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Advances in Blockchain technology

Newsletter editor: Nikita Karandikar
(nikita.r.karandikar@uis.no)

Applications to Renewable energy transactions

Renewable energy, especially solar energy is gaining traction as microgeneration capabilities continue to mushroom in domestic contexts. Solar energy introduces a degree of uncertainty as production is not in the producers control, but depends upon the weather. At times, the prosumer may have surplus energy they cannot use, other times, the prosumer may have a shortfall. This mismatch can be addressed through trading energy or through energy storage. Stored energy can then be used for other applications such as demand response and peak shaving for grid stability. Blockchain, especially permissioned blockchain finds easy applicability here as it can onboard several micro producers of energy, authenticate them in order to reduce the potential for malicious activity and create a decentralized marketplace offering the prosumers agency in addition to a monetary value.

Several works aim to formalize this concept and to propose different frameworks and solutions for this use case. For instance, RenewLedger [1] is a blockchain-based framework for renewable energy transaction, storage management and direct-to-consumer demand response incentivization and gamification for peak shaving. It is designed and implemented using Hyperledger Fabric and has performance benchmarking experiments conducted using Hyperledger Caliper. The architecture is shown in Figure 1 in the right panel. Another work [2] presents a power transaction asynchronous settlement system for microgrid. The Figure 2 in the right panel shows a schematic of the proposed system. Extensive surveys [3], [4], [5],[6] on the state of the art in the domain also present more avenues for the application of blockchain to Renewable Energy .

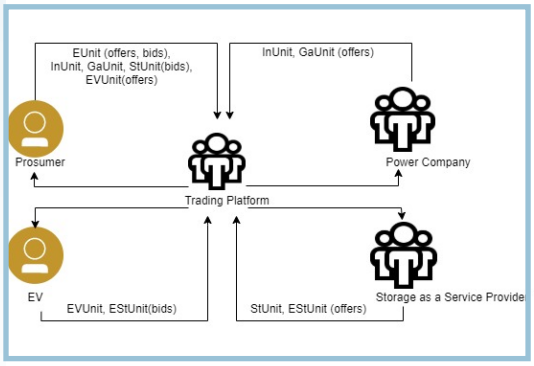

Figure 1: RenewLedger Architecture [1]

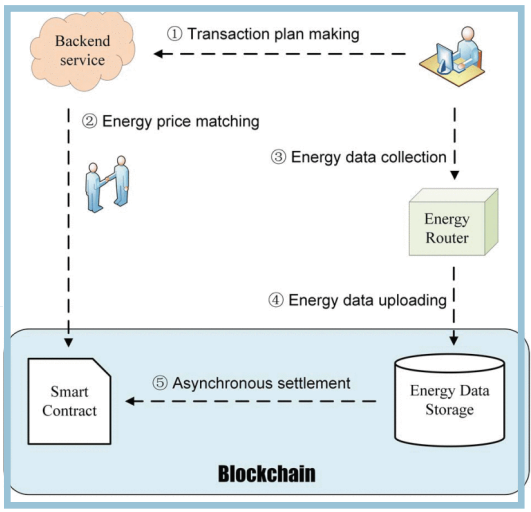

Figure 2: Schematic of settlement system[2]

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Security and Privacy

One of the major draws of implementing a blockchain based solution is the security and privacy it can offer. Token for controlled computation (TOTEM) [7] is a framework that integrates blockchain with big data systems. TOTEM framework allows computational code to be sent to the data silos to conduct data analysis instead of moving the data, as is conventionally done. In this way TOTEM addresses the reluctance of data owners to provide data due to security and privacy concerns. A TOTEM value acts as a gatekeeper for malicious code and permits a code to run for only as long as its TOTEM value allows. A further work [8] by the same authors demonstrate the customized computational part of the framework The Figure 3 in the right panel shows the architecture of the TOTEM framework. Another work [9] presents a detailed analysis and some future research directions for the integration of differential privacy in blockchain. A survey [10] on the security of blockchain systems conducts an extensive examination of security risks in popular blockchain platforms.

The authors in [11] present outline a system to be developed for quality critical management of decentralized resources with trust based on blockchain. The Figure 4 on the right panel presents the Conceptual diagram of DAppOps: a blockchain-based Decentralised resource management, DevOps and trustworthy Cloud ecosystem.

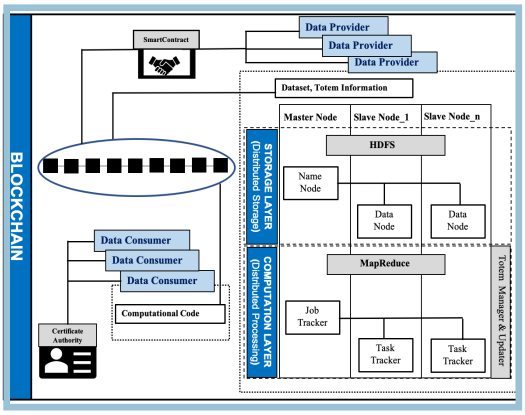

Figure 3: TOTEM Architecture[7]

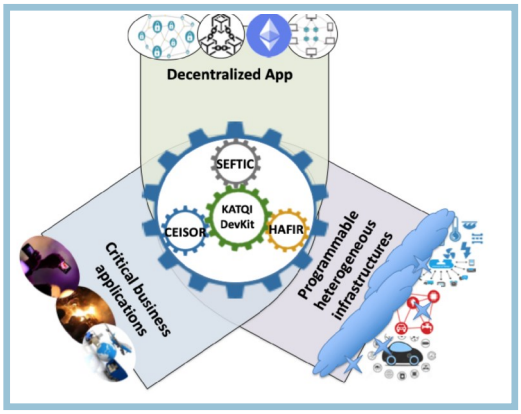

Figure 4: Conceptual diagram of DAppOps [11]

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