PROJECT: EXPERIMENTAL TEST OF CBDC

CENTRAL BANK DIGITAL CURRENCY

2023

- Retail CBDC
- Domestic payment

NORGES BANK

NORWAY

- 99,7 % internet penetration
- Approx. 50 % 5G mobile
- Close to completely cash less
- Digitally matured
- “All” people have a smartphone
- Public services are digitized
- High Trust in banks/govermnent
- Secure digital identity. BankID a separate company own by all banks. One single login to all banks, tax filing, company registry, health record, public services.
- Norway have Instant payment.

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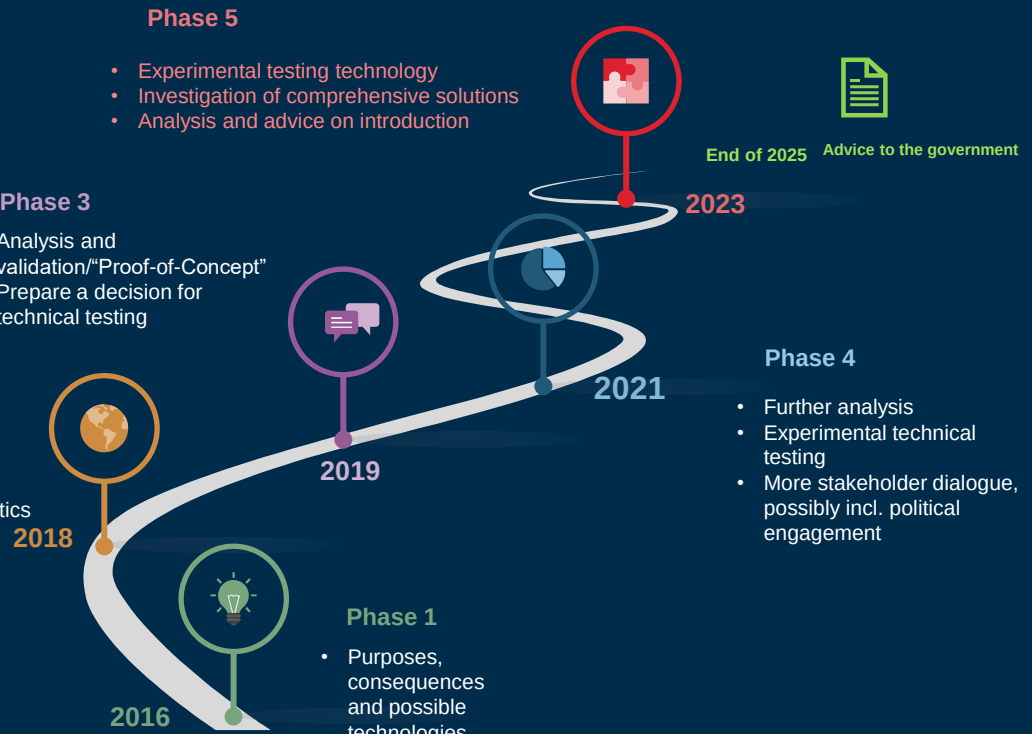
Earlier phases



OUR CHOICE OF TECHNOLOGY

GOOD FOR EXPERIMENTAL TEST
MOST LIKELY NOT FOR THE DEPLOYMENT OF CBDC IN PRODUCTION

Our aim is to learn

NORGES BANK

TECHNOLOGY – SANDBOX

Hyperledger Besu

The basic technology is based on Hyperledger Besu, which is also called **Enterprise Ethereum**.

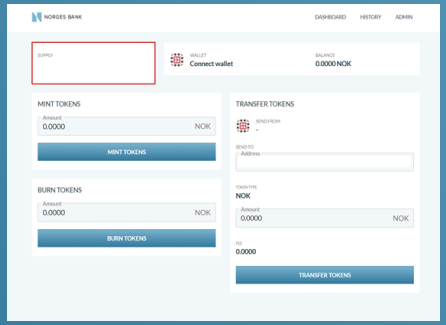
Consensus: Proof of Authority

Block every 5 sec

Wallet

We have a separate soft-wallet.

Banks are free to develop their own wallets, services and user-interface



ERC-20

Only Norges Bank can issue and burn

- **Norwegian kroner**
- **NOK**
- **4 decimal places**

Free transactions (no gas fee)

NORGES BANK

RFP1 - Central bank issue and redeem

CEO
Jacobo Toll-Messia

FinTech company based in Bergen, Norway

MVP / simple Pilot

Spring 2022
- ✓ Issue/mint new CBDC
- ✓ Send CBDC to private banks
- ✓ Receive CBDC from banks
- ✓ Redeem/burn CBDC

