

Incentive and Playful Strategy for a Participative Model of Learning and Experimenting Blockchain

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Abstract— In this paper, we are interested in the scalability of simulator models of new technologies, such as the blockchain, which present many technical and consensual constraints and challenges. Thus our proposal focuses on an important feature of meta-models of such simulators, namely the management of the incentive to participate in the proposal to make them evolve continuously. This is done through the election of a king based on his significant contributions to the evolution of the model. The introduction of an evolution can be an optimization of the model's performance or the integration of a recent advance in technology. To better illustrate our proposal, we do an implementation of a blockchain simulator with a perspective of optimizing its upgradability and trying to move towards a single simulation platform based on our model that aggregates the learning and experiment of the blockchain while managing the low and high level details.

Keywords— Blockchain, simulator, learning, modelling, scalability, technology watch.

I. INTRODUCTION

The blockchain is a fairly recent and disruptive technology that has become a buzzword interesting to various professions and profiles such as learners, designers, researchers and business. Indeed, it arouses a lot of interest thanks to the multiple possibilities it offers through, for example, the way of managing the elimination of the trusted third party, the consensus, the distributed trust, the double spending, etc. However, its challenges, such as those related to the trade-offs between scalability and decentralisation, need to be addressed [1],[2]. Moreover, it is for this reason that there are a large number of configurations that software developers have to undertake on the blockchains in terms of their architectural characteristics in close relation to the design decisions [3]. Thus, the following four tracks of learning, contribution from a business model aspect, modelling and designing solutions to face the challenges of the blockchain are attractive subjects.

We consider simulation as a modelling technique which consists in reproducing the dynamic behaviour of a system on a computer in order to know it better, to better control its evolution over time in a given environment and to evaluate its performances [4]. In addition, it can build an environment that is close to reality, in order to reinforce the feeling of immersion in the environment and to obtain almost realistic training effects [5]. The use of blockchain simulation for

design decision support [6], prediction [2], learning [7], and assessment [8] is a tendency. To avoid the multiplicity of disparate models, a metamodel is needed to standardise such models [9]. The metamodel presented by the latter [9] advocates the extensibility of events and their source.

Thus we propose the use of blockchain simulation for learning and experimenting by identifying the need to encourage the optimisation and extension of models in terms of integration of recent advances or performance. After proposing a strategy for solving such problems, we will set up a simulator that takes this characteristic into account for the purposes of learning, modelling, implementation, testing and evaluation of the blockchain. The simulator is mainly aimed at learners, business people, researchers and designers.

In section II we present the literature review before continuing with the methodological approach in section III and the presentation of the results obtained in section IV.

II. LITERATURE REVIEW

The use of simulation in the blockchain oriented to these four areas is of great interest justified by the number of studies and research carried out there. Indeed, studies [6] have addressed the designers' needs for performance evaluations of a blockchain. However, the addition of other technologies and consensus mechanisms are in prospect in this study. Others such as [7] have contributed to the learning of blockchain concepts but in a very summary way because the advantages, impacts and challenges of a blockchain protocol are not integrated. The author Goswami [10] has made a contribution on the scalability of transactions and their determining factors. In the paper [2], The authors show the feasibility of using architectural performance modelling and simulation tools to predict latency. Faria C. et al. [8] present Blocksims: a simulator for the implementation of a blockchain and the evaluation of its performance, which the study [11] has improved in efficiency by introducing the Merkle tree feature. Foytik et al. [12] studied platform testing and evaluation. They proposed a discrete event simulator to implement consensus and network layers in which simulation time steps are considered system events rather than regular time steps to facilitate faster computation. Although the experimental aspect is more discussed, we note a trend towards the use of simulation for learning and experimenting

blockchain. In order to standardise this sphere of use of simulation in the field of blockchain, the study [9] identifies the need to set up a meta-model validated by the community and presents responsible event strategies. In its proposal, the possible extension of strategies and events by a model is included. However, it does not address the issues of technological watch of the models. And yet, the need for technology watch is likely to be frequent. Indeed, the blockchain is subject to continuous advances to meet its challenges [10]. The concern is the same for the questions of optimisation of the model in terms of performance.

