Blockchain-enabled platform for financial reporting and VAT settlement – A use case

Jonas Sveistrup Søgaard, Ph.D. fellow & Manager
AGENDA

1. Setting the scene
2. The project
3. Further research
A G E N D A

1. Setting the scene

2. The project

3. Further research
Lowering the burdens for Danish companies

The Danish Business Authority leads the initiative “Automatic Business Reporting” with focus on lowering the burdens on Danish companies while also increasing productivity and competitive edge.

1. Setting the Scene

"Automatic Business Reporting" aims to reduce administrative burdens

The DBA drives the cross institutional initiative “Automatically business reporting” (ABR) which aims at automating “annual reports, other financial reporting, and financial accounting statistics”.

The overall aim is to reduce the administrative burdens of the ~300,000 companies in Denmark

Involved parties:
- Danish Business Authority (chair)
- Danish Tax Authority
- Agency for Digitalization
- Statistics Denmark

1.311 19.390

Danish Business Authority’s vision is to create the best conditions for growth

The Danish Business Authority has the power to implement and enforce legislation upon Danish companies.

Vision
To create the best conditions for growth in Europe.

Mission
In partnership with others we make it easy to attractive run a business in Denmark.

Easy meaning that rules and regulations are understandable, easy to administer for the businesses, and that all communication with our customers is done digitally and in an effective manner.

Denmark is the most digitized country in world

GDP per country, mUSD

<table>
<thead>
<tr>
<th>Country</th>
<th>DK</th>
<th>ES</th>
<th>US</th>
<th>Avg</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>71</td>
<td>58</td>
<td>62</td>
<td>Avg 67</td>
</tr>
<tr>
<td></td>
<td>71</td>
<td>62</td>
<td>71</td>
<td>Avg 63</td>
</tr>
<tr>
<td>2018</td>
<td>77</td>
<td>65</td>
<td>71</td>
<td>Avg 76</td>
</tr>
</tbody>
</table>

Connectivity
Digital public services
Internet usage
Business digitalization
Digital skills

I-DESI Index, 2018

DK

ES

US

Avg. 76
Avg. 63
Avg. 67
1. Setting the scene

2. The project

3. Further research
We found that DLT is fit for VAT settlement

By using Design Science Research (Hevner et al., 2004), we developed an IT artefact on Microsoft Azure Workbench with an Ethereum Parity implementation that proved it possible to let a Smart Contract hold VAT of invoices.

Research question

How can a DLT-enabled IT artifact be designed for financial reporting automation and VAT settlement with a specific focus on an open-book invoicing platform offered by the Danish Business Authority to trading partners in the SME segment?
Design principles as a foundation

Six design principles have guided the project team from the selection of the use case to the choice of technology platform as well as through the design and development activities in the PoC process.

2. THE PROJECT

User
- Simplification for the end user

Data
- Security and access control
- High selective transparency
- High data protection

Architecture
- High scalability
- ~230 mill. invoices per year and peak days ~475 t
- Component-based (loosely coupled) structure
The artefact optimizes the invoicing process

Two-way invoice authentication ensures tuned transaction base, minimizes VAT fraud and creates common truth. It builds on ontology from McCarthy, Blums, Weigand and Kruijff, VAT from Ainsworth & Hyvärinen, and Blockchain and Continuous reporting literature from Wang, Rozario, Zhang, and Dai.

Architecture of permissioned DLT

Platform value and assumptions

- Two-way invoice authentication ensures tuned transaction base, minimizes VAT fraud and creates common truth
- Every company is identified with national electronic ID (NemID)
- Exploiting the existing e-Invoicing standard Denmark has had since 2004 by law and PSD2 for bank information

Theoretically nexus

- **Ontology**
  McCarthy, 1982; Blums, 2016-2018; Weigand, 2018; Kruijff, 2017
- **VAT**
  Ainsworth, 2016; Hyvärinen, 2017
- **Blockchain and Continuous reporting**
  Wang, 2018; Rozario, 2018; Zhang, 2017; Dai, 2016-17
Artefact built on Azure Blockchain Workbench

2. THE PROJECT

Adding invoicing to the platform

Receiver
The recipient is the company that is to receive the invoice, and can, for example, be found using a CVR number. In this PoC, however, you must refer directly to a user.