- ✓ Wallet for Central Bank
- ✓ Wallet for private banks

Autumn 2022
- ✓ Batch payment
- ✓ Swap to other eco-systems

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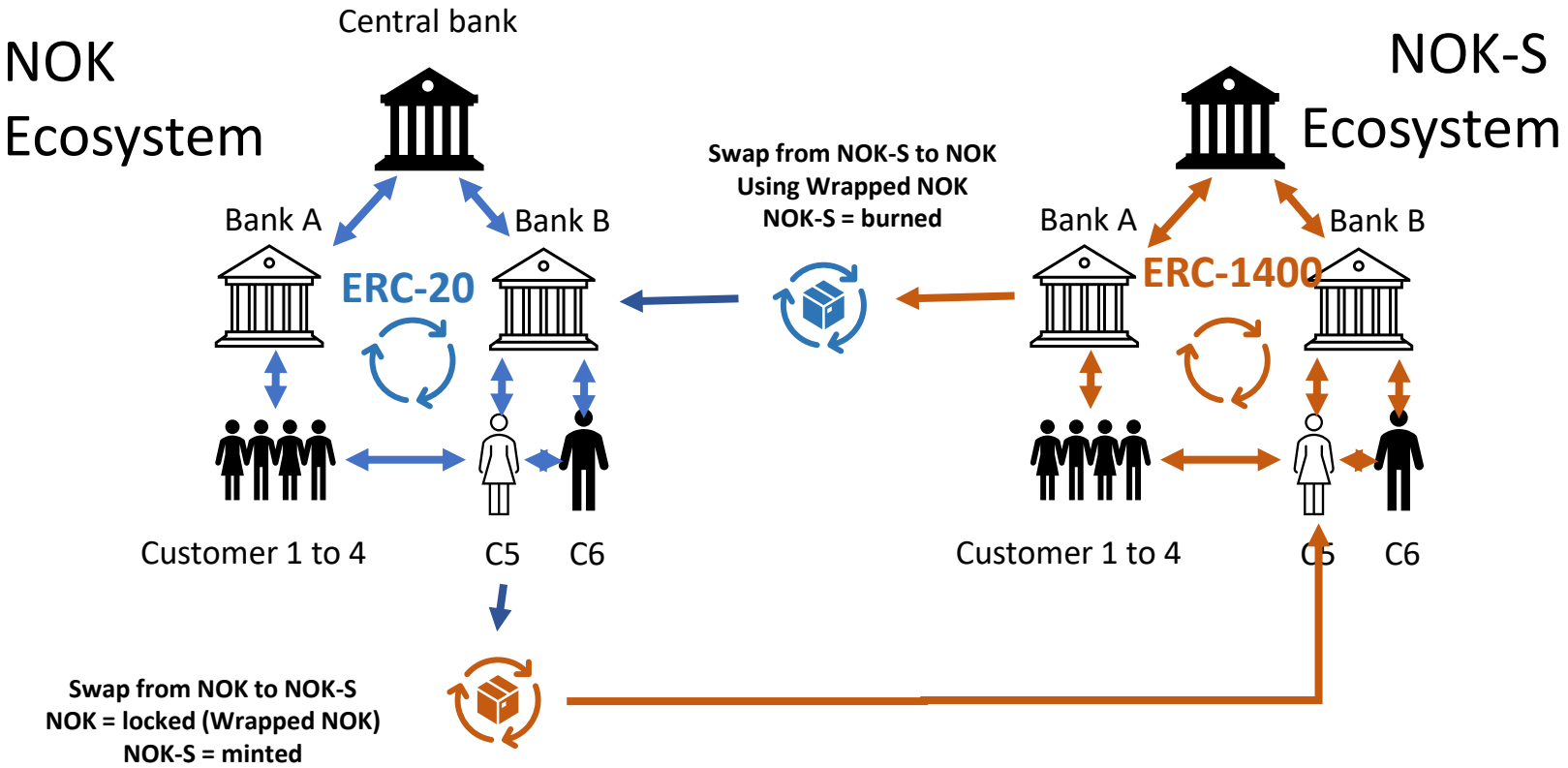
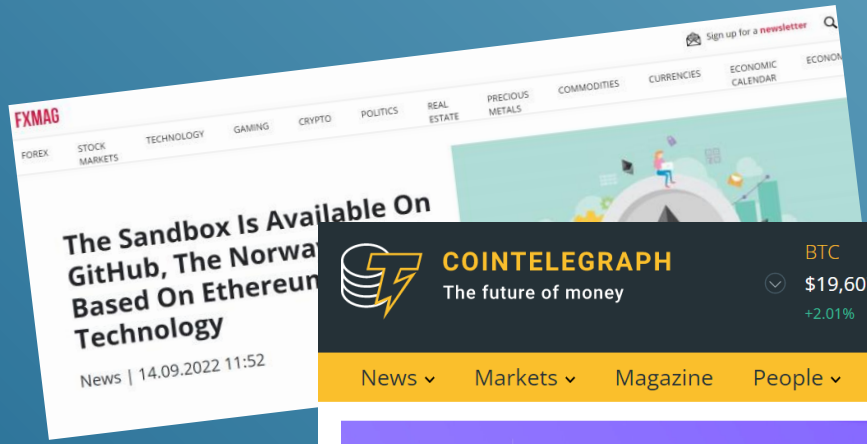
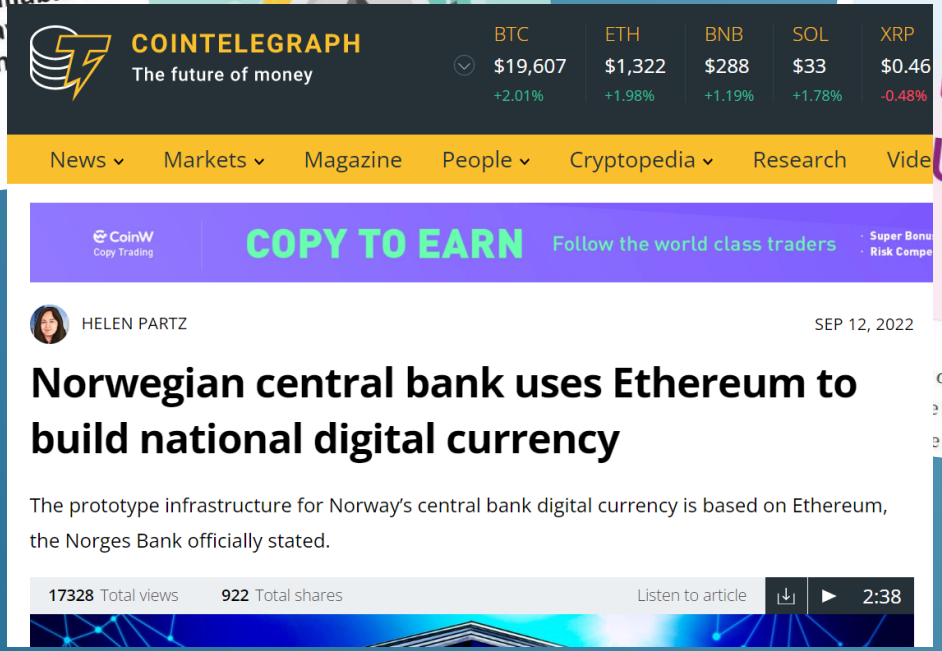
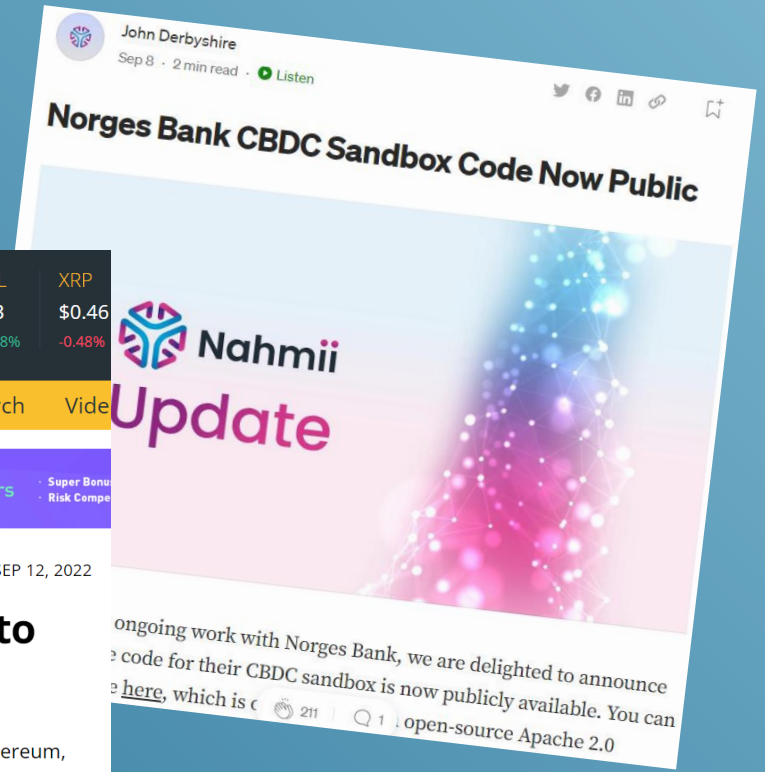
BRIDGE / SWAP


NOK
Ecosystem
Central bank
Bank A
Bank B
ERC-20
Customer 1 to 4
C5
C6
Swap from NOK to NOK-S
NOK = locked (Wrapped NOK)
NOK-S = minted
Swap from NOK-S to NOK
Using Wrapped NOK
NOK-S = burned
NOK-S
Ecosystem
Bank A
Bank B
ERC-1400
Customer 1 to 4
C5
C6

CODEBASE GITHUB







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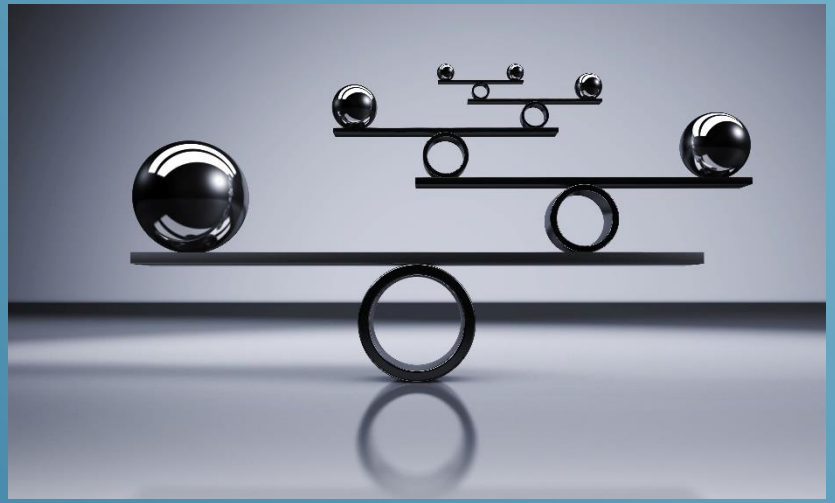
WHY HYPERLEDGER BESU?

