Learning module 7: Blockchain-based Decentralized Applications

Description

Decentralized applications differ from centralized alternatives, as they enhance a peer-to-peer network of participants. The need for transacting parties to communicate without the essentiality of a central authority is a common topic of discussion and evaluation among technology enthusiasts. Such Decentralized Applications (dApps) can disrupt various industries, which were presented to the audience as use-cases *e.g.* examples in finance, academia, supply chain, energy sector and others.

Learning Module 7 analyses dApps in all their aspects and is addressed to both technical and non-technical audiences, always keeping the topic challenging. The main aim of the module is to enable participants to evaluate which industries are ready to adopt Blockchain technology and to which extent. Decentralization and disintermediation are novel concepts and difficult to fully grasp. There are plenty of components that need to be taken into consideration such as the degree of security, privacy and interoperability. Each DLT network varies to the extent of satisfying these components. It is of ultimate importance for the content creators to evaluate the best practices and potential shortcomings of this technology. The basic structure and main design patterns of dApps are presented as an introduction to the basics of dApps development. Use cases for advanced dApps in various sectors a presented together with their relation to other disruptive technologies within the framework of the 4th Industrial revolution.

Dependencies

This learning module has the following prerequisites:

- Introduction to the DLT world (LM0)
- Smart Contracts (LM5)

Learning Objectives

- To comparatively present the conditions under which traditional centralized models and dApps can be used.
- To associate the key characteristics of dApps with the fundamental properties of blockchains.
- To explain the meaning of functional and non-functional requirements within the context of dApps.
- To comparatively present different blockchains as candidates for dApps development.
- To illustrate how the information flows at the architectural level of dApps.
- To present the technological stack of dApps.
- To present a number of indicative use cases built around dApps.
- To explain the possible synergies of dApps with other emerging technologies.
- To discuss the possible legal implications of dApps.

Learning Outcomes

- **Assess** whether a dApp is required as opposed to the traditional centralized model.
- **Analyze** the key characteristics of dApps with the fundamental properties of blockchains.
- **Identify** and **analyze** the functional and non-functional requirements of dApps.

- **Assess** the suitability of different blockchains for dApps.
- **Design** information flow architectures for dApps.
- **Identify** and analyze the main technological layers of dApps.
- **Examine** how dApps are being utilized in specific use cases.
- **Relate** dApps with other emerging technologies.
- **Identify** any requirements that may raise legal issues.

Syllabus

1. High-level anatomy of dApp
   1.1. Overview of the blockchain application stack
   1.2. Backend examples
   1.3. Frontend examples
2. dApp design patterns
   2.1. Patterns on Interacting with the External World
   2.2. Data Management Patterns
   2.3. Security Patterns
   2.4. Contract Structural Patterns
3. Basic dApps development
   3.1. Programming of public blockchains
   3.2. Programming of private/permissioned blockchains
   3.3. dApps lifecycle
4. Use cases of advanced dApps
   4.1. Decentralized exchange markets
   4.2. Decentralized data markets
   4.3. Blockchain-verifiable certificates and self-sovereign identities
   4.4. Emerging topics in the broader framework of dApps
5. Moving from dApps to the 4th industrial revolution
   5.1. The relation between IoT, AI and blockchain technologies