40th AIM Conference Riga, Latvia, 6-9 September 2018

Sustainable Industrial Development: Towards a Digital Future

Blockchain Technology Trends in Logistics and Supply Chain Management

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RTU DATORZINĀTNES UN INFORMĀCIJAS TEHNOLOGIJAS FAKULTĀTE

Content

- Dept. of Modelling and Simulation in RTU ecosystem
- Blockchain trends in LSCM
- Future development



Established in 1862





The largest and oldest technological university and the leading multidisciplinary research institution in the Baltic States with rich history and clear future vision





RTU: Facts & Figures





equipment, available at RTU

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RTU ensure multi-faculty and interdisciplinary research in the areas of great significance for the national economy and society in close collaboration with other research institutions and industry, both locally and internationally.



Faculty of Computer Science and Information Technology

- Trains IT professionals with higher education for successful industrial and academic career
- Founded in 1961
- Largest ICT faculty in Latvia
- Main tenets:
 - Based on engineering principles
 - Common ICT basis for all students
 - Coverage of wide range of information technology and computer science topics
 - All educational levels from college to doctoral studies



CS&IT Faculty: Study Programmes



RĪGAS TEHNISKĀ UNIVERSITĀTE

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CS&IT Faculty: Research Priorities

- Autonomous robotic systems and distributed artificial intelligence
- Development of intelligent systems with agent and Web technologies
- Use of ICT in education
- Simulation and modelling in different application areas
- Requirements and software engineering
- Analysis and modelling of enterprise business
 processes and business informatics
- Model Driven Application development



IT in telemedicine and processing of medical data





Institute of Information Technology

Research Area:

Hybrid Modelling and Optimization of Complex Systems and Advanced Data Processing Methods

Main research directions:

- Enterprise applications and integration
- IT project management
- Simulation-based sustainable management of complex systems
- Simulation metamodelling and optimization methodologies
- IT service and risk management
- Decision support systems and computational intelligence



The main activities in education and research are in the areas of modelling, simulation and optimization of complex systems, management of integrated information technologies, and computational intelligence development and research. Examples of investigated systems include logistics, transport, manufacturing, financial, medical, IT, service, etc.



Main educational directions:

- Courses in:
 - Modelling and simulation
 - Logistics information systems
 - Information technologies in e-commerce
 - IT governance
 - Decision making and computational intelligence
 - Production planning and control
 - Supply chain management
 - Management synthesis
- Joint Programme "European Master in Logistics and Supply Chain Management"



Joint Programme "European Master in Logistics and Supply Chain Management"

- Developed in cooperation with
 - Autonomous University of Barcelona, Spain
 - Wildau Technical University of Applied Sciences, Germany
 - Montan University in Leoben, Austria
- RTU specialization: Logistics Information Systems
- Organization of studies:
 - 1st semester at UAB
 - 2nd semester at RTU
 - 2nd year specialization at UAB, Wildau TU or RTU
- More information: <u>http://www.master-lscm.eu/</u>



Main research directions:

- Simulation-based metamodelling and hybrid optimization of complex systems
- Simulation-based sustainable management of complex systems
- Methodology and practical application of discreteevent simulation
- Simulation-based supply chain management
- Logistics information technologies and systems
- Decision support systems and computational intelligence



Blockchain in logistics and supply chain management.

Why blockchain?

Every time a product changes hands, the transaction could be documented, creating a permanent history of a product, from manufacture to sale. This dramatically reduces time delays, added costs, and human error that plagues transactions today.

For example, one shipment of refrigerated goods from East Africa to Europe can pass through roughly 30 people and organizations, with more than 200 interactions among them, according to Maersk.



Department of Modelling and Simulation Why blockchain?

Blockchain technology can help ensure provenance, providing traceability across the supply chain. This can thwart counterfeiters and ensure safety. The technology also allows manufacturers, shippers and customers to aggregate data, analyze trends, and perform predictive monitoring.

Technically, a blockchain is a digital, distributed transaction ledger that is stored and maintained on multiple systems belonging to multiple entities sharing identical information. This creates a web that shares the responsibility of storing, maintaining, and validating the information present on the blockchain. Any authorized participant can review entries and users can update information stored on the blockchain only if the network consesus algorithm validates it. Information stored in a blockchain can never be deleted and serves as a verifiable and accurate record of every transaction made within the ledger.