Norges Bank tests many of the 17 Characteristics listed in the 1/2021 report

Third parties can relatively easily get into the sandbox (more than 200 000 EVM programmers)

Test CBDC money is token-based and programmable



A good choice for an effective experimental test

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RFP2 - More user-cases

CEO
Jon Ramvi

FinTech company based in Oslo, Norway

- ✓ Verifiable Credential
  (EU Digital Identity Wallet - eIDAS2)
- ✓ Alias/Nickname database
- ✓ Interest calculation -CBDC
- ✓ Zero Knowledge Proof
- ✓ Offline

- ✓ GDPR/Privacy
- ✓ Multi signature
- ✓ Etc.

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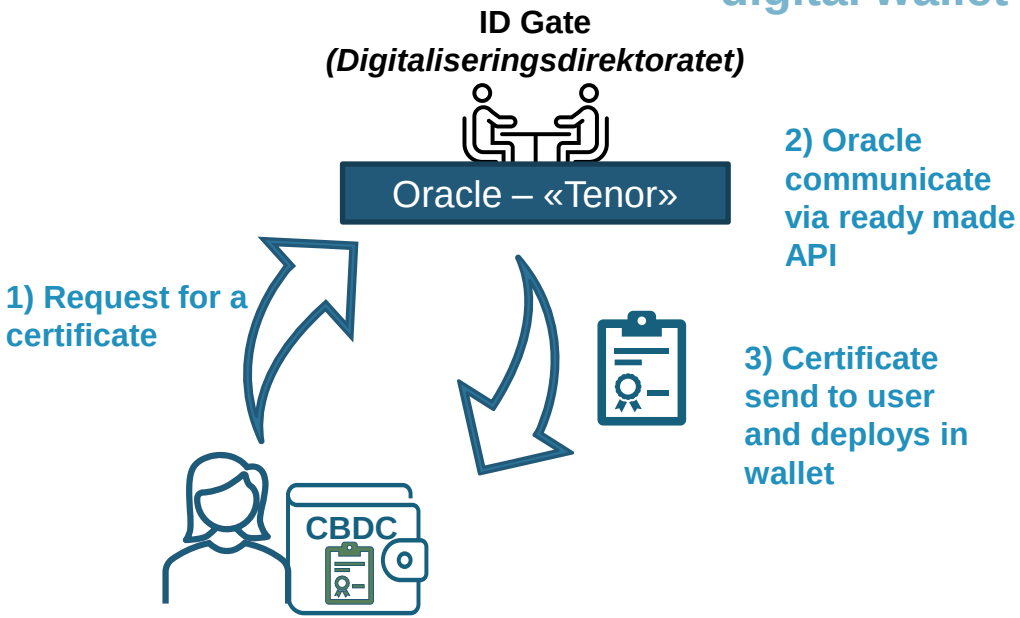
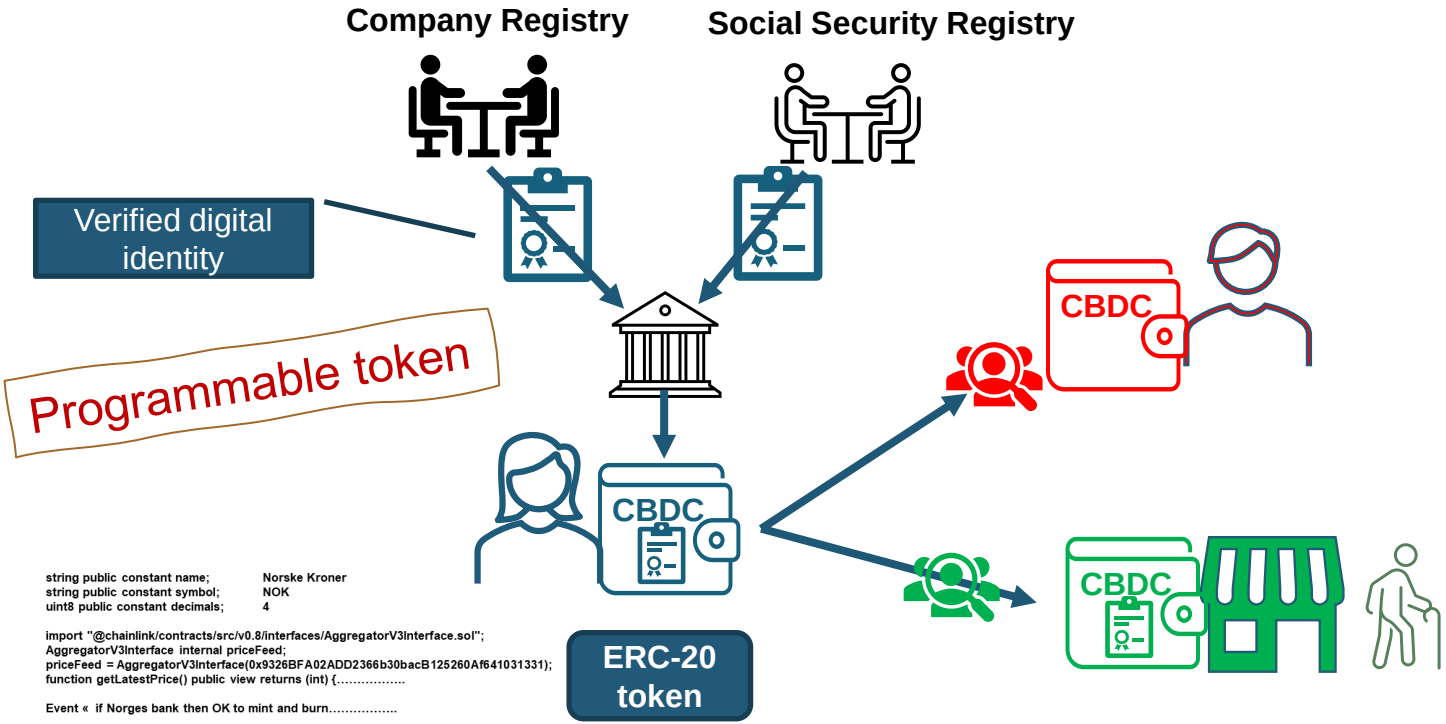
Verifiable Credentials (VC) – eIDAS2

digital wallet



Verifiable Credentials (VC) – eIDAS2

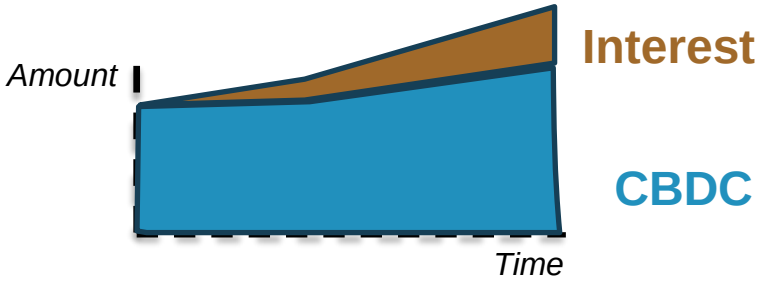
Verified certificate from centralised official databases



