PhD Title: Data-driven transaction models

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Abstract:

The wide adoption of SOA, Web 2.0 and XaaS technologies have provided openness, agility, interoperability and trust to Information Systems [1, 2, 3, 4]. Taking advantage of service selection and composition, processes are implemented in a control-driven strategy, invoking the next service or pushing messages to activate the next service implementing a given task. In order to provide secure and robust distributed applications, the integration of transaction processing mechanisms in services allows safe service orchestration. Besides, the adoption of SMACIT, increases the call for distributed and data-driven transactions. This trend is reinforced by the Blockchain development, allowing to set automated data-driven transactions.
Nevertheless, from the early 70s to the more recent Blockchain-based smart contracts and Distributed Application Organizations (DAO), transaction processing is organized in a peer to peer vision [5, 6, 7, 8]. It supports safe execution of distributed processes, logging precisely exchanges to support ACID and immutable properties in a control-driven process organization. Despite their interests, these peer to peer control-driven organizations do not fit service-based organizations relying on Data as a Service composition nor event driven service orchestration as a same event may be originated from different peers and used in different services [9, 10]. Moreover, these control driven P2P transaction models are not designed for ad-hoc or data-driven processes and have restricted roll-back abilities when complex events or multiple transaction dependencies are involved.
To overcome these limits, this PhD project aims at developing a transaction composition framework, orthogonal to the service composition, so that linked data-driven transactions can be set and managed. This involves adapting the ACID properties as well as roll-back processes to this distributed, multi-peers and data driven context where transactions may depend on each other.
To sum up, this PhD research project aims at:

(1) modelling multi-peers distributed transactions,
(2) proposing models to set multi-party transactions relying on P2P transaction composition to support a global and recursive specification of distributed transactions framework,
(3) proposing a set of models to integrate these transactions in a data-driven architecture
(4) identifying how distributed rollback mechanisms can be set.

To fit these challenges, this research work should be organized as follow:

- State of the art on transaction processing and distributed ledgers technologies
- State of the art on service-based transaction engineering models
- Specification of multi-peers transaction model
- Specification of P2P transaction composition
- Specification of a transaction life-cycle management model to support its evolutions to fit evolving context requirements.
- Choosing a support technology to implement a multi-party transaction composition demonstrator.

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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 service computing models as well as 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” and “event driven” visions 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, taking advantage of our more fundamental researches on service computing models.

Our works are presented via https://liris.cnrs.fr/equipe/soc