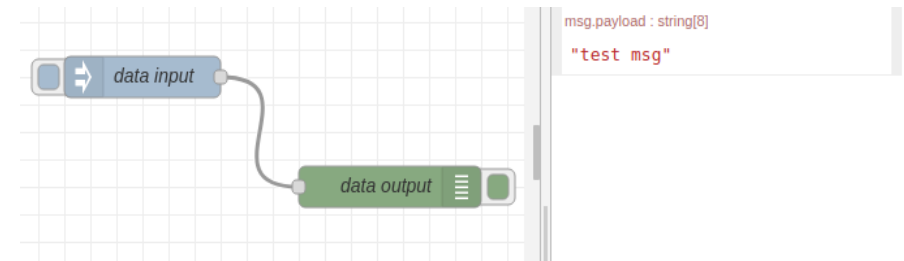


Figure 3 : Input and output node in Node-RED

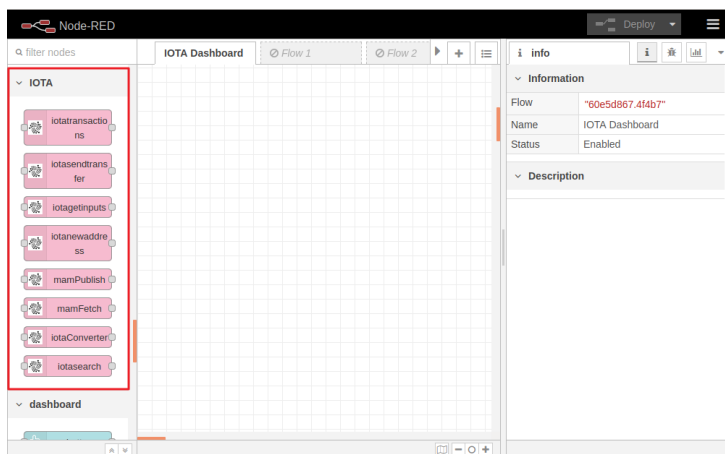


Figure 4 : Install IOTA related nodes onto Node-RED panel.

Development Process - Workflows

► First workflow

- Simulating traditional signal transaction.

► Second workflow

- Transmitting signal through Private Tangle Network.

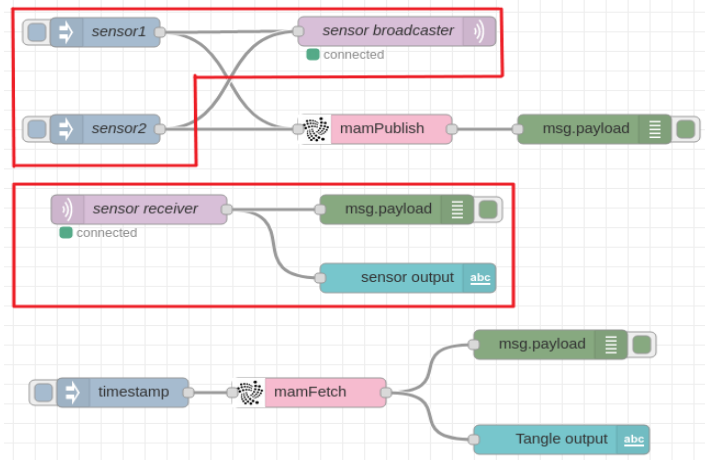


Figure 5 : First workflow.

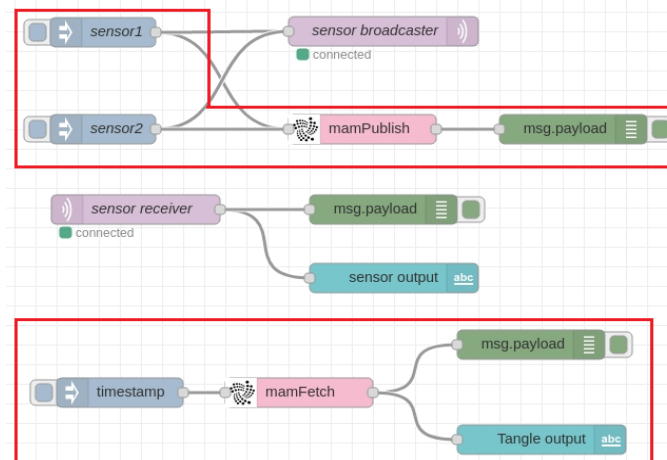


Figure 6 : Second workflow

Project Result

- ▶ **Permanent record**
 - ▶ Auto-record every transaction on the IOTA cloud for further inquire.
- ▶ **A secure data transaction platform**