 Problem – How do distributed distrusting stakeholders agree on current system state?

 Solution – If technology can help the stakeholders to reach consensus on history, agreement on current system state can be reached



Why not use centralized databases?

- Single point of compromise/failure
- Too much power vested in one entity
- Challenging to get every entity to agree on the one arbiter to trust



Why not use centralized databases?

- Blockchain eliminates the need for a centralized trusted database
 - Share databases across diverse boundaries of trust
 - Transactions leverage self-contained proofs of validity and authorization
 - Multiple nodes provide validation through consensus
 - Robustness without need for expensive replication and disaster recovery
 - Automatically self-configure and synchronize in peer-topeer fashion



- Decentralized Network
 - Peer-to-Peer Architecture
 - Nodes can join/leave freely
 - No central arbitrator
 - Redundancy and robustness to link failures
- Distributed Consensus
 - Transaction record
 - Distributed public ledger
 - Validation by committee
- Cryptographically Secure
 - Immutable audit trail

RIGAS TEHNISK UNIVERSITĀTE

• Data tampering prevented





Blockchain Development Platforms

- Ethereum
 - Generalized blockchain platform
- Multichain
 - Permissioned blockchain network
- Hyperledger Fabric
 - Open standard for blockchain for business
- Tierion
 - Supports integration of applications within blockchain network
- Guardtime
 - Industrial scale blockchain service with keyless signature infrastructure and secure one way function



Citizen Services – Provisioning Digital Identities

Approximately one-sixth of the world's population cannot participate in political, economic and social life because they lack the most basic information: documented proof of their existence.

Blockchain technology provides a tremendous opportunity to solve this challenge through the development of digital identity systems that are cryptographically secure. Governments and non-

governmental organizations (NGOs)

 Image: Second Second

ID2020 - a global ID system using blockchain; Source: Microsoft/Accenture

can use digital identities to provide a variety of citizen services and eliminate certificate forgery and identity theft.



Retail – Encouraging and Ensuring Ethical, Sustainable Consumption

Everledger is developing a blockchain-based system to provide secured proof of origin and ethical sourcing for high-value goods such as diamonds, wine, and even fine art. It uses blockchain to store a digital record for millions of precious goods.

For diamonds, this system would replace the flawed paper-based certification process currently used by diamond suppliers, intermediaries and buyers. Unlike paper records which may be forged or lost, blockchain records are permanent. Everledger achieves this by creating a digital thumb-print for each individual diamond.



Ethical sourcing of diamonds using blockchain; Source: Altoros/Everledger

This digital thumb-print contains unique identifiers that consist of over 40 metadata points, the Cs (color, clarity, cut, and carat weight) & the certificate number which can be laser inscribed if required. This thumb-print is then made visible and stored with all participants on the blockchain-based system.



Life Sciences and Healthcare

The United States Food and Drug Administration (FDA) is exploring the use of blockchain to share and audit electronic medical records, clinical trial results, and health data. By doing so, difficult-to-access data can be securely managed on one blockchain platform shared among stakeholders, driving transparency as well as unlocking potential new efficiency gains. In October 2017, this work expanded to assist the United States Centers for Disease Control and Prevention (CDC) in testing a blockchain-based platform for health surveillance. This solution aims to enable more efficient management of data during a health crisis. The CDC is expected to move from the prototyping phase to application deployment during 2018.

Source: FDA, June 2018



Life Sciences and Healthcare

MedRec projects was build towards a vision of individual patients controlling their own healthcare data. All of a patient's data from each of their healthcare providers and pharmacies could be stored, and the patient could choose to share (or not share) this data with specific healthcare providers. A prototype system by MIT Media Lab called MedRec is getting close to realizing this vision with a blockchain-based system to keep track of each patient's medication.