Receiver’s bank
The receiver’s bank would automatically show in a production solution, but in this PoC it must be specified for the example’s sake.

Auditor
Here the seller can add his auditor so that later point in time, he can gain access to an overview of the company’s transactions in connection with the preparation of the financial statements.

File Path
Specifies the location of the invoice on the user’s device.

Price excluding VAT
The price of the work done, excluding VAT, is entered here by the seller.

VAT
Here is the enter VAT, but can otherwise be calculated automatically based on the price.
Artefact built on Azure Blockchain Workbench

This report has been prepared in Microsoft Power BI and shows a bid on how an authority such as SKAT could follow the number of transactions and VAT reports. The Danish Business Authority will be able to monitor the platform, etc.

There are two starting points for the authorities' monitoring on the platform:

**Monitoring of taxes and charges**
Here, authorities like SKAT have insight into the number of VAT transactions and their value over a given period of time. The idea is that this data can be used to more easily spot fraud and abuse, as data can be read completely at company level.

**Monitoring the use of the platform**
Here, the use of the platform is visualized. It is possible to see here:

- The number of invoices sent on the platform in a given period
- The response rate (how many issued invoices are answered?)
- Corrections (how many invoices are renegotiated?).

This gives the authorities direct insight into the companies' transactions and in who both uses and does not use the platform.
## Evaluation of design principles as a foundation

<table>
<thead>
<tr>
<th>Design principles</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
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<tr>
<td>Architecture</td>
<td>High scalability</td>
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<td></td>
<td>Component-based (loosely coupled) structure</td>
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</table>
1. Setting the scene

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The Danish company ecosystem

Managing of standards

- Automatic Business Reporting

Managing of stakeholders

- Business Intelligence
- Instant audit
- Monitoring and control
- New public services provided by state-authorized private players that connect to the Danish enterprise universe through open APIs.
- Trans national trade
- International value chain management
- Micro lending
- Credit scoring
- E-krone

Company registry → Companies are automatically put on the blockchain platform as a wallet

Standard apps for the Danish company ecosystem.

3rd party apps for the Danish company ecosystem
1. Setting the scene

2. The project

3. Further research
Thank you.

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Eminence

Electronista 19/9 2018

Block21 – Episode 6 &7

LinkedIn articles
Architecture and component overview

Development tools
- IDE (VS code)
- Source code (VS team system)

API

App-governance
- Data access
- Roles and users

App-deployment
- App-logic & config.
- Test data
- Test cases

Platform-deployment
- Configurator
- ARM-templates
- Upgrades

Azure Blockchain Workbench
- dFakturering (logic)
- Reporting
- Custom API
- Admin
- Web
- Workbench-app

API

Service bus
- Ethereum
- SQL DB

Roles management
- Seller, buyer, government
A fundamental shift in reporting paradigms

Traditional reporting methods will evolve as the understanding of the possibilities is shaped by the introduction of new technologies, including blockchain.

