



# MODELLING SECURE COMMUNICATIONS FOR IOT ENABLED SMART WASTE MANAGEMENT SYSTEM

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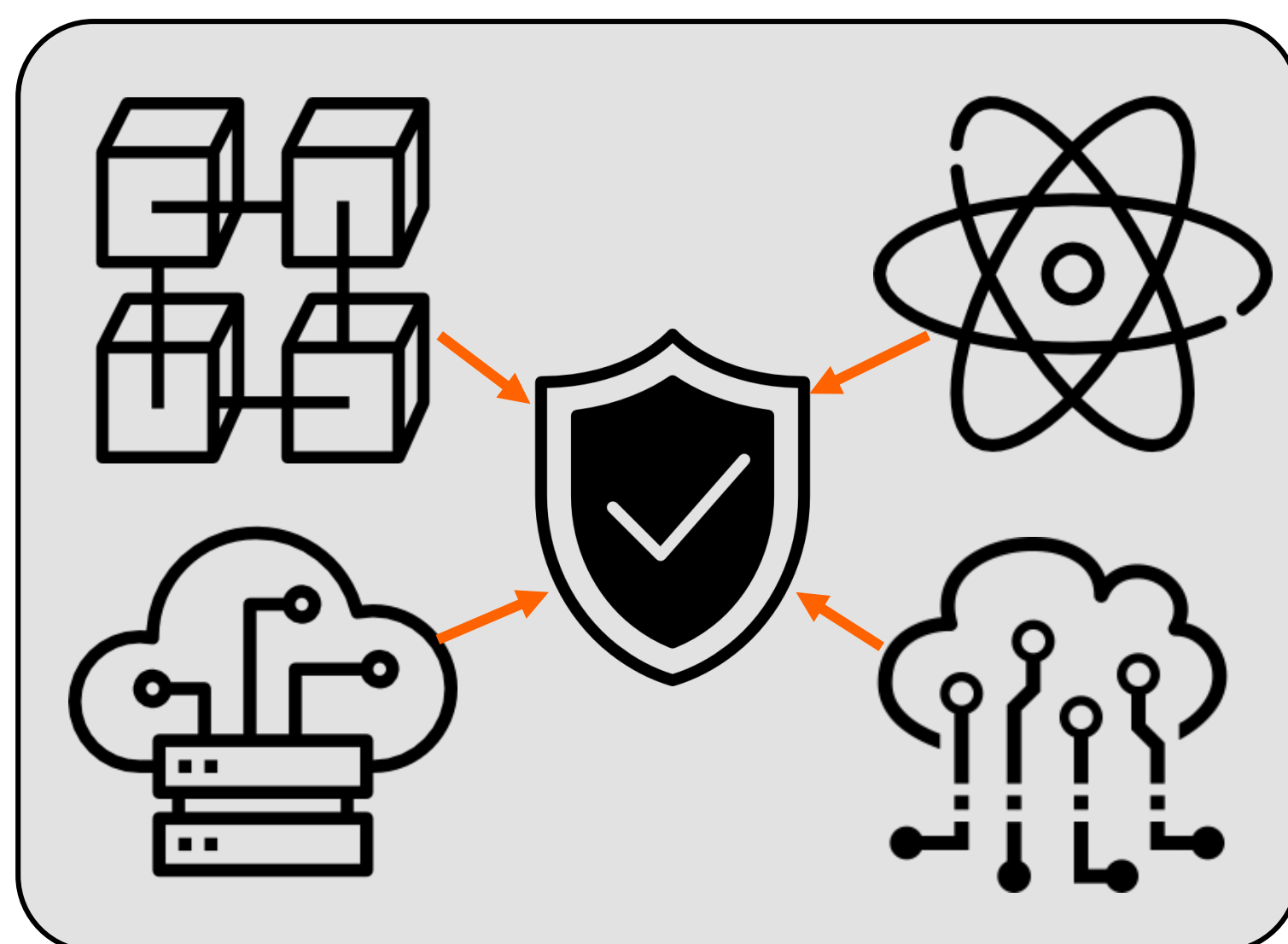
## BACKGROUND & MOTIVATION

Saint Petersburg is home to more than **5 million residents** and thus it generates a large amount of waste that needs to be handled. For this purpose, around **500 garbage trucks** are employed on a daily basis.

