Blockchain for a Circular Digital Built Environment

DiCE Lab Seminar – Digitalisation for a Circular Built Environment – 21 September 2023 @TU Delft

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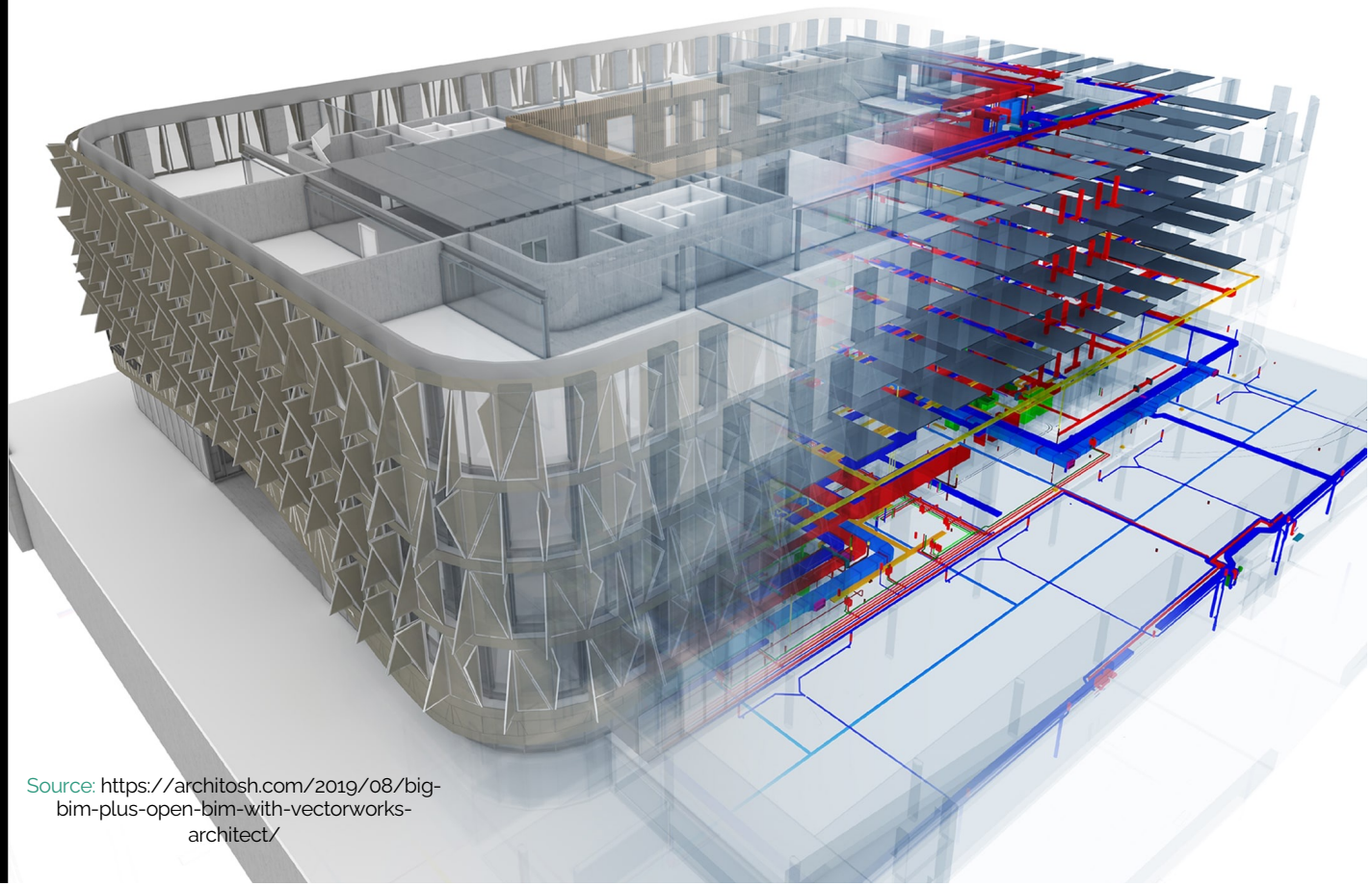
ETH, 2022 Doctorate on blockchain in construction under the supervision of Daniel Hall

