



Learning module 1: Peer-to-peer database design

Description

The possibility of having open, shared databases with certified and publicly verifiable data can lead to the involvement and empowerment of citizens in many areas.

Learning Module 1 provides an in-depth discussion of architectural design issues of data management. The challenges faced in designing a distributed and decentralized database are presented and analyzed in detail, by introducing the basic principles of database design and the mechanisms underlying peer-to-peer communication networks. Difficulties encountered in developing a reliable peer-to-peer database and potential solutions to such problems provided by blockchain technologies are presented.

Participants will understand how a database can be shared and synchronized between different nodes and why it is not easy to alter its structure afterwards. They will thus be able to determine when it is appropriate to use a distributed database. They will understand why a distributed database is reliable and how this technology can make transactions and data sharing within supply chains more secure. They will be able to recognize that in some cases it is worth creating a new ad-hoc blockchain, while in others it is better to use an existing blockchain to ensure the integrity of the data exchanged with their suppliers.

Dependencies

This module has no prerequisite.

Learning Objectives

- To explain what a database is and the basics of how it works.
- To introduce the basic concepts of peer-to-peer (P2P) communication technology and its advantages over the traditional paradigm.
- To explain the methods used to create a database in a P2P environment (*i.e.* the blockchain).
- To discuss criticalities, limits and drawbacks of using blockchain technology instead of a centralized database.
- To present use cases in which the use of blockchain technology is beneficial.

Learning Outcomes

- **Understand** the basics of database design.
- **Understand** the basic working mechanisms of peer-to-peer communication networks.
- **Understand** why blockchain technology has been developed as a solution to problems faced in designing a peer-to-peer distributed database.
- **Explain** in which cases peer-to-peer databases may or may not be useful.
- **Understand** why data integrity is not a guarantee of accuracy of information when the human factor is involved.



Syllabus

1. Explanation of what a database is and how it works
 - 1.1. Database principles, how a database works today
 - 1.2. Where databases perform better and why a new technology is needed
2. What peer-to-peer is and how it differs from the traditional communication paradigm
 - 2.1. Better performance on data distribution and data decentralization
 - 2.2. No point of failure
3. How to create a reliable database in a P2P network, the blockchain
 - 3.1. How block of information is linked together
 - 3.2. Why the chain data integrity is almost guaranteed
4. Criticality and limits of blockchain technology, use cases in which it is appropriate or not
 - 4.1. Why it is useful only when the information has to be exchanged between several subjects
 - 4.2. Best scenario: multiple actors with lack of complete trust
5. Successful practical cases and possible future implementations
 - 5.1. Quality and supply chain control
 - 5.2. More transparency in the private healthcare system