Interest on CBDC – positive & negative interest

Testing the aave calculation model

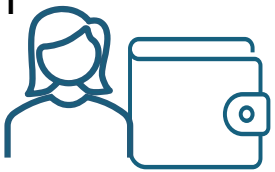
Norges Bank

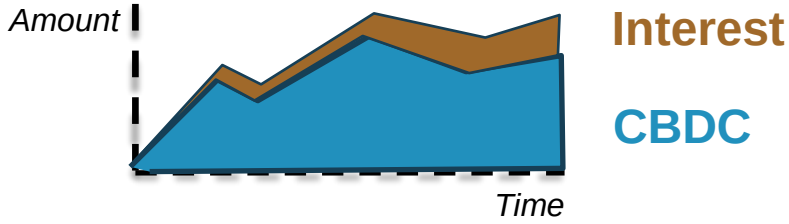


Programmable token

Aave model: based on every second, componded interest, calculated on transaction, mint and burn

Private person
Company





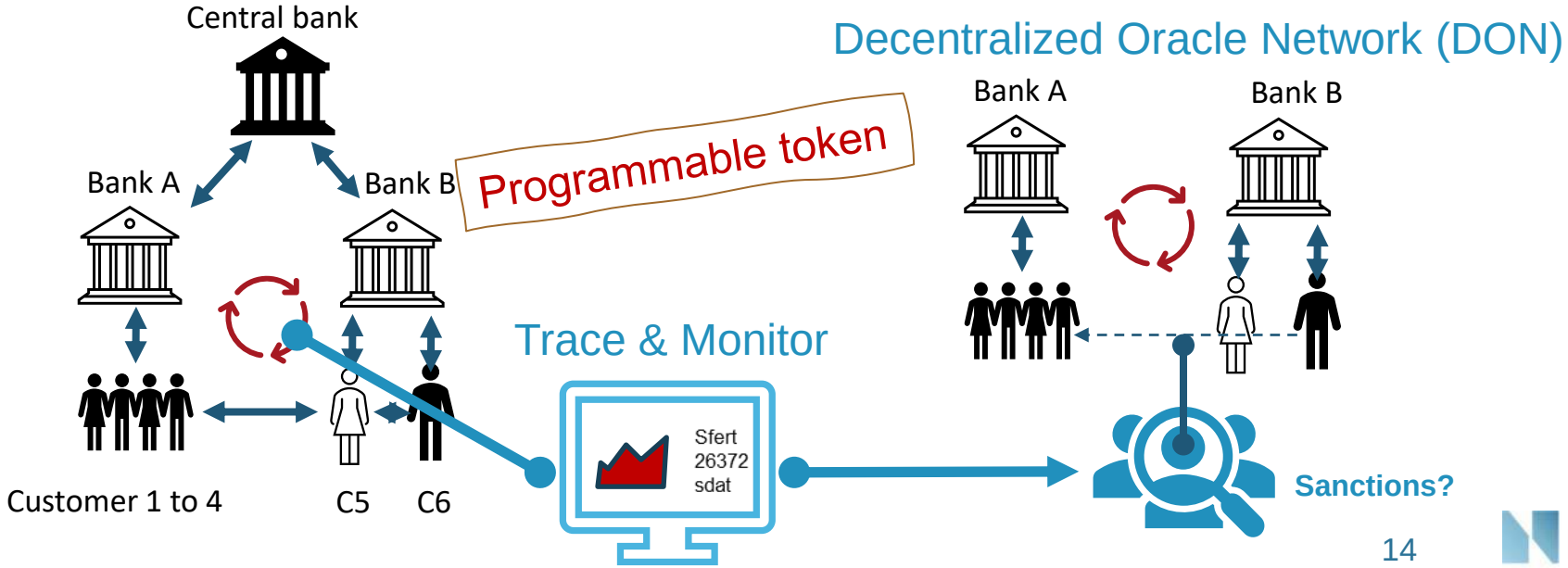

```
string public constant name;          Norske Kroner
string public constant symbol;        NOK
uint8 public constant decimals;       4

import "@chainlink/contracts/src/v0.8/interfaces/AggregatorV3Interface.sol";
AggregatorV3Interface internal priceFeed;
priceFeed = AggregatorV3Interface(0x9326BFA02ADD2366b30bacB125260Af641031331);
function getLatestPrice() public view returns (int) {.....

Event «  if Norges bank then OK to mint and burn.....
```

ERC-20 token

AML/CTF

Anti Money Laundering and Counter Terror Financing

EBA: 100 billion € in Compliance cost by banks – 1 000 billion illicit payment - approx. 1 % stopped
CBDC represent new technology either based on blockchain/DLT or account based in traditional technology. How can new technology reduce cost of doing compliance for banks/PSP and at the same time increase the discovery rate and seizure for illicit payment.



Other use cases

Anonyme payment.

Symfoni started with a project for anonyme payment in parallel with the NBX AML/CTF project. The plan was to utilize ZKP (Zero Knowledge Proof). But our programmers concluded that ZKP conflicts with business logic (smart contacts) inside our ERC-20 token. We ended up using something called “Stealth Addresses” strategy, that also can be quantum immune with a small change in the standard algorithm. This is not to say that Norges Bank plan to include anonyme payment in the future, but we needed to find out what the technology could allow. As anonymity and AML/CTF conflicts it was interesting to do them in parallel. As far as we know Norges Bank is the first central bank in the world to test anonyme payment this way.

Cap on CBDC.

This was the last service / user case Symfoni developed for us. If amount of CBDC exceeds a defined threshold, the amount over this threshold should automatically be transferred to the user’s bank account. As we did not have integration to banks in phase 4 CBDC was transferred to a special CBDC wallet. The payer did not get a notice, but the receiver got only the amount within the threshold and the transaction was automatically split between payee and the separate wallet. The cap was also on amount per day and week if exceeded defined threshold.

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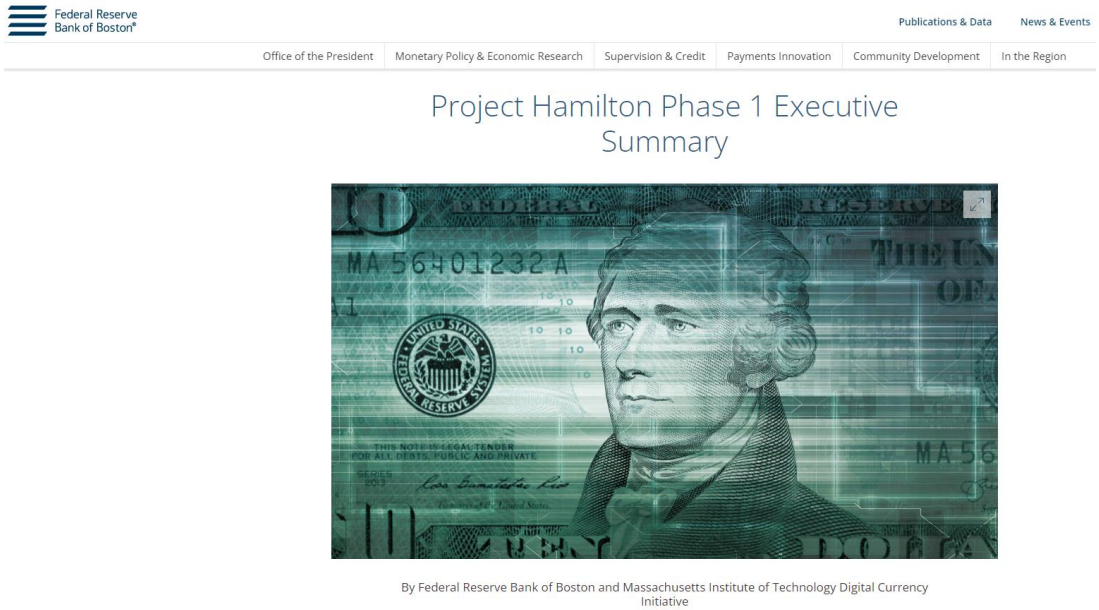
Project Hamilton – Boston FED / MIT

