Blockchain & BOND - project
Blockchains boosting Finnish Industry

Blockchain Forum
21.03.2018
Arto.Laikari@vtt.fi
# 2017-12-04 BOND Blockchain afternoon seminar

<table>
<thead>
<tr>
<th>Time</th>
<th>Presenter</th>
<th>Organization</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:00 - 13:05</td>
<td>Arto Laikari&lt;br&gt;Senior Scientist</td>
<td>VTT</td>
<td>Welcome, opening of the seminar</td>
</tr>
<tr>
<td>13:05 - 13:25</td>
<td>Markus Lehtonen&lt;br&gt;Founder</td>
<td>Blockchain forum ry</td>
<td>Blockchain forum ry</td>
</tr>
<tr>
<td>13:25 - 13:45</td>
<td>Pekka Nikander&lt;br&gt;Professor of practice</td>
<td>Aalto</td>
<td>SOFIE project&lt;br&gt;Secure Open Federation for Internet Everywhere</td>
</tr>
<tr>
<td>13:45 - 14:05</td>
<td>Jukka Myllyaho&lt;br&gt;Head of Capital Markets, Finland</td>
<td>Accenture</td>
<td>Blockchain @Accenture</td>
</tr>
<tr>
<td>14:05 - 14:25</td>
<td>Ari Mutanen&lt;br&gt;CEO</td>
<td>Altoros Finland</td>
<td>Blockchain @Altoros Finland</td>
</tr>
<tr>
<td>14:25 - 14:45</td>
<td>Timo Koskinen&lt;br&gt;CTO</td>
<td>IBM Finland</td>
<td>Blockchain @IBM</td>
</tr>
<tr>
<td>14:45 - 15:05</td>
<td>Elina Huttunen&lt;br&gt;Technical adviser</td>
<td>Finnish Standards Association SFS</td>
<td>Blockchain standardization</td>
</tr>
<tr>
<td>~15:05</td>
<td></td>
<td></td>
<td>Coffee break</td>
</tr>
<tr>
<td>15:35 - 15:55</td>
<td>Janne Pulkkinen&lt;br&gt;Chief Enterprise Architect</td>
<td>State Treasury of Finland</td>
<td>D9, Public Administration Blockchain Technology group</td>
</tr>
<tr>
<td>15:55 - 16:15</td>
<td>Timo Hotti&lt;br&gt;Solution Architect</td>
<td>OP Financial Group</td>
<td>The age of decentralization in the world of silos</td>
</tr>
<tr>
<td>16:15 - 16:35</td>
<td>Kristiina Valtanen&lt;br&gt;Research Scientist</td>
<td>VTT</td>
<td>Blockchain-enabled value creation</td>
</tr>
<tr>
<td>16:35 - 16:55</td>
<td>Arto Laikari&lt;br&gt;Senior Scientist</td>
<td>VTT</td>
<td>BOND project&lt;br&gt;Blockchains Boosting Finnish Industry</td>
</tr>
<tr>
<td>16:55 - 17:00</td>
<td>Arto Laikari&lt;br&gt;Senior Scientist</td>
<td>VTT</td>
<td>Conclusion</td>
</tr>
</tbody>
</table>


In the event: **110 registered visitors from 58 companies**
Artificial Intelligence (AI), Blockchain, IoT, … Opportunity or threat? Science or Fiction?
Blockchain

- MTV3 - 8.11.2017: Civil marriage could be done in the Internet – using Blockchain technology (Finnish article)

- World of coins: Bitcoin, Ethereum, EstCoin, Cryptoruble, Auracoin, Solarcoin, Dentacoin, Whoppercoin, Adult coins… & ICOs (e.g. www.icoalert.com)

- Sharing economy: Smart lock linked to an Ethereum Blockchain (Slock.it)

- Etc.

27/03/2018

BOND-project, Arto.Laikari@vtt.fi

Images: www.pixabay.com
Main topics of the presentation

- BOND-project - Blockchains Boosting Finnish Industry
- What is Blockchain?
- Blockchains and standardization
- European commission & Blockchain (examples)
- Finnish Public administration’s Blockchain technology network
- Blockchain Use Case area examples (BOND + in general)
- Blockchain & IoT
- BOND vision and main objective
BOND-project
Blockchains Boosting Finnish Industry

- Project duration 10/2016 – 04/2018

- Funding: TEKES (Industrial Internet – Business Revolution programme), companies and research partners

- Joint project research partners: VTT, ETLA ja Aalto university

- Diverse company involvement, 9 companies (see next slide)
BOND consortium

- **Research partners:**
  - VTT
  - ETLA
  - Aalto

- **Companies:**
  - 3Step IT Group Oy
  - Boogie Software Oy
  - Euroclear Oy
  - Fortum Oyj
  - Keskinäinen Työeläkevakuutusyhtiö Elo
  - Kouvola Innovation Oy
  - Nokia Solutions and Networks Oy
  - Telia Finland Oyj
  - Tietomitta Oy

---

Advisory members:
BOND project

- Is not researching cryptocurrencies

- Research partners together with the participating companies selecting use cases, which interest them.