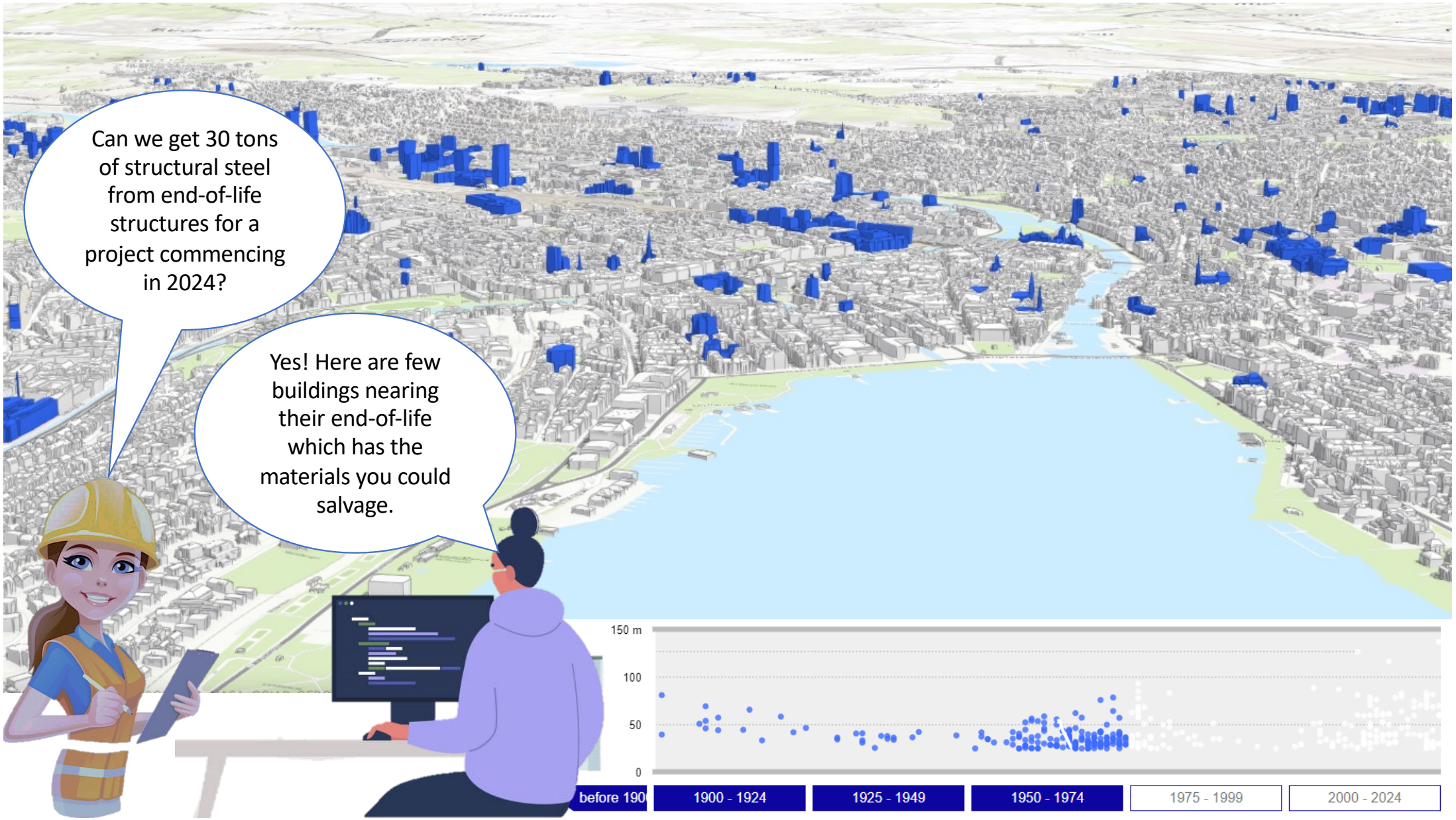
ETH, 2017 MSc in Civil Engineering (Construction Management and Geotechnical Engineering)

Motivation



Source: https://architosh.com/2019/08/big-bim-plus-open-bim-with-vectorworks-architect/

More and more data is being generated that can be useful in the transition to a circular economy.


Can we get 30 tons of structural steel from end-of-life structures for a project commencing in 2024?
Yes! Here are few buildings nearing their end-of-life which has the materials you could salvage.
150 m
100
50
0
before 190
1900 - 1924
1925 - 1949
1950 - 1974
1975 - 1999
2000 - 2024

Motivation

Circularity of Built Assets and Products

=!

