Storing and Attesting Conceptual Models on Blockchains

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Abstract: The IT-based storage and distribution of conceptual models is necessary for sharing the knowledge contained in them between different parties. This may include for example enterprise models that document the strategies, business processes or IT architectures of a company, software models that give insights into the software architecture of applications and services, or arbitrary types of domain-specific models for specific purposes. In this contribution we review approaches for using blockchain technologies in this context. This encompasses on the one hand the storage of models using purpose-built blockchains and on the other hand the so-called attestation of models using existing blockchain platforms. In addition, we discuss potential future research directions in this area.

Keywords: Conceptual Model; Blockchain; Smart Contract; Storage; Attestation

1 Motivation

Conceptual models constitute today an important tool for business and information systems engineering [Sa18]. Applications include business process and data modeling, simulation and analysis, as well as enterprise and IT architecture management. Thereby, the storage and distribution of models play an important role in persisting and transferring the contained knowledge. In part, this aspect has been investigated in model versioning, where model serialization determines the suitability of versioning requirements, e.g. for model merging [ASW09]. Recently, the benefits blockchains can offer in this context have been researched. These technologies store information in a decentralized, distributed, immutable, and transparent way [FM20], which permits to make the versioning of models transparent and trace any changes to their originators via their public keys.

2 Model Storage using Purpose-Built Blockchains

Today's commonly used public blockchain platforms such as Bitcoin or Ethereum are not designed to store large amounts of data. If one wishes to store the content of conceptual models entirely on a blockchain, purpose-built blockchains are necessary. This has been for example demonstrated in the approach of Knowledge Blockchains, where the content of conceptual models is stored on a blockchain together with detailed change permissions [FH18]. In

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the course of a mining process, the permissions are checked decentrally against proposed changes. The advantage of this approach is the transparent storage of model information in a fully decentralized way.

3 Attestation Using Existing Blockchain Platforms

Another direction is the attestation of conceptual models using blockchains. Thereby, only a hash value summarizing the content of a model is stored on a blockchain such that the existence of the model is immutably documented. Due to the limited size, data can be stored on existing platforms inside a smart contract, as it has been demonstrated for the Ethereum platform in a first implementation of such an approach [HF19]. The models involved are distributed either by point-to-point transfer to specific parties or by distributed storage in a network. E.g., models of course certificates might be sent to students and third-party employers, while supply chain process models are shared by multiple companies. Attestation with distributed storage is particularly relevant in any case where models are shared and changed by multiple parties with partially opposing interests, such that control must not lie solely in the hands of a single model owner. To achieve this, distributed storage is content addressable, e.g. in IPFS [BD19]. I.e., a hash value in a smart contract is sufficient to retrieve a model that is stored by network participants, resulting in immutability and availability.

4 Future Research Directions

The storage of models on blockchains is still in its infancy. Further research regarding the scalability of such approaches is necessary. This also applies to attestation approaches where real-world use cases need to be investigated to further develop this direction.

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