Revolutionizing medical records through a single source of truth; **Source:** MIT Media Lab

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Meat traceability

Product status at each stage of production can be recorded using blockchain. The records are permanent and inalterable. They also allow the tracing of each product to its source. Global retailer Walmart uses blockchain to track sales of pork meat in China. Its system lets the company see where each piece of meat comes from, its processing and storage, and sell-by date. In the event of product recall, the company can also see which batches are

			æ			
Supplier	Producer	Distributor	3PL	Retailer	Store	Customer
 Uploads data on anti- bacterial fodder Cow is tagged with RFID chip, proving free range 	 Gets informa- tion on cow and designated beef products, cuts and prepares meat accordingly Adds QR code to packaging 	 Automatically receives notification about receipt of beef products Chooses suiting 3PL based on fully available data on customer, delivery date etc. 	 Is informed about origin and destination of beef products Reviews instructions how to store the products Flexibly optimizes network flows 	 Runs machine learning-based forecasting Adds potential recipes & wine suggestions to the data record Provides app for end- customer 	 Has full transparency on delivery time Adapts orders, promos, etc. accordingly 	 Scans QR code via app Gets insights into beef origin, ageing duration, etc. and suited recipes and wines Earns points in cross-company loyalty program



Coffee supply chain

Bext360 is using blockchain technology to better track all elements of the worldwide coffee trade—from farmer to consumer—and thereby boost supply-chain productivity. After pilots in California, Uganda, and Ethiopia during 2017, it's now live—for at least one producer - Ireland's Moyee Coffee, which provides specialty coffee to offices, independent retailers, and online subscribers, expects to have all its coffee fully blockchain-traceable this year.

Seafood verification

Pacific Tuna project launched: The Blockchain Supply Chain Traceability Project tracks tuna from vessel to market. The effort, focused on the Pacific Islands' tuna industry, is intended to eliminate illegal fishing and human rights abuses. The new initiative, launched in late December by the environmental organization WWF and its partners — including blockchain company Viant — is intended to provide an example of how blockchain can preserve the integrity of the food supply. It provides a step-by-step way to verify the journey from the ocean to the market.



Cold chain monitoring

Food and pharmaceutical products often need special storage. Also, enterprises also see the value in sharing warehouses and distribution centers, instead of each one paying for its own. Sensors on sensitive products can record temperature, humidity, vibration, and other items of interest. These readings can then be stored on blockchain. They are permanent and tamperproof. If a storage condition deviates from what has been agreed, each member of the blockchain will see it. A smart contract can trigger an action to correct the situation. Depending on the size of the deviation, this action may be to simply adjust the storage. However, it could also extend to changing 'use-by' dates, declaring products unfit, or applying penalties

Electric power microgrids

Smart contracts are being used for redistributing excess power from solar panels. The Transactive Grid is an application running on blockchain to monitor and redistribute energy in a neighborhood microgrid. The program automates the buying and selling of green energy to save costs and pollution. The technology for running the program is the Ethereum platform, designed for building smart contracts of any kind.



Automotive Supply Chain

Kouvola Innovation uses RFID tags to communicate shipping requirements to various carriers, reports *Aftermarket Business World*. The shippers then bid on the shipment and the contract would automatically be awarded to the one that best meets price and specs. Blockchain tracking the shipments.

Groupe Renault is experimenting with storing the digital twin of its vehicles on a blockchain-based system which would provide a single source of truth for each vehicle's maintenance data. In July 2017, the company released a prototype that was created in collaboration with Microsoft and VISEO – it uses blockchain to connect each new vehicle's maintenance events to the vehicle's digital twin. This data is fully traceable and visible to authorized parties such as the vehicle owner.

In future, the entire automotive industry could collaborate on a single blockchainbased platform to store the digital twin of every vehicle, including important events and status updates. This would allow, for example, maintenance data and odometer readings to be stored together as a comprehensive record.



Maersk and IBM

Maersk and IBM are launching a joint venture to use blockchain technology to make the global supply chain more efficient and secure. This initially plans to commercialize two core capabilities:

• A shipping information pipeline will provide end-to-end supply chain visibility and enable everyone involved in managing a supply chain to securely and seamlessly exchange information in real time.

• Paperless trade will digitize and automate paperwork.

Various partners have piloted this platform, including DuPont, Dow, Tetra Pak, Port Houston, the Customs Administration of the Netherlands, and U.S. Customs and Border Protection.

According to IBM and Maersk, future partners will include General Motors and Procter & Gamble, among others.



