

Riksbank e-krona project

Background

We digitalize companies and organizations through strategy, code and culture. We create innovative technological solutions that create value, do good and let us have fun along the way. Here is our response to the Riksbank's wish to comment on the e-krona project, which aims to investigate and develop a state-guaranteed digital supplement to cash.

Our vision for e-krona

Everyone should be able to participate in the digital economy. We consider it a fundamental right to be able to take part in the social infrastructure that payment services make up. The individual's participation should not be conditional on a customer relationship with a private bank. Vulnerable groups such as paperless, new arrivals and people outside the banking system are often restricted to physical cash. Even wealthy groups such as tourists and business travelers experience thresholds to participate fully in the economy in Sweden. All groups should be included in a solution for the e-krona.

The e-krona can open up new business models and revitalize industries challenged by the digital economy. For example, today there are two dominant revenue models for digital news media: advertising or subscriptions. However, the potential for selling individual digital newspapers and articles is kept back in a world where transaction fees amount to about 2 SEK. If the e-krona allows microtransactions, which phenomenon has hit a lot in among other things the gaming world, and in China through WeChat, both small and large actors within culture and media become a winner. It is also possible to create completely new actors that were previously unavailable within the gig economy.

In principle, for all traders, a new digital infrastructure for payments can lead to efficiency and cost savings. According to Dagens Handel, approximately 1.5 billion paper receipts are printed annually. Receipts can be embedded in digital transactions and painlessly exported to accounting agencies which would facilitate everyday life as well as cost savings. Both variable and fixed costs for bankgiro / autogiro, credit cards and swish are reduced. Among the losers are traditional major banks and card distributors. The winners are Sweden's private individuals, companies and other organizations.

Overall, we see great societal gains with the e-krona concept. The added value for the individual is initially low, but we estimate that this will change as services are linked to the platform with features of today's payment system (including Swish).

Technical experiment

We are reached daily with news about data breaches, malfunctions, failed procurements and other IT incidents. Digitalization is progressing at an incredible speed, the global political situation is uncertain, institutions are challenged, and at the same



time technology makes science fiction a reality. In short, the world is full of "Wicked Problems"¹ and VUCA (Volatility, Uncertainty, Complexity, Ambiguity). This is particularly true of the Riksbank's investigation project to create a new digital means of payment, which we consider to be on the border between complex and complicated as described in the Cynefin framework². We are therefore pleased with the humble position the Riksbank takes in relation to its own as well as other experts' ability to see what is waiting around the corner.

Our experience is that many fundamental insights about this kind of complex problem do not arise until in practical implementation - one learns by doing. We have therefore chosen to work and materialize code already at this stage. We have called the concept "Betakronan" and used the Hyperledger Fabric³ blockchain stack.

Before starting to code we formulated a number of hypotheses to validate/reject. Because of the limited time frame we chose to narrow down to the question of registry based vs. value-based solutions that were highlighted in the interim report by the Riksbank. The hypothesis we wanted to try was this: **We think it is possible to create a hybrid solution that combines desirable features from both models.**

We have verified that it is possible to create a solution that is mainly registry based, but which can generate "codes" that can be transferred to others as a value document, such as in the form of a QR code on physical paper or by scanning a mobile screen. We have confirmed that this solution can be done as an identified individual and anonymously. It can also be done without access to the Internet as long as the parties trust each other. Otherwise, risk will be eliminated once the transaction is verified with the network. A new hypothesis is that the risk can be reduced in various ways by making abuse cumbersome and/or unattractive, or imposing other restrictions. Another thought worth investigating is to allow other physically present "witnesses" to co-sign transactions. A general recommendation is that hardware development is avoided as much as possible since it may expose new security holes, lock the platform over time, and significantly lower the possible rate of innovation.