One student 40 %

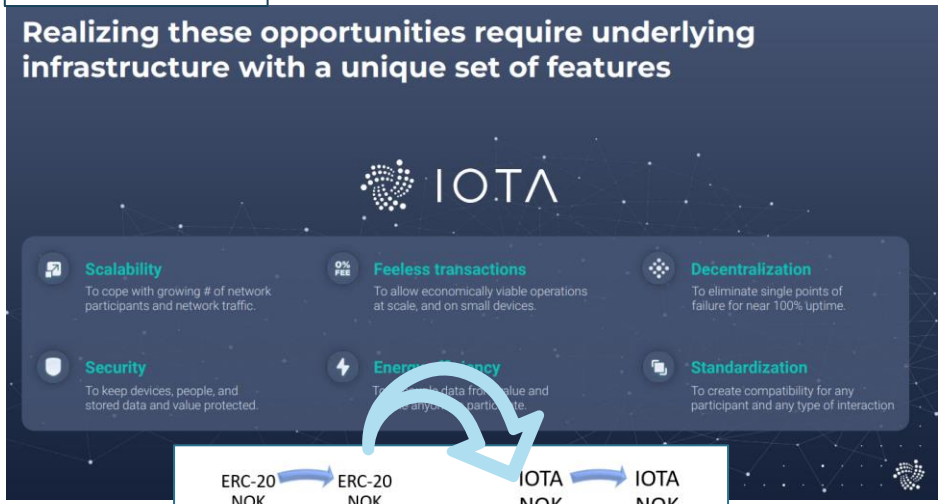


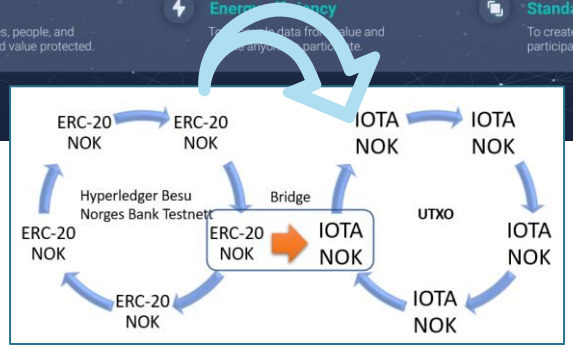
Off-the-shelf test

Workshops

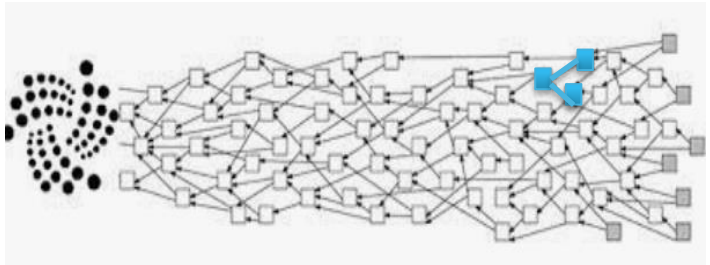
IoT and M2M payment

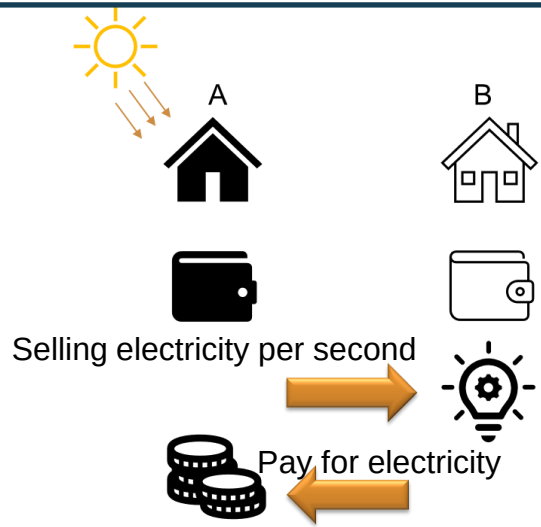
ALPHA VENTURI





Directed Acyclic Graph or **DAG**





Public engagement and Hackathons /Ideathons

University Bergen

The Norwegian Digitalization Agency

University of Oslo

Fintech Norway

Etc.

NORGES BANK

ALLE TEMA | AKTUELT

Forside › Alle tema › Finansiell stabilitet › Digitale sentralbankpenger › Prosjekt Icebreaker

Prosjekt Icebreaker

BIS og sentralbankene i Norge, Sverig
kryssende betalinger med digitale se

for International Settlement (BIS)

SVERIGES RIKSBANK

news.cision.com / Sveriges Riksbank / The Riksbank tests

The Riksbank tests c
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nk and the central banks of Israel and Norway and th for Inter
er, a joint exploration of how Central Bank Digital Currencies (CBDCs
ents.

yments continue to be plagued by high costs, low speed, limited access and insufficient transparency. The
d an ambitious programme to improve cross-border payments, aiming to achieve faster and cheaper, as
sparent and inclusive cross-border payments. One of the workstreams explores how CBDCs could play a
cross-border payments. The BIS Innovation Hub and other international institutions and standard-settin
been working together to investigate the use of CBDCs for cross-border payments. The most recent
ed last July.

is a collaboration between Sveriges Riksbank, the Bank of Israel, Norges Bank, and BIS Innovation Hub
velop a "hub" to which participating central banks will connect their domestic proof-of-concept CBDC
ive is to test some specific key functions and the technological feasibility of interlinking different

BIS

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Project Icebreaker: Central banks of Israel, Norway and Sweden team up with the BIS to explore retail CBDC for international payments

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Norway, Sweden, and Israel central banks launch "Project Icebreaker" with BIS to explore central bank digital currencies

