

PhD Title : Smart-Contract composition to support Collaborative Information System

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Abstract:

To fit the renewed globalized economic environment, enterprises, and mostly SMEs, have to develop new networked and collaborative strategies, focusing on networked value creation (instead of the classical value chain vision), fitting the blue ocean context for innovative products and service development. Even if collaborative organizations such as virtual enterprises, collaborative networks... have been studied for decades [1], [2], [3], the closer connection of information systems involved by the so-called “Industry 4.0” developed by leading industries in Europe, US and Asia requires to set new IT models to support agile and evolving collaborative Business Process enactment.

By now, these product/service ecosystems are mostly supported by software services, which span multiple organizations and providers, and on multiple cloud-based execution environments. This increases the call for openness, agility, interoperability and trust for both production and Information System organization. These IS requirements can be partly fulfilled by SOA, Web 2.0 and XaaS technologies and Business models (taking advantage of service selection and composition), whereas the development of service-based execution platforms can be worthy adapted to the multi-cloud context. Moreover, the fast development of Blockchain technologies [4] also favor these distributed organization by providing trusted and distributed environment to establish peer to peer contractual relationships [5]. As reviewed in [6], the Blockchain technology provides a convenient support for inter-organization Business process management. More precisely, smart contract technology can be seen as an efficient support for various self-executed contractual clauses to set collaborative Business Process (see [7] for example to see how smart contract can be integrated in a BPMN model). Nevertheless, the lack of flexibility due to the underlying « code is law » paradigm or the way the smart contract can activate parts of each partner information system to launch intra-organizational business processes to perform the requested tasks are still challenging.

Despite of their individual interest, these service and Blockchain technologies lack of integration to support more agile collaborative business process development. While smart contract allow to define easily individual contractual relationships, a basis to set inter-organizational business process, they cannot be easily composed to set multi-tier collaborative organizations. Last but not least, these smart contracts cannot easily be plugged to existing corporate information system to design a consistent collaborative business process integrating each partner own processes so that more efficient interactions can occur between the different Business Process, fitting the information sharing challenge involved by the industry 4.0.

To overcome these limits, this PhD research project aims at (1) modelling a multi-tier architecture to integrate Blockchain smart contract in multi-tenant Collaborative Information Systems, (2) propose models to set multi-parties smart contracts relying on the composition of more elementary smart contracts to support a global and recursive specification of collaborative framework, (3) propose a

set of models to turn collaborative BP description into smart contracts in a model-driven approach and (4) identify how contextual adjustments can be introduced in smart contract to overcome the lack of agility involved by the “code is law” paradigm.

This research work should be organized as follows:

- State of the art on blockchain and smart contract technologies, paying a particular attention to their applications in collaborative business
- State of the art on service-based collaborative information system engineering models
- Proposition of a multi-layer architecture integrating the blockchain components in the collaborative information system organization
- Specification of multi-tier smart contract model
- Identification of a model driven smart contract generation based on collaborative BP specification
- Specification of a smart contract life-cycle management model to support its evolutions to fit evolving context requirements.

Collaborations with on-going and forthcoming projects mixing academic and industrial partnerships are expected.

References:

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Research environment

Research environment

This PhD work will be achieved in the Service Oriented Computing (SOC) research team of the LIRIS Lab.

SOC team researches combine theoretical foundations and implementation works as well as technology transfer to promote the development of strategies 'as a service' induced by the development of Cloud Computing. To this end, we design architectures, models and algorithms to extend the service model, composition and orchestration mechanisms to fit both the classical "control driven" process organization and the new "data driven" vision provided by the web 3.0 vision. These works also address the Internet of Everything, Multi-cloud, blockchain and Internet of Things challenges, paying a particular attention to the deployment constraints. Several Industrial and Collaborative projects focused on these different topics provide a rich collaborative research environment.

Our works are presented via <http://liris.cnrs.fr/equipes?id=62>