As part of the EU funded bloTope project, the city is transitioning to be a Smart City, and in my thesis project, in collaboration with ITMO University, I am looking at how various technologies, such as **IoT, Quantum Technology, Blockchain and Software Define Networking**, can be exploited to make the Waste Management process smarter and more robust and secure.

## RESEARCH QUESTIONS

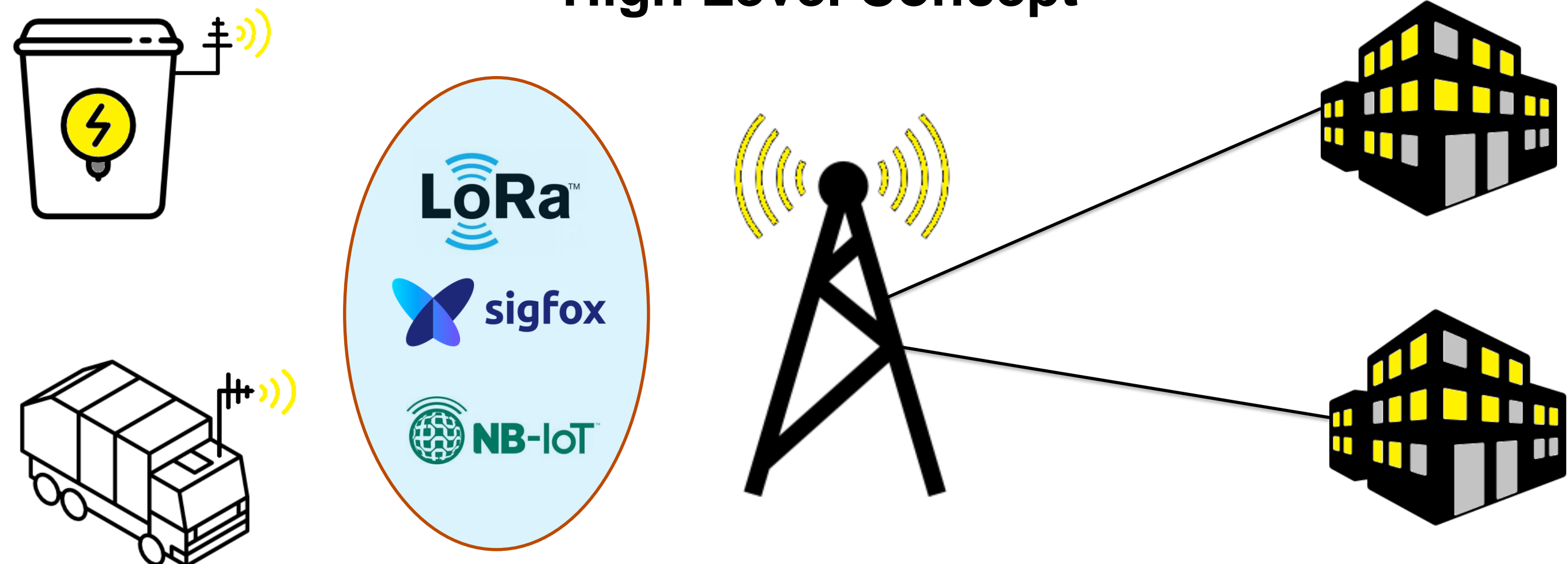
1. How can these technologies be **combined** to improve security and robustness?
2. Is there a way to **unify** the security of IoT?



## INTERNET OF THINGS

**IoT** is considered to be a basic building block of any smart city project. In the **waste management context**, IoT refers to battery operated sensors and mobile communications units embedded in waste bins and garbage trucks. The main use for the data collection is to make smarter decisions when scheduling the route for garbage trucks. Various technologies and protocols are available and my aim is to study them in detail from various aspects, with **security** and **sustainability** being the most important ones. The goal, with regards to IoT, is to come up with a way in which communications can be **secured** in a **unified** way, to make waste management more resilient and robust.

