

Application form mySNF

Instrument **Bridge - Proof of Concept**

Part 1: General Information

Basic data

Project Title Scaling blockchain: optimized partitioning as a service
Project title in English Scaling blockchain: optimized partitioning as a service

Research Field Engineering sciences
Main Discipline 20506 Information Technology
Field of the planned innovation 2018 Block Chain
University Università della Svizzera italiana - USI

Applicant(s)
Main Applicant **Long Hoang Le**

Grant Application

Amount requested (CHF) **Total** **96'200**
Requested starting date **01.09.2020**
Duration (months) **12**

Attachments

Project description ProjectPart_LongHoangLe.pdf
Records of achievement Rec_PhD_Thesis.pdf
Rec_Publication2.pdf
Rec_Publication1.pdf
Rec_Publication3.pdf
CV of applicant CV_LongHoangLe.pdf
Copy diplomas Diploma_BSc.pdf
Diploma_MSc.pdf
Commitment letter host institute Confirmation_USI_LongHoangLe.pdf
CV head of host research group CV_Host_Pedone.pdf
Reference letter ReferenceScience_Le_USI.pdf

1. Responsible applicant

Last name	Le
First name	Long Hoang
Function (title)	
Academic degree	MSc
Date of birth	25.05.1988
Gender	male
Marital status	Married
Swiss social security number	756.8674.1176.75
Language	English
Nationality	Vietnam
Correspondence address of application	Address of workplace

Home address

Address supplement	
Street, No.	Via Trevano 57
P.O. Box	
Postcode / Zipcode	6900
Place	Lugano
Country	Switzerland

Address of institute

Name of Institution 1 (e.g. laboratory) *	Distributed System Group
Continuation 1 (e.g. inst /dept.)	Faculty of Informatics
Continuation 2 (e.g. University)	Università della Svizzera italiana
Street, No.	Via Giuseppe Buffi 13
Address supplement 1 (e.g. building)	
Address supplement 2(e.g. office)	
P.O. Box	
Postcode / Zipcode	6900
Place	Lugano
State, canton, etc.	Ti
Country	Switzerland

Communication

Secretariat line	
Switchboard	
Direct line	
Fax office	
Home telephone number	
Cellphone	+41 77 944 48 82
Website	
E-mail address	lel@usi.ch

2. Designated host lab / Institution

General information

Name of Institution 1 (e.g. laboratory) *	Distributed System Group
Continuation 1 (e.g. inst /dept.)	Faculty of Informatics
Continuation 2 (e.g. University)	Università della Svizzera italiana
Address supplement 1 (e.g. building)	
Address supplement 2(e.g. office)	
Street, No.	Via Giuseppe Buffi 13
P.O. Box	
Postcode / Zipcode	6900
Place	Lugano
State, canton, etc.	Ti
Country	Switzerland
Beginning of the stay	01.12.2020
End of the stay	30.11.2021

Communication

Secretariat line	+41 58 666 40 00
Switchboard	
Website	https://www.inf.usi.ch/
E-mail address	

3. Basic data I (science)

Original title	Scaling blockchain: optimized partitioning as a service
Title in English	Scaling blockchain: optimized partitioning as a service
Requested starting date	01.09.2020
Duration (months)	12
Research field	Engineering sciences
Main discipline	20506 Information Technology

4. Basic data I (innovation)

Field of the planned innovation

2018 Block Chain

Swiss Competence Centers for Energy Research (SCCER)

No SCCER

Action area

5. Basic data II

Summary

Since Bitcoin's initial launch in 2009, blockchain technologies have attracted extensive worldwide attention. The growing adoption of blockchain-based systems have raised many new challenges. Two primary challenges in this context are scalability and interoperability.

Scalability is the ability to achieve a target throughput and latency in the presence of increasing workload without compromising the decentralized nature of blockchains. Scalability could be achieved by state partitioning. In order to be effective, the partitioning must ensure that most requests or transactions access one partition only and are equally distributed among partitions. That way, partitions can work in parallel to improve performance.

Interoperability allows communication and data exchange between multiple different blockchains. Interoperability is gaining more attention in the blockchain community. Some blockchain systems are introducing inter-blockchain communication (IBC) protocols that enable communication and data exchange between multiple blockchains. This technology allows users to choose where to place smart contracts. Moreover, some solutions start to appear that allow smart contracts to move between existing blockchains.