<table>
<thead>
<tr>
<th>Current paradigm</th>
<th>The paradigm of the future</th>
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<tbody>
<tr>
<td>Standalone times and “snapshots”</td>
<td>Real-time data</td>
</tr>
<tr>
<td>Individual inspections</td>
<td>Ongoing insight</td>
</tr>
<tr>
<td>Retrospective</td>
<td>Instantly and predictively</td>
</tr>
<tr>
<td>Sample-based analysis of transactions</td>
<td>Analyzes of all transactions</td>
</tr>
<tr>
<td>Asset Oriented Accounting</td>
<td>Transaction-based accounting policies</td>
</tr>
<tr>
<td>One-way communication</td>
<td>Multi-Directional Communication</td>
</tr>
<tr>
<td>Sporadic investigation of fraud</td>
<td>System Supported Identification of Fraud</td>
</tr>
</tbody>
</table>
SAF-T & other, real-time reporting overview

While not exhaustive, the following map highlights key country requirements for SAF-T, e-audit and real-time reporting requirements, particularly within Europe. New legislation is coming out frequently which reflects the dynamic nature of this area.
Deloitte Global Blockchain community

Innovation and Ideation
- We identify relevant use cases to harvest the benefits of Blockchain technologies
- Our thought leadership, developed in conjunction with our ecosystem of innovation and Blockchain companies, enables you to make sense of the broad innovation landscape
- We track over 200 Blockchain companies
- In 2018 the Dutch office opened their ‘Blockchain center of Expertise’ connecting all areas of expertise within the firm

Product Development
- We mobilize our global practitioners to your organization to re-engineer business processes or design new ones
- We bring our broad set of services, across compliance, technology, talent, operations and tax, to effectively integrate your Blockchain solution
- We deliver as one team in collaboration with external companies

World leader in innovation & strategy consulting

Strategy Development
- We lead you to define “where to play and how to win”
- We drive business, technology, integration and talent strategy
- We develop strategies to pilot and implement Blockchain based solutions
- We define an iterative and flexible approach to match the rapid changes in the ecosystem

Prototyping
- We accelerate prototyping by using our existing technology capabilities and industry experience
- We have prototypes up and running: Digital Bank, Loyalty & Rewards and Smart Identity
- We have over 35 prototypes in development

Industries where we have deep business process knowledge

Global delivery network with 9 development teams – having delivered 35+ blockchain prototypes*

1,600+
Practitioners in our Blockchain community from 40 countries

Selected ecosystem alliances with technology and innovation leaders
# Introduction to Deloitte’s blockchain practice

Recognized as a global leader in digital and innovation consulting by ALM, Forrester and IDC and awarded by Central Banks for our work with blockchain.

## Thought Leaders / Innovators
- **Groups or organisations that help innovate, ideate, and incubate to support Blockchain innovation**
  - Think tank that offers educational programmes and a business incubator
  - Non-profit creating partnerships with global business and intellectual leaders
  - World’s leading trade association for digital assets & Blockchain industry
  - Irish research university with a depth of expertise within distributed ledger technologies
  - Research lab specialized in digital currencies
  - Trading firm focused on providing links between research areas to innovate business solutions
  - India’s largest technical university with a particular emphasis on Blockchain
  - FinTech incubator, venture fund and corporate innovation consultancy
  - Silicon Valley think tank that offers educational programs and a business incubator.

## Collaborators
- **Vendors working within the Blockchain space with whom we have teaming agreements**
  - Bitpay: Global bitcoin payment service
  - Xapo: Bitcoin wallet
  - BitGo: Blockchain company and consortium leader
  - IBM: IT company supporting workflow digitization
  - Ledger: Digital asset exchange company
  - AlphaPoint: Provides an API to build applications on Blockchain
  - Civic: Open source blockchain project
  - Hyperledger: Open source blockchain platform

## Platforms
- **Alliances with Blockchain platforms that we have built prototypes upon and investigated further**
  - Ripple: Real-time payment protocol
  - MONAX: Open Blockchain platform
  - Bluzelle: Cloud-optimized Blockchain platform
  -丸: Smart contracts platform
  - Loyyal: Blockchain-based loyalty & rewards platform
  - Iota: Decentralized blockchain app provider
  - IMM: Issuance and trading Blockchain platform provider
  - Thales: Security hardware
  - Stellar: Financial Blockchain platform
  - SETL: Issuance and trading Blockchain platform provider

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