Politecnico di Torino
Dipartimento di Automatica e Informatica

PhD in Computer and Control Engineering
XXXVI cycle

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Blockchain and IoT applications for supply chain and transportation

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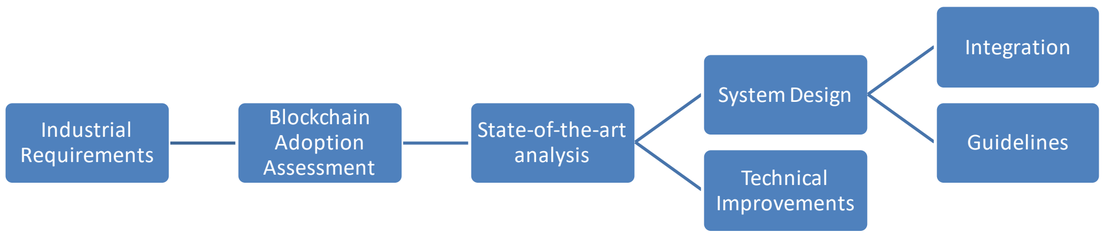
1. Introduction / Context

Supply chains lack correct, timely, accessible, authentic, verifiable, and standardized information.

Blockchain is a shared database that may solve many of the above problems. However, blockchain introduces additional challenges, including false myths, the disruption of centralized paradigms, efficiency, garbage in/out problems due to oracles, privacy and GDPR compliance, and assessing the legal value of smart contracts.

2. Goal / Objectives

This research focuses on providing insights for building successful blockchain solutions. To which extent is blockchain a viable alternative? Which blockchain should be used? How to streamline the development of blockchain solutions for supply chain networks? How to migrate to decentralized paradigms?



3. Method

We cooperate with many industrial partners to understand the needs and the objectives of the industry. We analyze existing technologies from multiple perspectives (technical, managerial, and legal). We build small-scale prototypes. We propose guidelines to underline the blockchain adoption barriers, benefits, and best practices [1].

4. Results

We made contributions on technical and managerial topics.

- The blockchain adoption decision framework: a flowchart that allows to decide if blockchain is a viable alternative. The flowchart can be used by non-technical managers.
- A methodology to level the differences among permissioned blockchain frameworks to make meaningful performance comparisons.
- A list of guidelines for smart contracts [1]. Our guidelines consider managerial, technical, and legal issues. Moreover, our guidelines are framework independent.
- A way to secure smart contracts through N-versioning programming.

5. Conclusions

Blockchain is an interesting technology but presents many subtleties that may go unnoticed. Blockchain is not meant to replace existing systems but to coexist with them. Currently, non-technical issues are the more pressing ones, as they might halt blockchain adoption.

6. References

1. Capocasale, V. and Perboli, G. (2022). Standardizing smart contracts. IEEE Access, 10, 91203–91212. doi:10.1109/ACCESS.2022.3202550.
2. Capocasale, V., Gotta, D., Musso, S., & Perboli, G. (2021). A Blockchain, 5G and IoT-based transaction management system for Smart Logistics: an Hyperledger framework. *COMPSAC 2021.*
3. Perboli, G., Capocasale, V., & Gotta, D. (2020). Blockchain-based transaction management in Smart Logistics: A Sawtooth framework. *COMPSAC 2020.*