BOND-project, Arto.Laikari@vtt.fi
What is Blockchain?

- Blockchain: Distributed database with continuously growing list of data records confirmed by participating nodes using cryptography.

- Blockchain use case "feasibility" criteria: *)
  1. A database shared by multiple parties
  2. Enabling multiple concurrent writers
  3. Maintaining consensus regarding the content of the database
  4. Interacting modifications
  5. The absence of trust
  6. The undesirability of intermediation

*) Mattila J. et. al., 2016
What is Blockchain?

"Blockchain" is a distributed database that maintains a continuously growing list of data records, chained together against revision and tampering.

“Distributed consensus” is an agreement between different compute-nodes over what is a true or false record.

As every client has a copy of the blockchain it is impossible to manipulate information and cover up your tracks. The integrity and provenance of information systems can be mathematically proven.

Source: Guardtime 2017
Blockchain explained

- Youtube video: ”Blockchain Demo” (Blockchain 101 – a visual demo)
- Step by step explanation of:
  - Hash
  - Block
  - Blockchain
  - Distribution
  - Tokens
  - Coinbase

- https://www.youtube.com/watch?v=_160oMzblY8 (17 min. 49 sec.)
Blockchain consensus protocols

- Proof of work (e.g. used in Bitcoin)
- Proof of stake
- Proof of activity
- Proof of burn
- Proof of capacity
- Proof of elapsed time
- Proof of importance
- Proof of authority
- Etc.
What is Blockchain?

- Is Blockchain = Bitcoin?
  - Bitcoin is implemented using blockchain technology
Blockchain – Gartner hype cycle 08/2016

Source: Gartner (July 2016)
Blockchain – Gartner hype cycle 07/2017

Many Blockchain related items on the raising "Innovation Trigger" slope!
(Note! Not visible in this figure)

gartner.com/SmarterWithGartner
Hype Cycle for Blockchain Technologies, 2017
On the Rise

- Blockchain Wallet Platform
- Smart Contract Oracle
- Postquantum Blockchain
- Smart Contracts
- Distributed Storage in Blockchain
- Zero Knowledge Proofs
- Blockchain PaaS
- Things as Customers
- Blockchain for IAM (Identity and Access Management)
- Decentralized Applications (Dapps)
- Blockchain for Data Security
- Metacoin Platforms
- Quantum Computing
- Consensus Mechanisms
- Sidechains/Channels
Cryptocurrencies boosting Blockchain

- Bitcoin rally during 2017, especially Q4/2017
- Trade with [Bitcoin] futures started Dec 2017
- Other Cryptocurrencies, over 1300 "cryptocurrencies" exist (11/2017)
- ICO’s (Initial Coin Offerings)
- Blockchain breaking to common knowlegde
Bitcoin value – source coindesk

Bitcoin (USD) Price

19.7.2010 / $0.06
16.12.2017 / $19343
4.2.2018 / $8647

$8,647.62 ▼-6.25%
Today's Open $9,224.39
Today's High $9,363.41
Today's Low $8,457.81
Change ▼$576.77
Market Cap $0.146T
Supply 16,844,838
Things to consider when "selecting" Blockchain

- Open like Bitcoin vs. Private/Consortium blockchain
- Permissioned vs. permissionless?
- What implementation platform should be used?
  - Bitcoin based meta-data platforms
  - Blockchain platforms for financial applications - FinTech
  - Smart contract platforms
  - Consortium/Enterprise platforms
  - Sidechain/Anchored platforms
  - Multipurpose platforms & services

- Privacy, security?
Blockchain platforms, connection to real world

- Financial Application Platforms
- Smart Contract Platforms
- Bitcoin based Meta-data Platforms
- Consortium / Enterprise Platforms
- Sidechain / Anchored Platforms
- Multipurpose Platforms

"Oracle"

"Real world"