September 29, 2022 - by Kanlayakorn Pengrattana - 1 Comment

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GLOBAL government FINTECH

DIGITAL CURRENCIES

'Project Icebreaker' to test 'immediate' cross-border retail CBDC payments

By **Ian Hall** - September 30, 2022, 2:21 pm

RFP3 – Cross border + more

Norwegian Block Exchange

CEO

Stig Aleksander Kjos-Mathisen

FinTech company based in Oslo, Norway

- ✓ Programmers for Project Icebreaker
- ✓ KYC/AML/CTF

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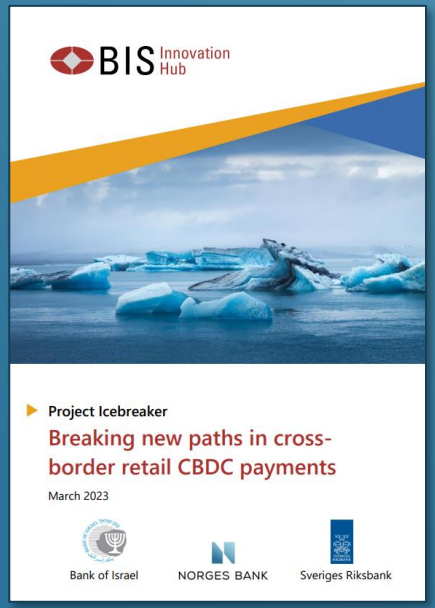
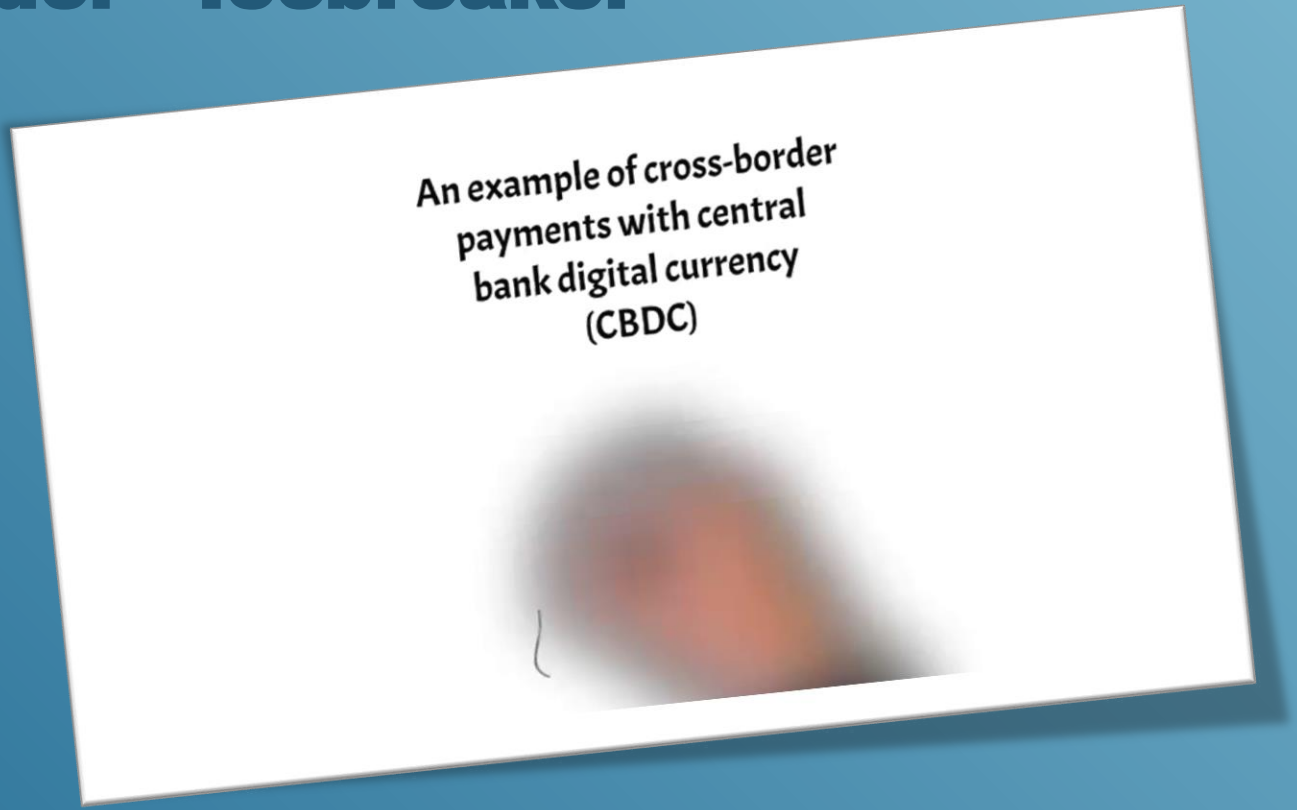
Cross border - Icebreaker





NORGES BANK

NORGES BANK

Lasse Meholm

Oktober 2023

Experimental test of technology for CBDC phase 5

a part of the Norwegian CBDC project

Agenda

presentation October 2023

1) Strategy25
2) Earlier phases
3) Organizing
4) Sandboxes
5) Estimate project plan
6) Cooperation

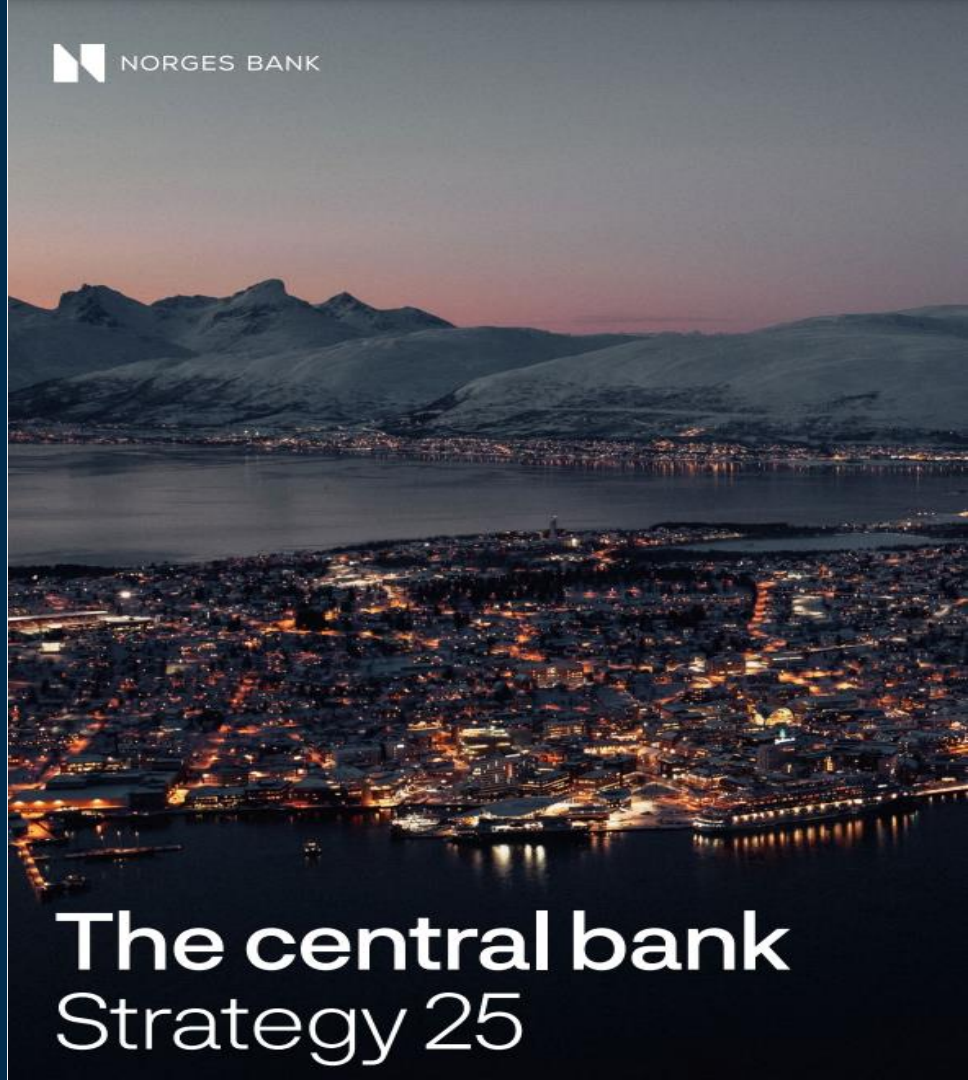
Strategy25

Norges Bank will prepare the ground for the issue, if appropriate, of a central bank digital currency (CBDC).

A CBDC may be necessary to ensure that NOK will continue to be a safe, efficient and attractive means of payment in the future too.