So we asked the following question: **how can we manage and carry out technology watch and optimisation in the simulation models of a technology such as the blockchain characterised by these frequent advancements?** The answer to this question allows us to apply it in the setting up of a unique simulation platform for learning and experimenting the blockchain. The second question we asked concerns the model for learning and experimenting with blockchain.

In this study, in addition to the open source features and model validated by the community, we add the optimisation incentive aspect to move towards a participatory model with continuous integration of the concepts and recent advances in blockchaining applied in a simulator aggregating learning and experimentation. In the following section we describe the work that led to the proposed model and its application..

III. METHODOLOGICAL APPROACH

The model we obtained is based on two hypotheses verified by scenarios that led us to two proposals.

A. *Characteristics and Strategy for the optimisation and technology watch of a simulation model of a technology subject to advancements: the blockchain case*

We complete the characteristics for a reliable use of simulation models and present a model integrating our proposals. Indeed, in this part we show that for a simulation model, in addition to the characteristics of **open source access** and a **basic meta-model** presenting extensible strategies and events oriented towards the functioning of the models [9], the management characteristic of the model **optimisation** in terms of performance for example and in terms of technological watch is interesting. By the way, we are in a context where many studies facilitating the use of blockchain simulation have been carried out. For a reliable use of such simulators for scientific validation, [9] identified the need to set up a community-validated meta-model. Thus, he proposes a metamodel that could be applied to set up a simulation model of the blockchain. Their proposal supports possible extensions in the model part. Such work is interesting because it avoids dispersion. However, it is important to integrate the technological watch aspect. We formulate our **hypothesis 1: Integrating a technology watch management strategy is a parameter for moving towards an optimal simulation model for technologies such as the**

blockchain. To bring an answer to this hypothesis, we have conceived the scenario below (scenario1).

Suppose we have three studies E1, E2 and E3 using the same meta-model (e.g. the meta-model of [9]). Two studies C1 and C2 contribute respectively on E1 and E2 on two distinct aspects to optimise them as did [11] which shows that BlockSim [8] can be optimised with the integration of merkle trees. Assume that at a time t, the contributions C1 and C2 are useful for optimising E1, E2 and E3. Let us also admit that each model has integrated the contribution made on it, i.e. E1 and E2 have integrated C1 and C2 respectively.

This would mean that at the moment t the E1, E2 and E3 models would be more optimal if they had integrated C1 and C2. C1 and C2 can be an engineering contribution on the performance of the models or a technology watch contribution. Indeed, the blockchain is a fairly recent technology and its problems can be improved to achieve ideal efficiency [10] for example. Moreover, several new methods have been proposed by both researchers and professional communities to mitigate the challenges of scalability, privacy, security, etc [13]. It would therefore be interesting to allow a technological watch of the models in order to tend as much as possible towards a complete simulator integrating the maximum of knowledge relating to the technology. Thus, our first hypothesis is verified. Open source access to models based on a meta-model validated by the community is important in that it avoids dispersion and has a positive impact on the reliability of the model. However, these characteristics (**open source and reference metamodel**) are **not sufficient** to lead to a model integrating subsequent advances or those that were not taken into account. **Hence it would be interesting to manage the optimisation and technological watch aspect of the models.**

This proposal is materialised by a metamodel integrating these three characteristics and a management model proposal for the third characteristic, which is the incentive for optimisation and technological watch of the models. Such a model could be used for learning and experimenting with the blockchain. So instead of optimising several models targeting one or a few of our identified profiles, the model aggregates the needs of these profiles and is optimised in a single step.

B. *Simulation models for learning and experiment blockchain (LEB)*

In this section we propose a platform for the four target areas and therefore it is for learners, designers, researchers and business. We follow with the formulation of **hypothesis 2: in many participatory models such as those announced by proposal 1 (our previous proposal), aggregating learning oriented and experimentally oriented environments would be an asset for a better synchronisation of advancement and blockchain simulation.** The idea is to combine in one platform the functionalities intended for these four profiles. Indeed, in order not to restrict the contribution to the research level only, it will be necessary to encourage the use of the platform to favour the detection of possible evolutions and its integration.