Image source: Pixabay
Smart contracts

- Smart contracts are software programs that can enforce the contract in a way that the contract itself and its effects on the inputs are verifiable.
- Contracts are executed automatically (without third parties).
- Usage examples:
  - Voting
  - Auctions
  - Lottery
  - Escrow systems
  - Crowd funding
  - Micropayments
  - Etc.
Blockchains and standardisation

- Are Blockchains already standardised?
  - New field, work has started!
  - What should be standardised?
- ISO/TC 307 - Blockchain and electronic distributed ledger technologies (First meeting: 04/2017 Sydney, Australia, Second 11/2017 Tokyo, Japan)
  - Study groups and working groups initiated – evolution ongoing
  - See more detailed next slide
- SFS ry. (Finnish Standards Association) started a national blockchain follow-up group: “SFS/SR 229 Lohkoketjuteknologia” to support ISO standardisation. --> BOND: VTT & Kouvolan Innovation members.
- CEN/CENELEC Focus Group on Blockchain and Distributed Ledger Technologies about to start.
- Discussion ongoing also in W3C, IETF, ITU etc.
ISO/TC 307 Blockchain and distributed ledger technologies

- 30 participating members, 12 observing members

- ISO/TC 307/SG 1: Reference architecture, taxonomy and ontology
- ISO/TC 307/SG 2: Use cases
- ISO/TC 307/SG 3: Security and privacy
- ISO/TC 307/SG 4: Identity
- ISO/TC 307/SG 5: Smart contracts
- ISO/TC 307/SG 6: Governance of blockchain and distributed ledger technology systems
- ISO/TC 307/SG 7: Interoperability of blockchain and distributed ledger technology systems
- ISO/TC 307/WG 1: Foundations
- ISO/TC 307/WG 3: Smart contracts
ISO/TC 307 Blockchain and distributed ledger technologies

- 16 ISO/IEC Liaison committees to ISO/TC 307
  - The committees can access the documents of ISO/TC 307
- 13 ISO/IEC Liaison Committees from ISO/TC 307
  - ISO/TC 307 can access the documents of the committees

Organizations in liaison (Category A and B)

- EC European Commission A
- FIG International Federation of Surveyors A
- ITU International Telecommunication Union A
- SWIFT Society for Worldwide Interbank Financial Telecommunication A
- UNECE United Nations Economic Commission for Europe A
SFS & CEN/CENELEC

- SFS SR229 Lohkoketjuteknologiat – Mirror committee to ISO TC307
  - From BOND: VTT and Kouvola Innovation members

- European CEN and CENELEC have started a focus group on Blockchain and Distributed Ledger Technologies (DLT) (12/2017)
  - The objectives of the Focus Group, among others, will be to identify potential specific European standardization needs, notably in support to the current standardization activities being developed in ISO/TC 307 ‘Blockchain and DLT’.
Finland: National level standardisation
SFS SR 229 Lohkoketjuteknologiat

- Mirror committee for ISO TC 307
- Currently a small group, as the standardisation has just started
  - New participants warmly welcome!
- Tasks:
  - Follow the international standardisation
  - Participate in the international standardisation
    - Provide ”Finland’s” comments on ballots and draft standards.
    - Nominate experts to international working groups and international meetings
  - Later also to evaluate the need for translation of standards

Want to join? Contact: Elina.Huttunen@sfs.fi
European commission & Blockchain (examples)

- European commission and parliament have also recognized the importance of the emerging Blockchain and its opportunities.

  “Blockchain technology is complex, controversial and fast-moving, but is of increasing interest to citizens, businesses, supervisors and legislators across the European Union.”

- European Parliament / Science and Technology Options Assessment (STOA) and European Commission DG CONNECT organized a Joint Blockchain event on 11.5.2017


BOND-project, Arto.Laikari@vtt.fi
EU Blockchain Observatory and Forum

- European Commission launched the EU Blockchain Observatory and Forum on the 1st of February 2018

- map key existing initiatives in Europe and beyond;
- monitor developments analyse trends and address emerging issues;
- become a knowledge hub on blockchain;
- promote European actors and reinforce European engagement with multiple stakeholders;
- represent a major communication opportunity for Europe to set out its vision and ambition on the international scene;
- inspire common actions based on specific use-cases of European interest.
EU Commission factsheet of Blockchain

- Interesting compact information packet:

- Financing Horizon 2020 Research & Innovation projects. So far €83 million have been allocated by the EU in blockchain related projects, and potentially up to €340 million could be committed from 2018 to 2020.

- Testing blockchain solutions (through proof of concept) and piloting projects in support to EU policies in areas like regulatory compliance, tax and customs, energy, identity management,...