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sending payment to socket { '$class': 'org.riksbanken.ekrona.AccountTransaction',
  from: 'resource:org.riksbanken.ekrona.Account#1',
  to: 'resource:org.riksbanken.ekrona.Account#2',
  amount: 5,
  receipt:
  { '$class': 'org.riksbanken.ekrona.Receipt',
    payload: '{"title":"Payment for #n3IPLNCHAE Tidningsartikel.", "amount":5,"orderId":"n3IPLNCHAE", "currency":"SEK"}',
    vat: 1.25,
    id: 'n3IPLNCHAE' },
  transactionId: 'f8cfffca9ea40bbacfd26e75af3d4456d535c84ef289050d23b261ee88a6e6bb',
  timestamp: '2017-10-17T15:58:43.000Z' }
```

We have performed (simulated) transactions between individuals and external services/traders and managed to embed metadata in the form of digital receipts in the transactions. We see that authentication can be linked to external solutions such as e-credentials/BankID and the European eIDAS initiative, which would enable other EU citizens to identify themselves when they are doing transactions in Sweden. However, transactions take place between accounts that do not necessarily require explicit owners and, in principle, you could use this solution without being registered at all.

In our work we have made a number of choices based on our reasoning and have just begun scratching the surface. These can of course be done differently in a real implementation, depending on which properties are valued the highest. Issues that arise are, for example:

- Should accounts be shared by several persons/legal persons?
- What are the requirements from money laundering legislation?
- Do minors also have to have accounts and if so how do we deal with the relationship with guardians?
- Should you be able to store a copy of your own part of the blockchain?
- Under what conditions should the Riksbank have the right and be able to change the network?
- What transparency should administrators have and under what conditions? Right hierarchies, encryption and keys ...

¹ J C Camillus, *Strategy as a Wicked Problem*, Harvard Business Review, 2008: hbr.org/2008/05/strategy-as-a-wicked-problem

² J C Camillus, *Strategy as a Wicked Problem*, Harvard Business Review, 2008: hbr.org/2008/05/strategy-as-a-wicked-problem

³ Source code on github.com/iteam1337/betakrona-hyperledger, also described on betakronan.se

We suggest that the Riksbank provides a distributed platform with an API that enables services built on top, in line with what is proposed in the interim report. Furthermore, we propose that the lightweight client that the Riksbank still should provide is published as an open source project, challenging Swedish developers and users to participate in an open and public building of a community service. It would be a unique choice that would truly embrace the digital era. Other 3rd-party actors can provide commercial options that provide more functionality and official support with this open source solution as a reference. Integration with community services can be moderated by inviting the user to e.g. Tax Agency, Social Insurance Agency and CSN under certain conditions. In summary, the Riksbank should focus on building the underlying infrastructure and simplifying for developers to create valuable services.

Why Hyperledger and blockchain technology?

Hyperledger⁴ originates from IBM but was published as an open source project. Today, the project is under the Linux Foundation with supportive members like Cisco, Intel, J.P. Morgan and Deutsche Börse Group. The platform does not constitute a separate currency. There is no concept of "miners". But it is based on blockchain architecture and has similarities with Bitcoin and Ethereum. However, the platform is tailored to the needs of large organizations (see list of collaborators) and therefore adaptable to a variety of alternative applications. Some fundamental differences compared to Bitcoin's blockchain are a significantly greater transaction flow, greater control over rights/visibility and support for smart contracts.

We chose Hyperledger as a platform for this technical experiment, but believe that the e-krona can be implemented on several blockchain technologies. A completely different starting point would be based on a conventional database such as PostgreSQL. Such a path would mean starting from a more familiar but fundamentally vulnerable technology that can be made more secure and robust in different ways. We view blockchain technology as an opportunity to start from an architecture where many elements of security, integrity and resilience are already built-in. We have e.g. assumed that physical access to servers that store the registry should not allow unauthorized effects. All transactions create an unbroken chain, which makes it difficult to manipulate data afterwards (and without traces). This counteracts manipulation which is essential for reliability and acceptance of the e-krona.

Conclusions and summary

We chose to look more closely at Hyperledger because we thought it was a promising platform and that it would be incorrect to disqualify the blockchain technology without actively working with it. Our experiences so far are positive. However, the point in this text is not to sell Hyperledger as the correct solution – on the contrary, it may be a completely different platform that should be chosen in the end. What we want to emphasize is the importance of an experimenting, iterative and hypothesis-driven approach. More questions and insights will continue to emerge, known-unknowns as well as unknown-unknowns. Analyzes and expertise can provide a lot, but we think it is crucial that it is combined with a long phase of the kind of open experimentation that characterizes the digital age. We hope that the Riksbank will continue on this path and dare take another few steps in the right direction. It could be an important social innovation in itself – to be radically open to society how this project progresses.

In summary, we recommend that the Riksbank to:

- Explore multiple paths in parallel – where blockchain technology is one path
- Allow a longer development period where understanding and architecture emerge
- Utilize a mixture of skills and competencies (economists, designers, behavioral scientists, hackers, ...)
- Be radically open and transparent in the process
- Avoid "The Big Procurement" with an enormous requirement specification that inevitably becomes hopelessly out of date within 3 years

⁴ Read more about Hyperledger: www.hyperledger.org/about