Blockchain in LSCM Conclusions

- No need to trust each other or have a trusted third party
- Distributed system
- Agreement on history translates to agreeing on system state
- Nth record in the hash chain commits to all previous records.
- Any change in previous record invalidates hash chain
- Reliable and independent technological platform to choose from
- Huge annual increase of blockchain industrial implementation quickly creates best practices
- Frost & Sullivan and EY predicts the penetration rate of blockchain technology by 2025 in functional areas such as retailing and leasing, supply chain logistics, and smart
 manufacturing will hit 37.2 percent.



Blockchain Challenges

Scalability and Validation Speed

- Blockchain platforms take 10 min or longer to confirm transactions and 7 transactions/sec maximum throughput
- Cannot yet match speed of mainstream payment processor
- Bottlenecks in Blockchain architecture limit high throughput and low latencies
- Parameterization of block sizes and intervals will not be sufficient for high load blockchain deployments
- Need for scalable consensus protocols, network topology and storage



Blockchain Challenges

Privacy

- Data breach attacks on permissioned blockchain platforms
- Need for privacy guarantees in case of attack on validating nodes
- Tradeoff between resilience and privacy
- Need to include cryptographic techniques, such as, multiparty computation, homomorphic encryption, etc within permissioned blockchain platforms



Blockchain in LSCM Conclusions

"The blockchain has the potential to transform the supply chain and disrupt the way we produce, market, purchase and consume our goods. The added transparency, traceability and security to the supply chain can go a long way toward making our economies safer and much more reliable by promoting trust and honesty, and preventing the implementation of questionable practices."

Ben Dickson, TechCrunch, Nov 25, 2016



HOME

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What is Cryptocurrency How to use Blockchain What is blockchain

BLOCKCHAIN ASSOCIATION of LATVIA

DEVELOPMENT Our Mission is to help in creation of a business environment and legislative fran companies developing blockchain so



Association

IV FN

🕮 English About us

To complete our mission we, the Blockchain Development Association of Latvia

- We will organize educational events about blockchain and benefit it cou
- We will contribute to developing an understanding between private companies, developing blockchain projects and government officials

AKTUĀLI! LU studentu Biznesa inkuba

Latvian Blockchain

pirmais blokkēdes tehnoloģiju pirmsaks

Evija Ansonska, LU Biznesa, vadības un ekonomikas fakultāte 17.01.2018.

Sašaurināt tekstu Sadalīt tekstu kolonnās

Latvijas Universitātes (LU) studentu Biznesa inkubators sadarbībā ar Latvijas Blockchain asociāciju izveidojis Latvijā unikālu pirmsakselerācijas programmu, kas 12 nedēlu laikā palīdzēs tās dalībniekiem attīstīt blokkēdes tehnoloģijas biznesa idejas. Trim labākajām komandām būs iespēja doties uz Kriptoieleju Šveicē, lai prezentētu biznesa idejas un piesaistītu sākuma kapitālu. Pirmsakselerācijas programmai var pieteikties līdz 18. janvārim, aizpildot pieteikuma anketu: ej.uz/blockchainapplication

Pirmsakselerātora atvērto lekciju 16. janvārī LU Dabaszinātnu akadēmiskajā centrā apmeklēja 200 interesenti. Viņus uzrunāja un Latvijā unikālā blokkēdes tehnoloģiju programmā piedalīties aicināja LU rektors prof. Indrikis Muižnieks, ministru prezidenta biedrs, ekonomikas ministrs Arvils Ašeradens un LU Biznesa, vadības un ekonomikas fakultātes (LU BVEF) dekāns asoc. prof. Gundars Bērzinš, kā arī LU studentu Biznesa inkubatora vadītājs Mikus Losāns un programmas mentori.

Ministru prezidenta biedrs, ekonomikas ministrs Arvils Ašeradens uzvēra: "Latvijas Universitāte ir spērusi ļoti tālredzīgu soli atverot pirmo blokķēžu jaunuzņēmumu pirsakselerācijas programmu, kas palīdzēs attīstīt jaunuzņēmumus tieši šajā jomā. Mēs gaidām blokķēžu vienradžus!"