- Assess the need for an EU blockchain infrastructure and its benefits.
European Commission Blockchain info day

- 2017-12-19 Information Day on Horizon 2020 Blockchain, Distributed Ledger Technologies Topics and Fintech coordination action

- Links to the presentations:
Horizon 2020 existing EU projects on blockchain

- **17 Projects listed:**
  - D-CENT (social money for democratic societies)/EU-funding ended in May 2016- [https://dcentproject.eu/](https://dcentproject.eu/)
  - DECODE (decentralised management architecture)- [https://www.decodeproject.eu/](https://www.decodeproject.eu/)
  - SUNFISH- [http://www.sunfishproject.eu](http://www.sunfishproject.eu)
  - Symbiote- [https://www.symbiote-h2020.eu](https://www.symbiote-h2020.eu)
Finland: Public administration’s Blockchain technology network – D9

- Strong interest to understand and collect information about Blockchain / DLT
- Over 40 different experts from different sides of government participating:

<table>
<thead>
<tr>
<th>Sector</th>
<th>Organizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Finance</td>
<td>D9 -Digioffice, Ministry of Finance, State treasure of Finland, Prime minister’s office Finland</td>
</tr>
<tr>
<td>Ministry of Social affairs and Health</td>
<td>Ministry of Social affairs and Health, Bank of Finland, Financial Supervisory Authority</td>
</tr>
<tr>
<td>Ministry of Transport and Communications</td>
<td>Ministry of Transport and Communications, The Finnish Defence, Finnish Communications Regulatory Authority</td>
</tr>
<tr>
<td>Tax administration</td>
<td>Tax administration, National Land Survey of Finland, Social Insurance Institution of Finland</td>
</tr>
<tr>
<td>Ministry of the Interior</td>
<td>Ministry of the Interior, Police of Finland, Customs</td>
</tr>
<tr>
<td>Ministry of Economic affairs and employment</td>
<td>Ministry of Economic affairs and employment, Finnish Immigration, Finnish Communications Regulatory Authority</td>
</tr>
</tbody>
</table>

BOND-project, Arto.Laikari@vtt.fi
## Examples of Blockchain Use Case areas

### Financial Use Cases
- Currency
- Digital security trading
- Escrow/custodian service
- Securities
- Loans
- Exchange
- Payments and transactions
- Crowdfunding
- RegTech
- Invoicing

### Non Financial Use Cases

#### Application development
- Digital content
- Ride-sharing
- Digitization of documents and contracts
- Decentralized storage
- Company incorporations
- Decentralized Internet and computing resources
- Home automation
- Digital identity
- IT portal
- Digitizing assets
- Reputation management
- Prediction platform
- Authenticity of a review and endorsements
- Authentication and authorization
- Market place
- Smart contracts
- Real estate
- IoT and Smart property
- Energy
- Property
- Music
- Smart Corporations
- Health

#### Non Financial Use Cases
- Supply chain management, logistics and stock optimization
- Public services
- Manufacturing
- Gaming
- Elections and voting
- Insurances
- Smart buildings
- Land titles
- Taxation
- Notary service and document registry
- Agricultural & drone networks
- Mobile networks
- Integrated smart city
- Self-driving car
- Car leasing/buying
- Digital assistants/chatbots
- Science
- Household appliances
- S2aaS
- Circular Economy
- Forestry
- Employment service
- Vehicle inspection

![Image](www.pixabay.com)
Examples of BOND-project Use Case areas

- General BOND research topics
  - Market places & smart contracts
  - Connection of virtual and real world
  - Blockchain-enabled value creation

- Chosen BOND application areas
  - Energy market and industry
  - 5G
  - IoT
  - Smart environments & buildings
  - Asset management
  - Logistics

Images: www.pixabay.com
Example BOND-project  Use Case: Monitor/control the building process

- Building a house is a complex process, which involves several stakeholders.
- Basically the process is well defined and the result should be a safe and healthy building.
- Business driver for the case is to ensure that the result of the building process produces a house, which fulfills the set requirements. *

- Selected sub-case: monitoring the process of producing a concrete structure.

- Case to be enhanced in continuation projects!

Example BOND-project  Use Case: Blockchain Network Slice Broker in 5G

- Network Slice Broker concept aims to enable mobile virtual network operators, over-the-top providers, and industry vertical market players to request and lease resources from infrastructure providers dynamically according to needs.

- In the future digital factory, the leasing of resources could also happen autonomously by manufacturing equipment.