Indeed, a study such as [7] presents an application that allows users (learners) to enter the elements relating to a blockchain concept themselves via a GUI (graphical user interface). This allows users to have a structural view of the concepts. It also helps a person with a kinesthetic profile to retain concepts better than a simple, well-documented diagram would allow. This gives it a didactic character. However, beyond the structure, the blockchain has processes (that [9] called events) which depend on technological strategies. Indeed, blockchain has many configurations and variants to take into account [3]. The learning elements of such a simulator deserve to be optimised in terms of functionality, which could address problems such as scalability. **Hence it would be important to extend such a study by focusing on the protocol and its impacts.** In addition, based on work done with students in their final year of engineering studies coming from two fields of study, telecommunications and computer science, we were able to see that the 4 profiles are linked. The level of knowledge differs and it is important to upgrade it through learning to better understand the input and output of the experiment. Indeed, the work was done under the supervision of our team's researchers. It was a series of presentations on the blockchain made by and for the students. Most of these students have startups and are working in various fields. They were divided into groups, regardless of their fields of study, and the groups were formed on the basis of the sorted list of the two classes together. Each group was free to choose a topic from those proposed or its own. The common point of all the topics was the blockchain as the underlying technology. Among the fields they have chosen to apply the blockchain we have virtual reality, land, civil status, HR, education, finance, etc. Each group presented their topic and discussed it with their peers, their teacher and the other researchers in the team. Thanks to this approach, the participants in these presentations (student teachers and researchers) played the profiles we are interested in in this study (learner, business, designer researcher). Indeed, the presenters are naturally students and therefore learners. The teacher-researcher, having followed the evolution of the students from before the introductory course to the end of the presentations, was in a position to observe their evolution as learners from the profane stage to the end of the training. By presenting their subject, students play the role of a businessman who is interested in how the blockchain could boost their field, but also the role of a designer who proposes models for the application of the blockchain. The researchers who attended the presentations were able to identify probable research problems. In addition, this work allowed us to see how knowledge for users (learner and business), concerns (for designers) and ideas for contributions for researchers may have evolved during this period. Thus, we support our participatory model by orienting it towards the Learning and Experiment of a disruptive technology such as the blockchain.

These contributions are materialised in results that we present and discuss in the section below.

IV. RESULTS

To remedy our problem with scenario 1, we proposed in this study to look for a strategy to optimize the proposals by integrating the new advances. Since it is not obvious that a very small number of contributors to a model are aware of all the advances made on the other models or even independently of a model, we opt for a social participatory model where anyone can make a contribution. However, in order not to have just anything as proposal, we will need, like the public blockchains, to allow access (open source model), to encourage participation as they do with minors, but also to validate proposals for contributions. Thus we propose as result 1 a meta-model integrating all its characteristics and as result 2 a model for encouraging and validating new contributions.

A. A possible meta-model for the optimisation of a simulation of frequently advancing technology

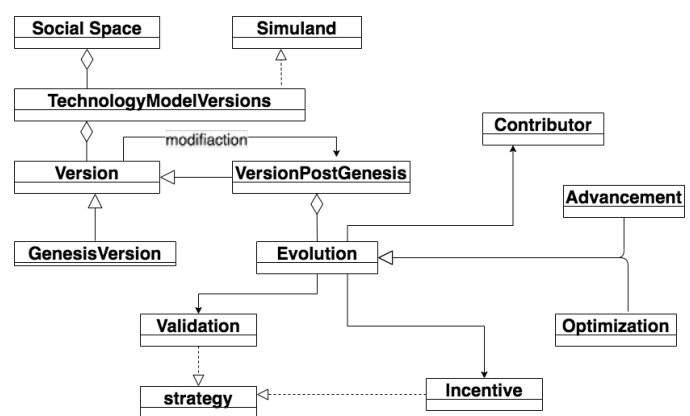


Figure 1. A possible meta-model for the optimisation of a simulation of frequently advancing technology

We propose a meta-model to obtain participatory models of a simulation of a technology subject to advancements such as the blockchain. By analogy with the operating principle of the Nakamoto protocol [14], our meta-model is described below:

- A simuland which can be a meta-model of the technology in question and which is validated by the scientific community as proposed in [9].
- In a social space favouring interactive interventions, we will have the open source models contained in (TechnologyModelVersions). TechnologyModelVersion therefore contains the different versions. The first version is called the genesis version and it must conform to the simuland.
- Other versions can be added to the TechnologyModelVersions of the social space that we call the VersionPostGenesis. A PostGenesisVersion thus contains an evolution modifying an existing version.
- In order to encourage contributors to add developments based on advancements or optimizations of operations, an incentive strategy is needed. In order not to consider

any proposal as an evolution, a validation mechanism is needed.