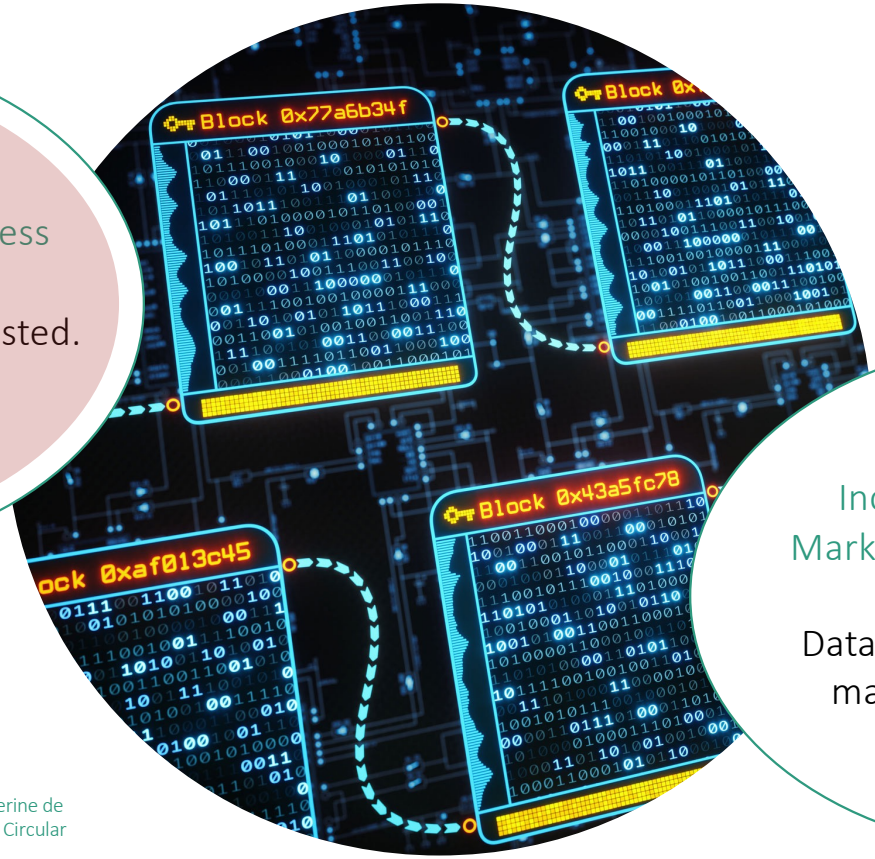
Circularity of their Data

Blockchain for a Circular Digital Built Environment

Blockchain and Its Connection to Circular Economy

Time Stamping, Storage, Access

Data must be available and trusted.