- 2 conference paper accepted

- 1 journal paper under work
Example BOND-project  Use Case: Blockchain Network Slice Broker in 5G

- Conference paper: **Blockchain Network Slice Broker in 5G, Slice Leasing in Factory of the Future Use Case**

- Conference paper: **Creating Value Through Blockchain Powered Resource Configurations: Analysis of 5G Network Slice Brokering Case** accepted
  - To be presented in IEEE WCNC 2018 in Barcelona, 15.-18.4.2018
  - "Intelligent Computing and Caching at the Network Edge" Workshop keynote at IEEE WCNC 2018 in Barcelona

- Journal paper under work, to be finished soon.
Example BOND-project Use Case Energy market & Blockchain

- Industrial Blockchain Platforms: An Exercise in Use Case Development in the Energy Industry
  - Defining the target state
  - Conceptualization of the use case
  - Technical specifications
  - A checklist for BC use cases

- Open source POC skeleton implementation


Example BOND-project Use Case: Real estate market and Blockchain

- Workflow management in a complicated transaction process: the selling of a share of stocks in a housing corporation.

- Ethereum-based smart contracts to facilitate the interaction of various parties involved

- Interplanetary File System (IPFS) to combine data from a number of separate information pools.

- Distributed Workflow Management with Smart Contracts

See also: http://www.tekniikkatalous.fi/kaikki_uutiset/suomessa-kehitettiin-paperiton-asuntokauppamalli-lohkoketjuteknologia-myy-asuntosi-digitaalisesti-6684525 (Finnish article)
Upcoming BOND Use Cases

- Other BOND Use Cases are under development.
- More results will be published later.
- Next BOND seminar planned to be organised in 2018.
Blockchain & IoT

- Blockchain and IoT are "siblings", together they make a good family!

- Blockchain provides
  - Security, privacy, trust, identity
  - New computational layer
  - Data storage
  - Micro-payments

- **BUT**, ensure the validity and origin of the data!

BOND-project, Arto.Laikari@vtt.fi

Images: www.pixabay.com
Blockchain governance

- Who owns and who maintains the "blockchain system"?

- Creating a blockchain Use Case or application it is assumed that there just is a Blockchain system available

- Is the implementation open / closed, permissionless / permissioned, without identity / with identity...

- Should it be government, EU, consortium, single company, foundation, open source community? How do YOU see it?
Blockchain governance

- Who owns and who maintains the "blockchain system"?
  - Incentives to "run the system"?
    - Developers
    - "Miners"
    - Users
  - Mechanisms for coordination?
- Standardization work at ISO/TC 307/SG 6 Governance of blockchain and distributed ledger technology systems has started
- In 2018 the European commission will work on Governance and interoperability framework of the Blockchain technologies.
- What happens in a decentralized system, when things “go wrong”?
Many reasons for the need for arbitration / dispute resolution

- **Is the Smart Contract legally binding?** In many common law jurisdictions, a contract can only be valid if it is entered into by a person (i.e. a human or legal person, such as a corporation) with legal capacity to do so. There is also common law authority (for example, in English law) that a contract cannot arise unless there is sufficient certainty over who the contracting parties are. Some civil law jurisdictions lay down other legal requirements for the formation of a legally binding contract.

- **Coding errors** may cause unexpected performance issues.

- There may be **discrepancies between coding and natural language versions** of a Smart Contract.

- Parties may want to terminate a Smart Contract for **repudiatory breach** or unwind it on the grounds of **misrepresentation, mistake or duress**.

- **Subsequent changes of law or regulation** (e.g. sanctions) may make performance of the Smart Contract illegal.

- Smart Contracts may perform on the basis of an **inaccurate data feed**.

Governance -> Blockchain and identity

- Who provides the identity in Blockchain?
- National identity services -> not working in global environment
- Sovrin
- IBM & SecureKey Technologies – Blockchain-based Digital Identity network for consumers on IBM Blockchain
- 21 Companies Leveraging Blockchain for Identity Management and Authentication (13.2.2017)
- Who manages the access right?
- Standardization work at ISO/TC 307/WG 2 Security, privacy and identity has started.
BOND vision

- Finnish blockchain ecosystem consisting of public sector, research organisations and companies fully exploits the potential of blockchain technology in their research, business and technology portfolio. Finnish blockchain development and solutions are internationally competitive and well-known.

BOND main objective

- To form an understanding of blockchain tools, technologies, solutions and business possibilities in different domain areas, first focusing on Finnish business environment.
Contact information

BOND-project

www.bond-project.fi

VTT

Arto Laikari
Project Manager
Arto.Laikari@vtt.fi
TECHNOLOGY FOR BUSINESS

Thank you