- 2018 November foundation of the IEEE Latvia Blockchain Group, by
 - RTU ITI
 - IEEE Latvia Section
 - IEEE Computer Society Latvia Section Chapter
 - in cooperation with other IEEE Blockchain groups in USA (Silicon Valley, San Diego, Dallas), China (Shanghai, Beijing), Singapore, India (Bangalore), Canada (Waterloo), Europe (Belgium, Switzerland, Ukraine)
- 2018, January 1st the IEEE Future Directions Committee has approved the formation of the IEEE Blockchain initiative <u>https://blockchain.ieee.org/</u>



IEEE-SA Blockchain for Clinical Trials Forum	12 February 2018	Orlando, FL, USA
2018 IEEE International Conference on Cloud Engineering (IC2E)	17-20 April 2018	Orlando, FL, USA
First IEEE Workshop on Blockchain Technologies and Applications (BTA) 2018	17 April 2018	Orlando, FL, USA
Co-located with 2018 IEEE International Conference on Cloud Engineering (IC2E)		
The IEEE Fourth International Workshop on Container Technologies and Container Clouds (WoC)	17-20 April 2018	Orlando, FL, USA
Co-located with 2018 IEEE International Conference on Cloud Engineering (IC2E)		
The Third International Workshop on Towards Global Interoperability among IoT Systems (Globe-IoT)	17-20 April 2018	Orlando, FL, USA
Co-located with 2018 IEEE International Conference on Cloud Engineering (IC2E)		
NOMS 2018 - 2018 IEEE/IFIP Network Operations and Management Symposium	23-27 April 2018	Taipei, Taiwan
IEEE/IFIP Man2Block 2018	27 April 2018	Taipei, Taiwan
Co-located with IEEE/IFIP NOMS 2018		
Intercontinental Blockchain Conference (EU Parliament)	24 May 2018	Brussels, Belgium
UCSD Extension & SDIEEE Blockchain Healthcare Workshop	24-25 May 2018	San Diego, CA, USA
2018 IEEE/ACM 1st International Workshop on Emerging Trends in Software Engineering for Blockchain (WETSEB)	27 May - 3 June 2018	Gothenburg, Sweden
2018 IEEE Blockchain Summit Korea	7-8 June 2018	Seoul, Korea
2018 Crypto Valley Conference on Blockchain Technology (CVCBT)	20-22 June 2018	Zug, Switzerland
2018 IEEE International Conference on Blockchain (Blockchain-2018)	30 July - 3 August 2018	Halifax, Canada



IEEE Global Blockchain Summit	17-19 September 2018	Gaithersburg, MD, USA
Future of Blockchain	10-13 October 2018	Dallas, Texas USA
2018 IEEE Technology Time Machine (TTM)	31 October - 1 November 2018	San Diego, CA, USA
2018 IEEE Blockchain for Clinical Trials - Europe	14-15 November 2018	Glasgow, Scotland
2018 IEEE Blockchain for Agriculture Forum	28-29 November 2018	Honolulu, HI, USA
2018 10th IEEE International Conference on Cloud Computing Technology and Science (CloudCom)	10-13 December 2018	Nicosia, Cyprus
International Workshop on Resource Brokering with Blockchain (RBchain)	10 December 2018	Nicosia, Cyprus
In conjunction with 2018 10th IEEE International Conference on Cloud Computing Technology and Science (CloudCom)		

2019 IEEE/IFIP International Conference on Blockchain and Cryptocurrency (ICBC)

15-17 May 2019

Seoul, Korea

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technology will of range of topics, ir Participants also course. View the courses



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IEEE STANDARDS ASSOCIATION

roject Active

P2418.1 - Standard for the Framework of Blockchain Use in Internet of Things (IoT)

ACCESS VIA SUBSCRIPTION

ect Active

P2418.2 - Standard Data Format for Blockchain Systems

ACCESS VIA SUBSCRIPTION

Project Details

This standard provides a common framework for blockchain usage, implementation, and interaction in Internet of Things (IoT) applications. The framework addresses scalability, security and privacy challenges with regard to blockchain in IoT. Blockchain tokens, smart contracts, transaction, asset, credentialed network, permissioned IoT blockchain, and permission-less IoT blockchain are included in the framework.

Explore This Project



Project Details

The standard establishes data format requirements for a blockchain system (s). The standard addresses the following attributes of the system, including but not limited to, data structure, data classification (and its correlation), data element format, data type, identifier, and data length.



Thank you for your kind attention!

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