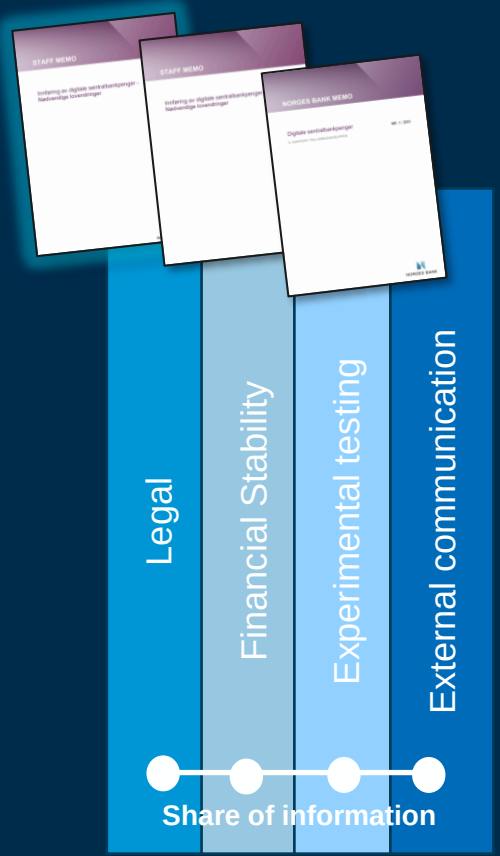
During the strategy period, we will analyze the possibilities afforded by, and the consequences of, introducing a CBDC and test candidate solutions.

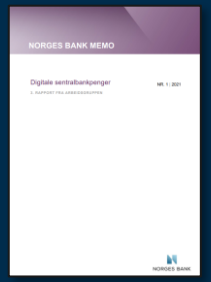
To obtain knowledge and contribute to international standardization and cooperation, we will work with other central banks and international organizations.



Phase 4 -CBDC

How did we organize?





Phase 5 -CBDC

How do we organize?

Phase 4

Phase 5

Share of information and experience

Peder Østbye

Analysis and advice on introduction

- Law
- Financial Stability
- Analytical work

Lasse Meholm

Technology Test

- Experimental testing
- External communication
- Developer and architect

Morten Audsen

Investigation of comprehensive solutions

- comprehensive solutions
- Solution architect
- External communication

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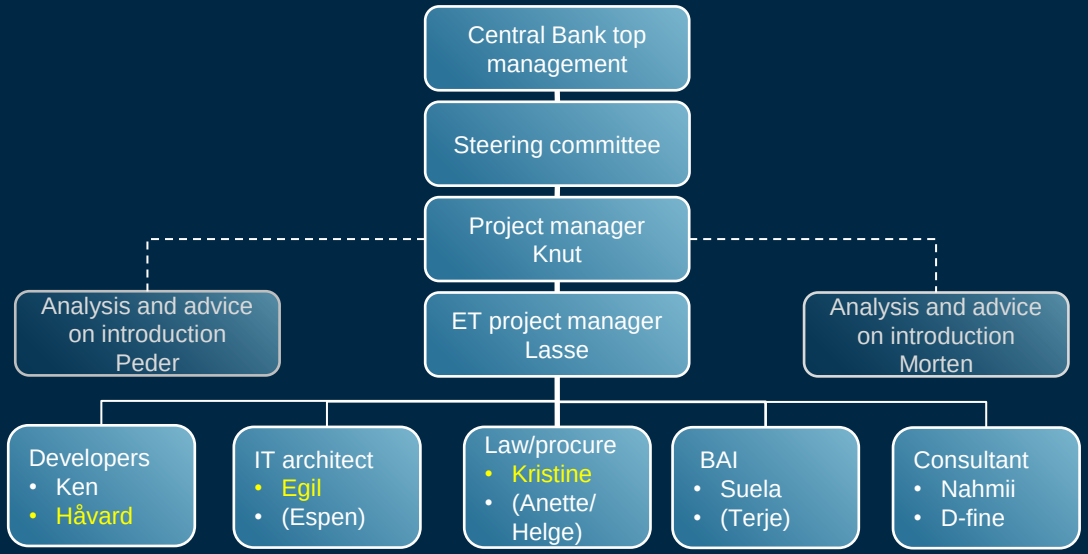
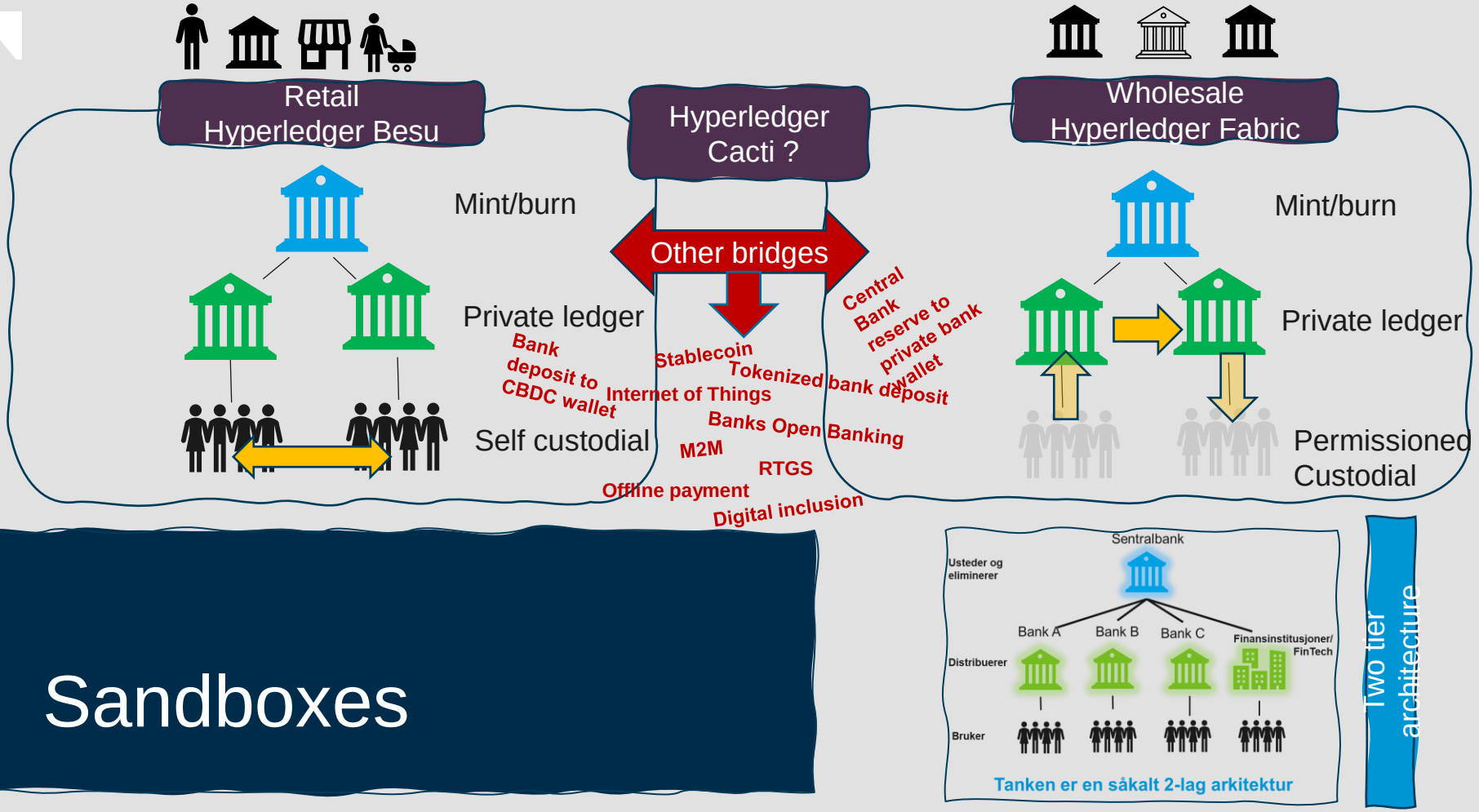
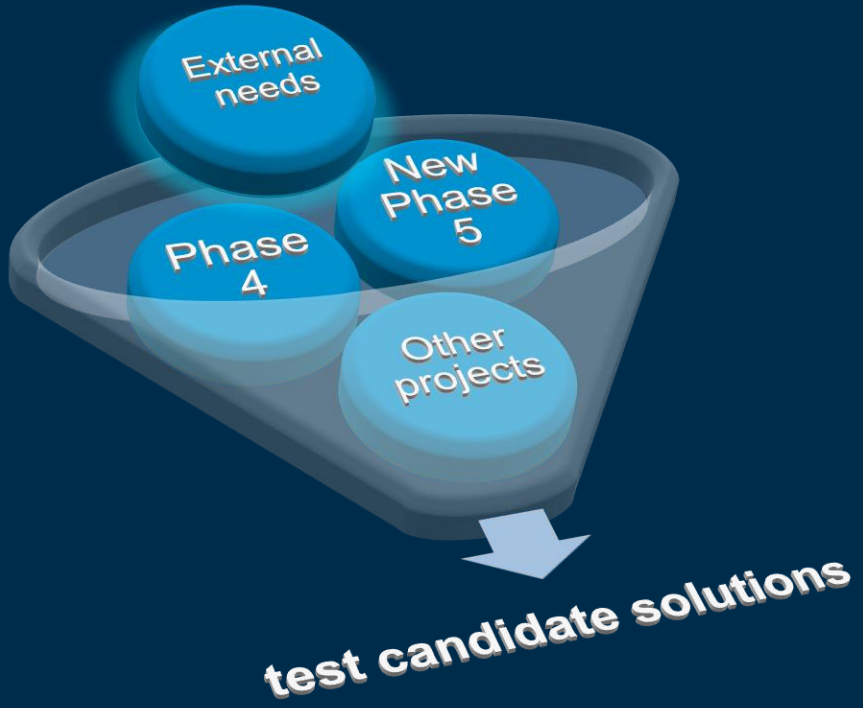
Organizing Experimental Testing (ET)