- The strategy therefore contains the incentive strategy and the validation mechanism (by analogy to mining and the consensus mechanism).

This model therefore takes into account the identified characteristics. Depending on the incentive and validation strategy which is applied, it can motivate various contributor profiles and extend the contributor profiles beyond researchers. In the following section, we propose an incentive strategy based on an analogy with the King of Ether [15].

B. Game of throne: King of Blockchain

This part develops a strategy model for an evolution of the model. We call it king of X where X is the name of the technology in question for example the blockchain. It is made by analogy with the smart contract King of ether [15]. The goal in our case is to elect each time a king who will sit on the throne. The access to the throne is facilitated by the importance of the evolution brought. The challenge for the players is therefore to replace the king. To interest more players, an application model of our metamodel can introduce a jackpot in the image of king of ether, part of which will be pocketed by the chosen one. And for a scientific validation of the contributions by the community and to further encourage researchers, contributors can collaborate to study and submit the idea. In this way, researchers will be able to provide the academic work necessary for the submission of the contributions to the community.

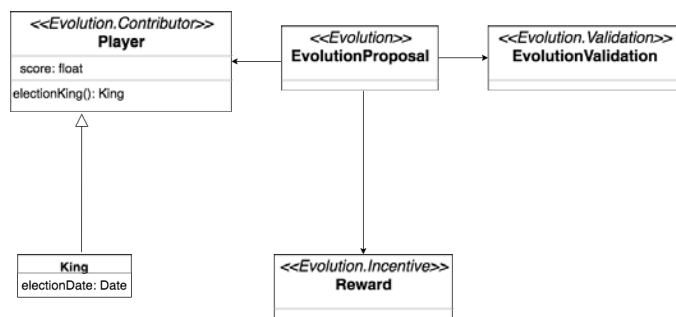


Figure 2. King of Blockchain: a possible strategy incentive

Our model reconciles advancements with the simulation models of a technology. We thus proposed the optimization of the model in terms of performance and technology watch. Nevertheless, we must be interested in the number of reconciliations to be made in the different models. This leads us to our proposal 2, which favors the synchronization between model and advancements by advocating the aggregation of the orientations of the blockchain simulation models. For the simuland we refer to the simuland of [9].

C. Learn and experiment Blockchain

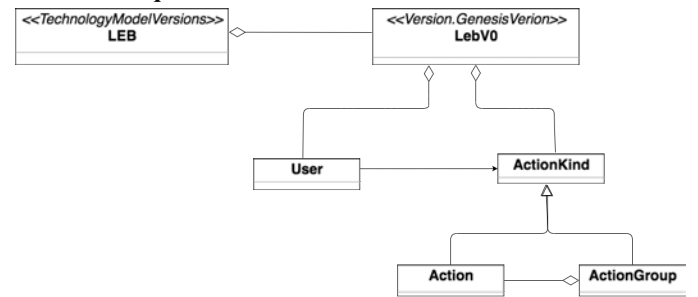


Figure 3. Meta-model Learning and experiment blockchain

In order to remain in the aspect of the single model for the different actions on the simulator, we have abstracted the model at a first level because, as in our preliminary study, the same individual can find himself requesting actions with different profiles. And the next level is presented below.