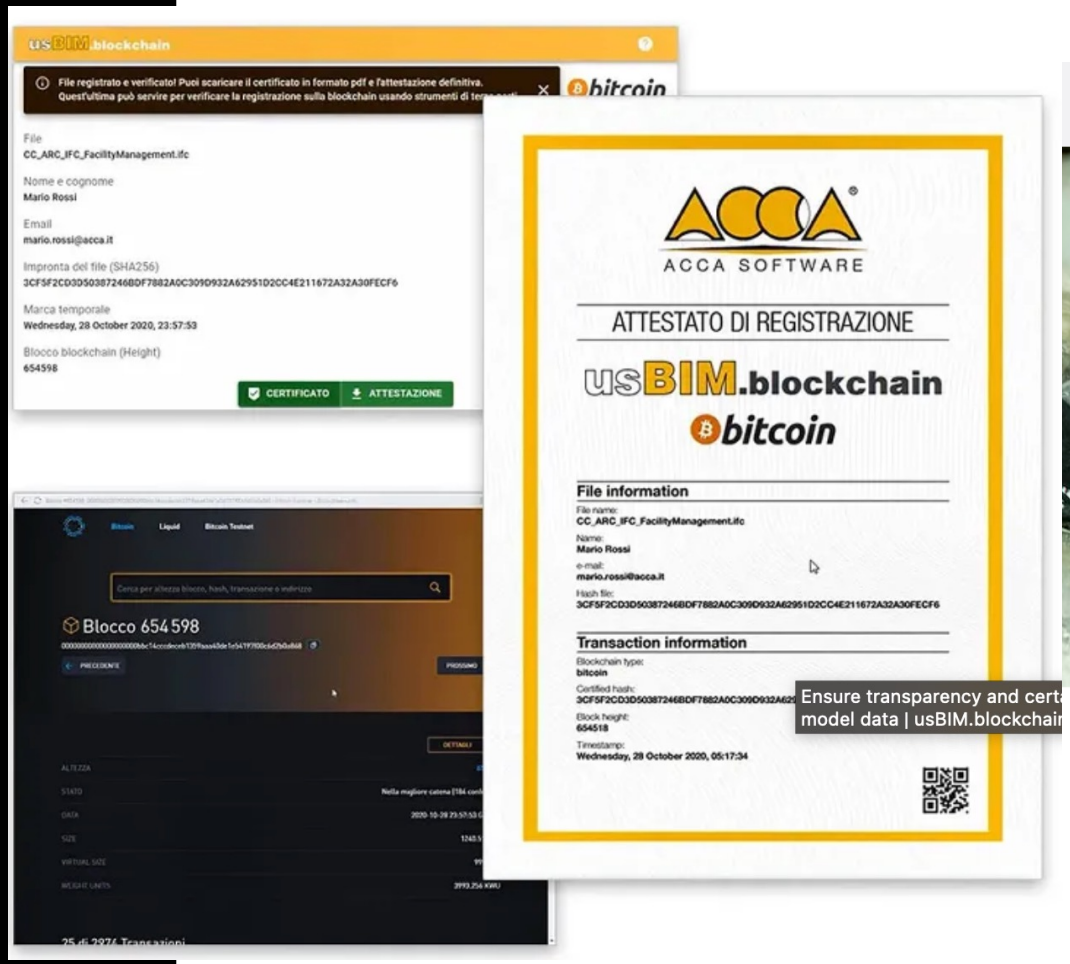
Incentives, Decentralized Marketplaces, Machine Agents

Data must be made available, maintained, and updated.

Categories based on: Hunhevicz, Jens, Catherine de Wolf (2023 Forthcoming). "Blockchain for a Circular Digital Built Environment.

Blockchain for a Circular Digital Built Environment

Track and Trace (Time Stamping + Storage)



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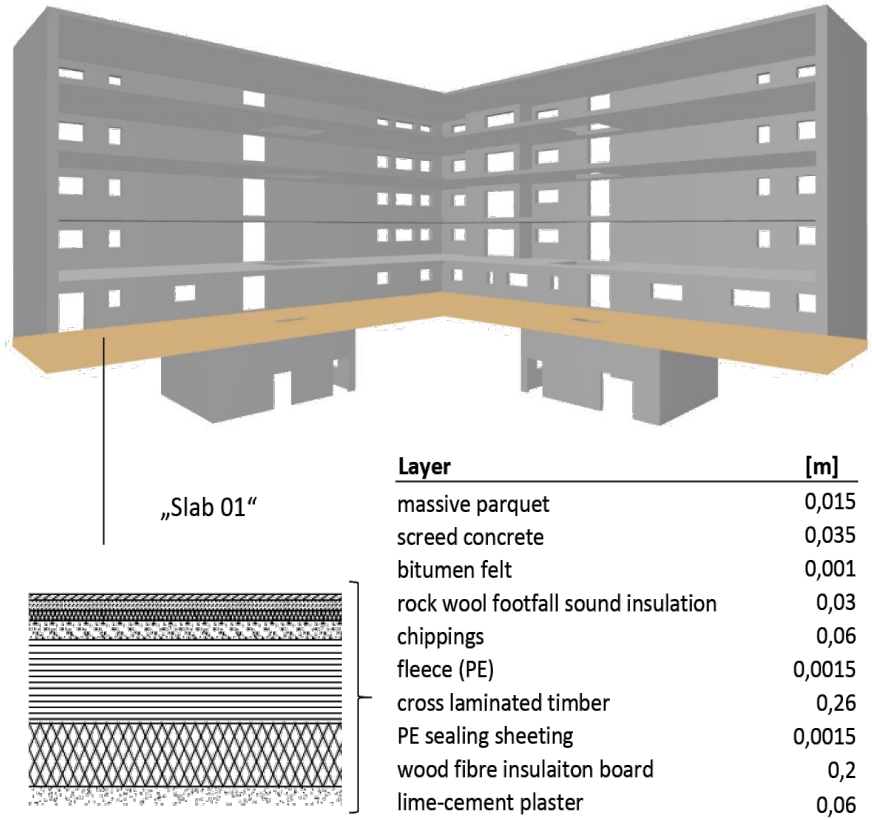
Track and Trace for Material Passports