### High Level Concept



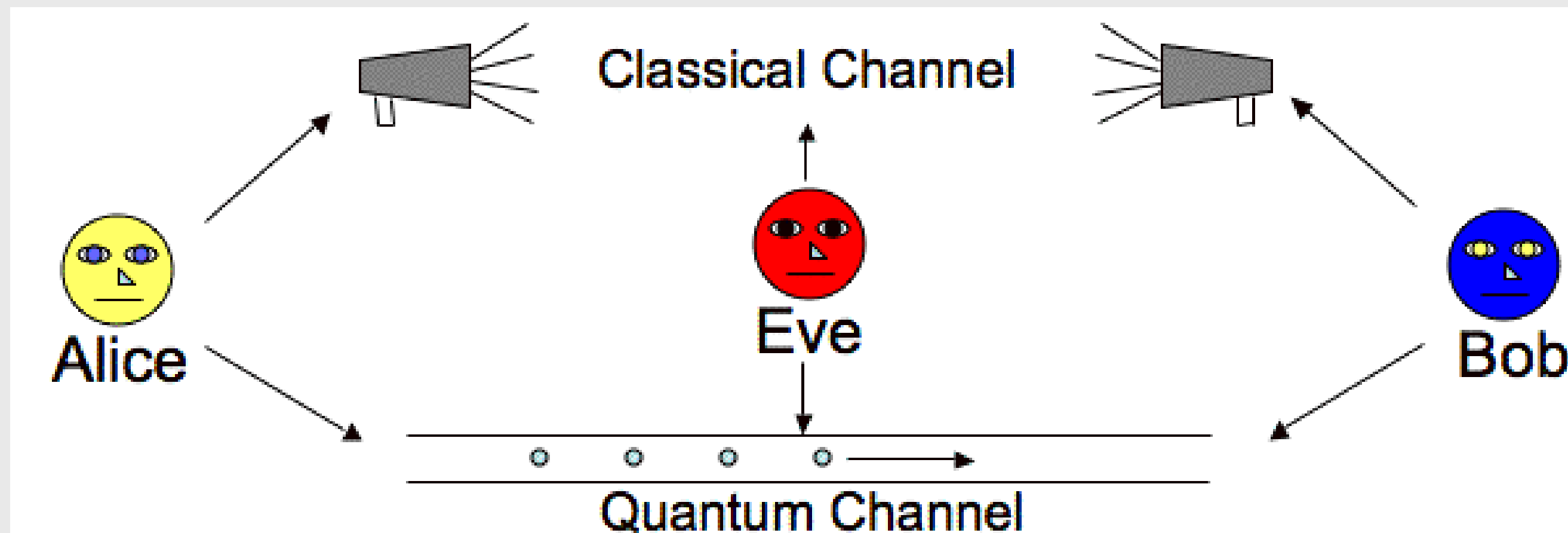
## BLOCKCHAIN TECHNOLOGY

Blockchain technology has enjoyed rapid adoption in many areas, largely thanks to the success of various cryptocurrency projects. It may serve **various purposes** besides the currency use-case, and my project aims to explore possible ways in which an immutable and decentralized/shared ledger can be useful for distributing encryption keys for a secure waste management system.

## SOFTWARE DEFINED NETWORKING

SDN can make the IT infrastructure more **programmable**, by decoupling the control and data planes. Various use-cases have been proposed in literature, ranging from synchronising configuration to **controlling Quantum Key Distribution** systems.

## QUANTUM TECHNOLOGY



By exploiting the laws of quantum mechanics, various solutions have been developed in recent years that can be used to generate **shared symmetric encryption keys** between two parties, that are **provably secure against eavesdropping**. Utilizing this technology for generating keys and storing them in a pool for distribution could offer increased security for the communication infrastructure of the waste management scenario. Within this project I seek to investigate how QKD technology may be integrated with waste management.

## CONCLUSION & NEXT STEPS

St. Petersburg is striving to become a Smart City, and waste management was selected to be an area for improvement by use of IoT and the other mentioned technologies. As soon as such an important service in the city gets connected and becomes more intelligent, various information **security threats arise**. Such a system thus needs to be properly **secured and hardened** against threats and attacks. As part of my thesis project I will study these technologies and work to develop a model for securing the information and communication flows

## MAIN REFERENCES

- Aguado et al., "Secure NFV Orchestration Over an SDN-Controlled Optical Network With Time-Shared Quantum Key Distribution Resources";  
Mosca, Stebila, and Ustaoglu, "Quantum Key Distribution in the Classical Authenticated Key Exchange Framework";  
Aguado et al., "Hybrid Conventional and Quantum Security for Software Defined and Virtualized Networks";  
Lei et al., "Blockchain-Based Dynamic Key Management for Heterogeneous Intelligent Transportation Systems."  
Sharma et al., "DistBlockNet";

FULL REFERENCES