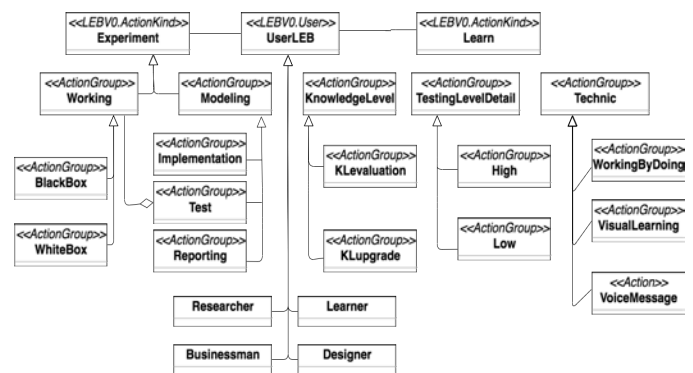


Figure 4. Learn and experiment Blockchain

Learning is intended for both the novice and the learner. It must take into account the different learner profiles: visual, auditory, kinesthetic. A knowledge level database for simulated technology allows the Knowledge Level (KL) to be prioritized and assessed, and knowledge to be upgraded to higher levels. The KL upgrade is based on learning by doing, voice messages and visual learning. If we take the case of study [7], which focuses on learning the blockchain, the knowledge level addressed is low level detail. However, in this study, learning is assimilated to the mastery of concepts, leaving aside the challenges and advantages of the blockchain and the solution is intended more for kinesthetics than for other profiles.

The experiment consists of the simulation of the functioning of the black box and white box technology, a modeling module that allows the implementation of a model. Thus in case of innovation, the contributors will be able to implement their new models. It also allows to model and predict the behaviour of a model. Below, we present a summary of the work in progress.

D. Implementation

Our study is part of a work in progress. It is a unique platform targeting various profiles to do all the learning, testing, evaluation and modelling of a blockchain. At different levels, the platform aims at evaluating and upgrading knowledge on the blockchain, comparing different models to choose the most suitable one. In addition, it is open to the integration of the evolution of the contributions within the framework of the blockchain in order to participate in a synchronization between those interested in the blockchain and the contributions. Currently, the models are being implemented and integrate a feature that completes the study [9]. The implementation of the genesisVersion of our simulator is in progress. For the moment, in relation to the study [7], we have added impact management depending on the protocol (Figure 5 and Figure 6). Indeed, we have started with the low level details of a blockchain. In Figures 5 and 6 we show how the simulator performs the calculations automatically (if the automatic impact generation option is chosen). Thus for the type of a given blockchain, we relate the impacts to the characteristics of the chosen type. The models are at various levels of abstraction and can thus be applied beyond the blockchain. In fact, we present a technology watch strategy for a technology with frequent advances.



Figure 5. Blockchain impact low level detail

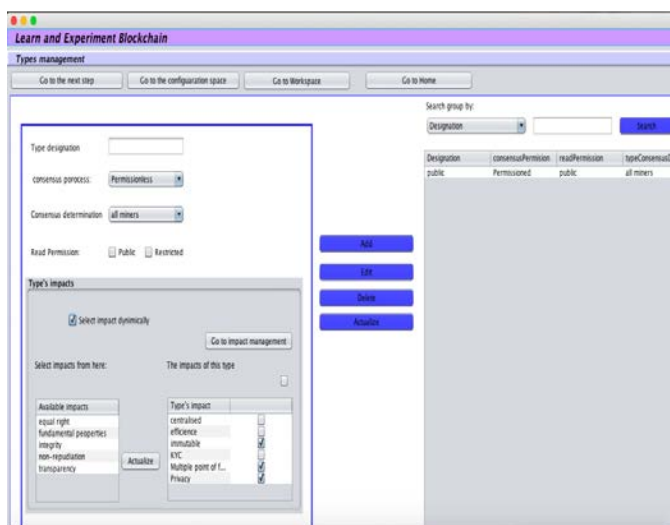


Figure 6. Blockchain type's impact low level detail

V. CONCLUSION

We are in a context where researchers are proposing solutions to classify the impacts of a blockchain protocol [3], simulators [2], [6], [8], [10], [12], [16] and their optimisation [11]. In addition, they advocate a standardisation of simulation models [9] without leaving out proposals for learning the blockchain [7],[17], their improvement and their field of application [18]. However, because of the advances to which the blockchain is subject [13] and the challenges it faces [13], [19], [20], a monitoring strategy that encourages the integration of new proposals or proposals not yet integrated into a model is very important. This is what we manage in this study by proposing a playful incentive strategy made by analogy with the principle of the functioning of the smart contract king of Ether.

We use the model to set up a simulator for Learning and Experiment Blockchain (LEB). LEB is a simulator that is currently being implemented for business people, learners, designers and researchers to test, model, evaluate and visualise a blockchain.

In perspective, future work will be done on the validation part recommended in our optimization incentive strategy, to complete the model evolution incentive technique presented in this paper.

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