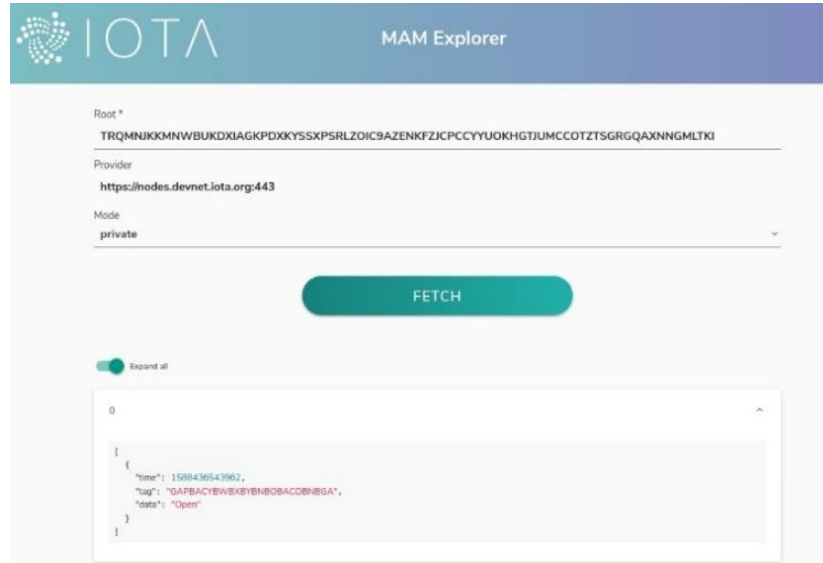


Figure 7 : Transaction inquiry on IOTA cloud.

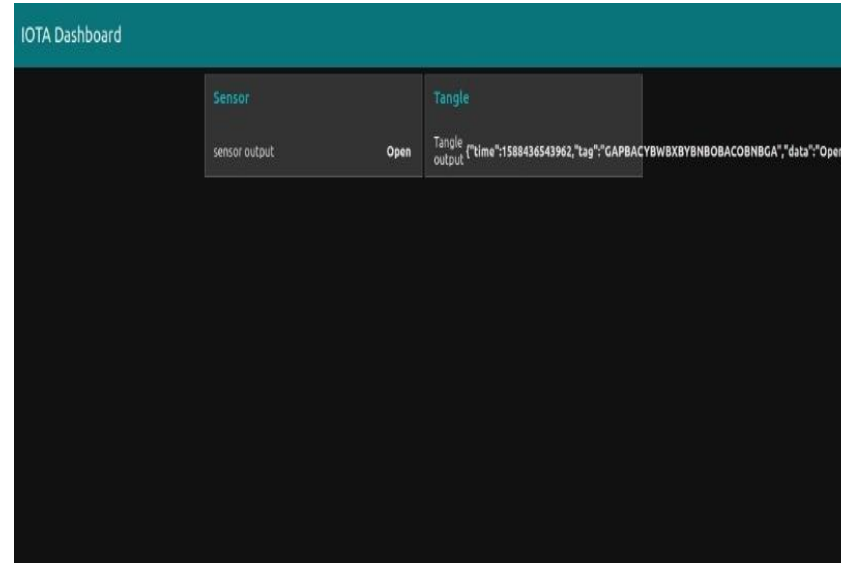


Figure 8 : Demonstration of a secure data transaction platform

Contributions & Conclusion

- ▶ Make the **data transactions more secure** in power systems and low-resource IoT devices.
- ▶ **Reduce time costing** and **human interference factors** between data transactions.
- ▶ Set up a **feasible example** for future research and development.

References

- ▶ IOTA Support. (2020). An introduction to IOTA. Available at: <https://iotasupport.com/whatisiota.shtml> (Access: 1 August 2020)
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- ▶ Rajalakshmi, A., & Shahnasser, H. (2017). 'Internet of Things using Node-Red and alexa', 17th International Symposium on Communications and Information Technologies (ISCIT), pp. 1-4. doi: 10.1109/ISCIT.2017.8261194

The background features abstract, overlapping green geometric shapes, primarily triangles and polygons, in various shades of green, creating a modern and dynamic visual effect. The shapes are layered, with some appearing more prominent than others, and they extend towards the corners of the frame.

Q & A

The background features abstract, overlapping geometric shapes in various shades of green, ranging from light lime to dark forest green. These shapes are primarily located on the left and right sides of the frame, leaving a large white central area.

Thank you !