Scalability and interoperability share a similar concern: They both need a mechanism that tracks and provides some information about blockchains. A partitioned blockchain needs an overview of the partitioning of the system to compute an optimized location to place contracts and objects, thereby maintaining the balance of the network and increasing the performance. In inter-blockchains transactions, where data could be shared and exchanged between different blockchains, it is necessary to track the movement of the data, as well as to have some information about the parties, including the cost of transactions and the performance of the network.

This project proposes an oracle service that provides such information. The oracle service consists of two main components, one on-chain and one off-chain. The on-chain smart contracts provide interaction interface for user smart contracts. The off-chain component monitors the blockchains by analyzing transaction history. To process user requests (e.g., for object location, for optimizing transaction costs) the on-chain and off-chain components communicate to extract the necessary information for the request. User transactions pay per-query fees to get the hints from the oracle service. The cost of each query depends on the time and resources that the system has spent for that query. With the information provided by the oracle, the blockchain system can effectively choose a partition to place objects to maximize the balance of the network, thus increasing the transaction speed, as well as optimizing the execution cost of transactions.

Keywords

blockchain

scalability

interoperability

state partitioning

Language of correspondence

German

Financial administration

Università della Svizzera Italiana Servizio Ricerca Signor Milan Savic

6. Diplomas - certificates

Academic qualification

Dr./PhD

University or college / place	Università della Svizzera italiana, Lugano, Switzerland
Date	15.07.2020
Academic qualification	MSc
University or college / place	International University, Ho Chi Minh City, Vietnam
Date	21.08.2014
Academic qualification	BSc / BA
University or college / place	International University, Ho Chi Minh City, Vietnam
Date	12.10.2010

7. Re-submission

8. University or research institution

University	Università della Svizzera italiana - USI
Remarks	The Faculty of Informatics of USI is defined by its educational model and its passion for scientific research. 200 researchers from around the world conduct research in eight different areas, with tens of millions of Swiss francs funding obtained

9. Requested funding

Requested funding	Total (CHF)	Year 1
Total (CHF)	96'200	96'200

Salary of applicant

Salary of applicant	Total (CHF)	Year 1
Total (CHF)	91'200	91'200

Salaries	Total (CHF)	Year 1
The applicants' own salaries	80'000	80'000
Total (CHF)	80'000	80'000
Total (%)	83%	83%

Social security contributions	Total (CHF)	Year 1
Social security contributions	11'200	11'200
Total (CHF)	11'200	11'200
Total (%)	12%	12%

Project

Project	Total (CHF)	Year 1
Total (CHF)	5'000	5'000

Research funds	Total (CHF)	Year 1
General project costs	5'000	5'000
Total (CHF)	5'000	5'000
Total (%)	5%	5%

Details

The applicants' own salaries		Total (CHF)	Year 1
Le, Long Hoang: n.n.		80'000	80'000
Work-time percentage	Year 1: 100.00%		
Social security contributions	Year 1: 14.00%		
Further information	Salary bracket Postdoc		
Total (CHF)		80'000	80'000
Total (%)		83%	83%

General project costs		Total (CHF)	Year 1
Travel costs		5'000	5'000
Relation to research plan / Comments / Additions	Travel and accommodation costs for participating in scientific conferences and dissemination events.		
Total (CHF)		5'000	5'000
Total (%)		5%	5%

Social security contributions		Total (CHF)	Year 1
Le, Long Hoang		11'200	11'200
Total (CHF)		11'200	11'200
Total (%)		12%	12%

10. Collaborations

Institution/person	Fernando Pedone
Country	Switzerland
Context	Fernando Pedone is a full professor at the University of Lugano (USI). He received his Ph.D. degree in computer science from Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland, in 1999. His professional interests include the theory and practice of distributed systems and distributed data management systems. He has been playing the role of supervisor of the main applicant during his Ph.D. Pedone will be supervising and giving background for the research.
Collaboration started	Yes
Types of collaboration	in-depth/constructive exchanges on approaches, methods or results Research Infrastructures

11. Research requiring authorisation or notification

Research on humans	No
Research on human embryonic stem cells	No
Research on animals	No
Research on GMO or pathogens	No

12. Fellowships for a research stay abroad

Confirmation host institution regarding the respect of the legal provisions and ethical guidelines required?

No

13. 3R – Replace, Reduce, Refine

Experiments involving animals have been partially replaced by alternative methods.

No

Experiments involving animals fully replaced by alternative methods.

No

Research field or project is in no way linked to animal systems

No

14. Access and Benefit Sharing (ABS)

Genetic resources used are subject to ABS regulations

No

15. Awareness of the relevant regulations

Relevant regulations noted and accepted

Yes