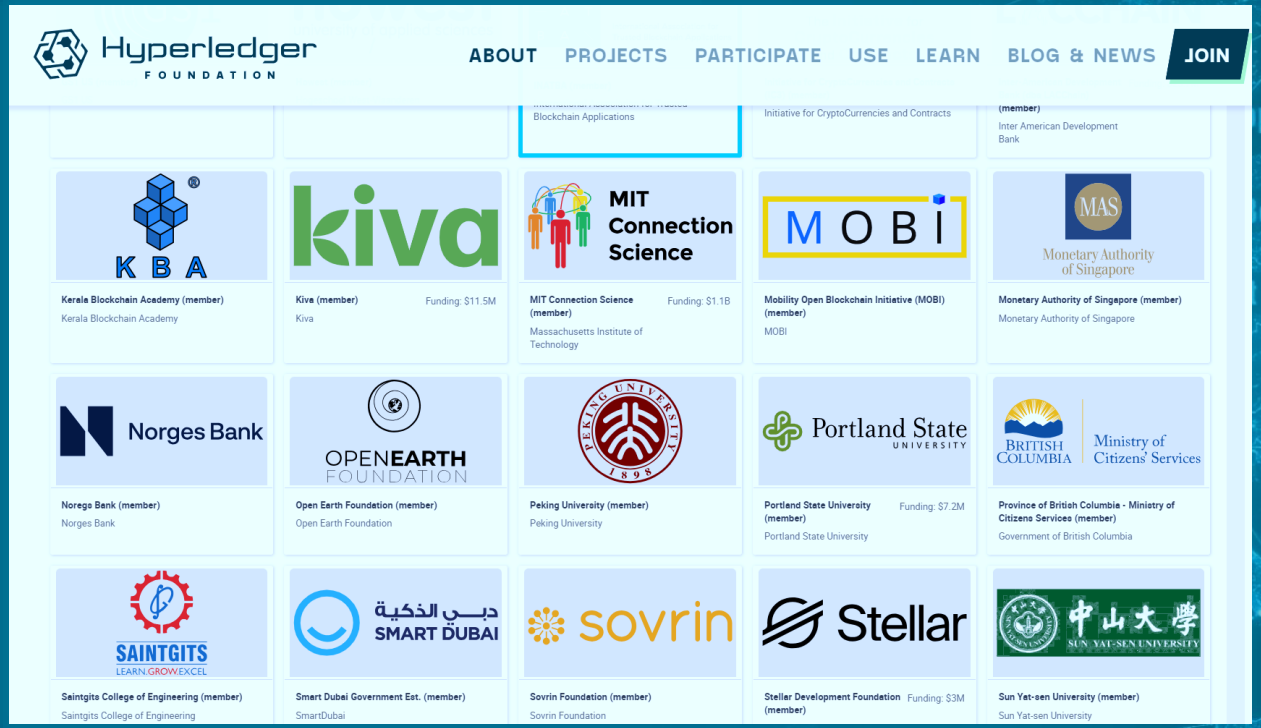
Started by October 2023


Retail
Hyperledger Besu
Hyperledger
Cacti ?
Wholesale
Hyperledger Fabric
Mint/burn
Private ledger
Self custodial
Other bridges
Central Bank reserve to private bank wallet
Stablecoin
Tokenized bank deposit
Bank deposit to CBDC wallet
Internet of Things
Banks Open Banking
M2M
RTGS
Offline payment
Digital inclusion
Mint/burn
Private ledger
Permissioned Custodial
Sandboxes
Sentralbank
Usteder og eliminerer
Bank A
Bank B
Bank C
Finansinstitusjoner/ FinTech
Distribuerer
Bruker
Tanken er en såkalt 2-lag arkitektur
Two tier architecture

Experimental test phase 5



Associated member of Hyperledger Foundation



RFP 2023

Frameagreement 2023 - 2025

Nahmii

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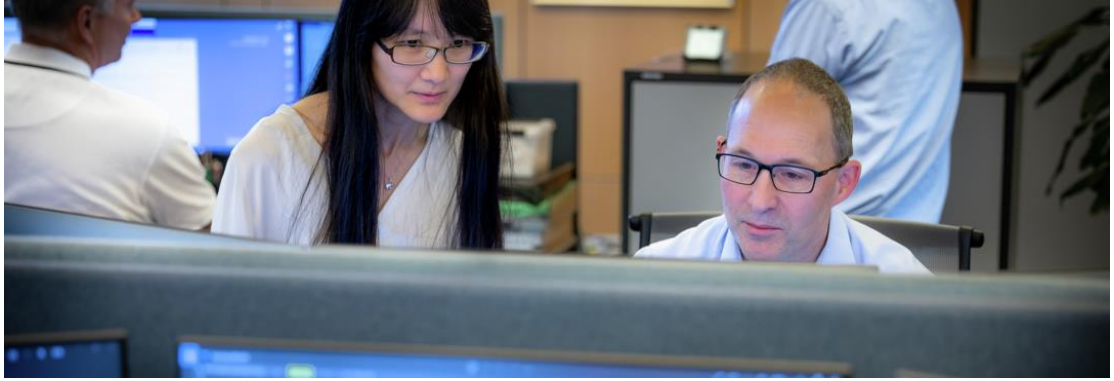

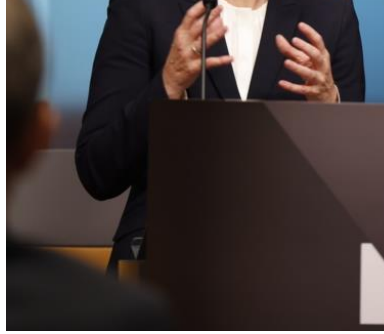

Next 2,5 years

- We look forward to a good collaboration with private and public organizations.
- The purpose is still to learn, experience and mature skills, thoughts and strategies.
- So that we prepare the ground for the issue, if appropriate, of a central bank digital currency (CBDC).