# Abstract

Distributed Ledger Technologies like blockchain has emerged as a promising area of research in academia and business. Its tamper resistant nature combined with other properties such as immutability, transparency and byzantine fault tolerance make it particularly interesting for applications in Finance, Internet of Things, Supply Chain Management, and Cloud Storage.

In this thesis, I first introduce the basics of blockchain and its related terminologies. Then, I highlight some of challenges faced by this promising new technology along with some potential solutions to those problems. After which, some choice examples of blockchain applications are presented. Next, I focus on the Ethereum blockchain, IPFS and Raiden Network and explore their potential in building powerful new decentralized applications or dApps.

As part of this thesis, a novel decentralized Supply Chain Management System was designed, implemented and tested. The design was realized using the Ethereum blockchain and was evaluated under various scenarios designed to simulate real world application and usage. This design has several key advantages over traditional systems. It is not only secure against distributed denial of service attacks but is also trustless, autonomous, transparent and censorship resistant.

# Introduction

\textit{“Blockchain is a continuously growing list of records, called blocks, which are linked and secured using cryptography. Each block contains typically a hash pointer as a link to a previous block, a timestamp and transaction data”} \cite{wiki:001}. It can serve as a distributed ledger that can record transactions without a central server or trusted third party. The transactions are available to all parties and are easily verifiable. It is inherently resistant to data tampering as altering data in any one block breaks the chain and requires that all subsequent blocks be calculated again using the new data. Technical details of blockchains are discussed in chapter [\ref{Blockchain}], however for a high level overview please refer to figure [1]. Blockchain has the power to revolutionize how business is conducted in digital age. Some are calling it the most important innovation since the development of the internet and the world wide web. The proponents of this technology believe that it will fundamentally transform the web itself. Internet of tomorrow will be powered by decentralized applications or Dapps. The first blockchain was invented by a person or group of persons known only by the pseudonym Satoshi Nakamoto. Bitcoin is a form of peer-to-peer electronic cash designed to transfer value between two parties without involving banks or other financial institutions. It was the first to solve the double spend problem in digital currency. Bitcoin paved the way for exponential growth in crypto currency market which together with other alt coins is worth over 120 billion dollars. The underlying technology which powers Bitcoin, Ethereum and other crypto currencies can be used for much more than just transferring X amount of crypto from Person A to Person B. Researchers are employing blockchain technologies to increase efficiency and reduce costs in industries such as Supply Chain Management, Internet of things, Banking and Finance.

The proponents of this technology claim that it is just beginning to show it usefulness. They claim that it will revolutionize our world and disrupt existing setups and processes. It is said that its impact will be similar if not more than that of the world wide web on our lives. Only this time it will not only impact everyday people and businesses but completely change the web itself as well. The move towards decentralized applications or Dapps and web 3.0 has already started. (search Dapps and web3.0 to better describe this line)