„Slab 01“

Layer	[m]
massive parquet	0,015
screed concrete	0,035
bitumen felt	0,001
rock wool footfall sound insulation	0,03
chippings	0,06
fleece (PE)	0,0015
cross laminated timber	0,26
PE sealing sheeting	0,0015
wood fibre insulaiton board	0,2
lime-cement plaster	0,06

Source: Meliha Honic

Track and Trace of data of can make data trustworthy to supply chain stakeholders over long time periods.

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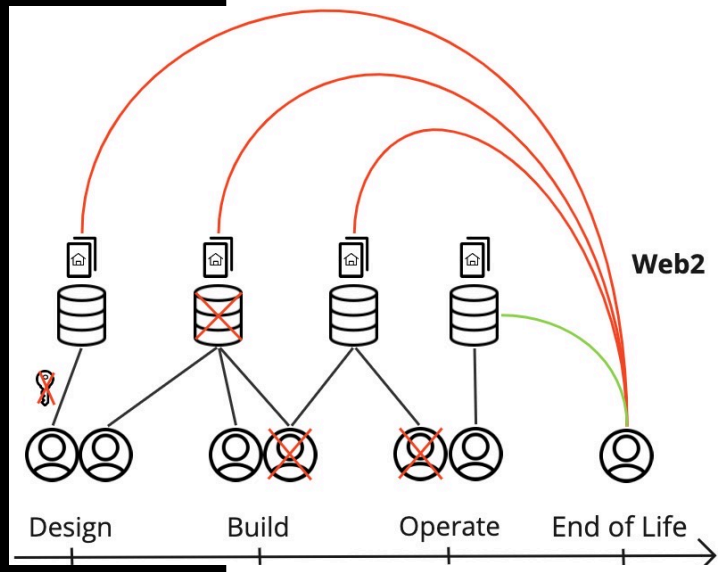
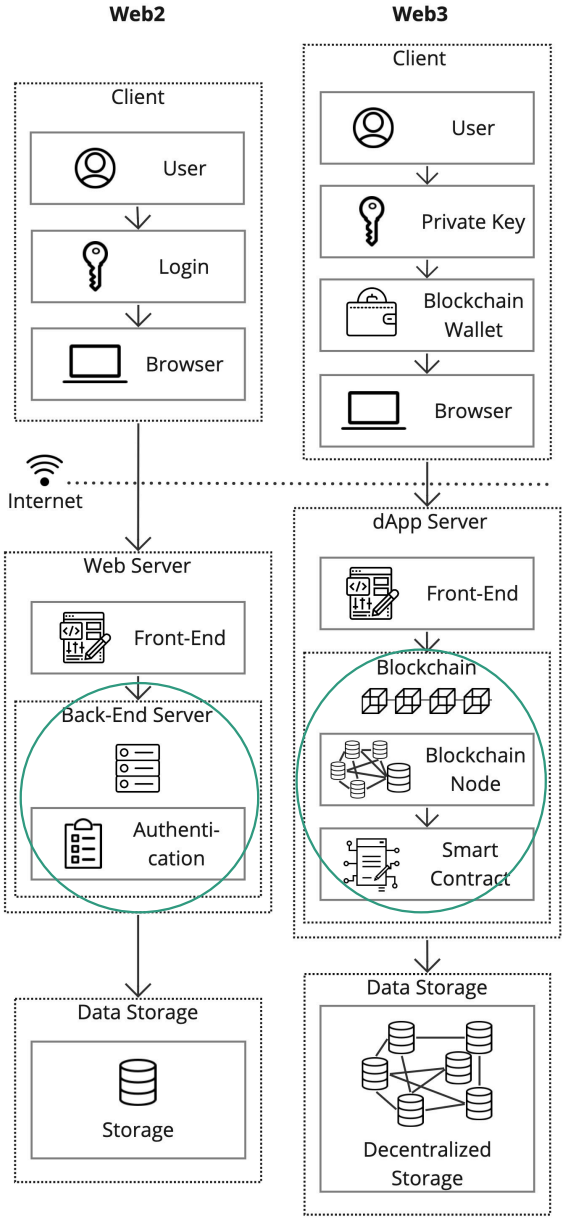
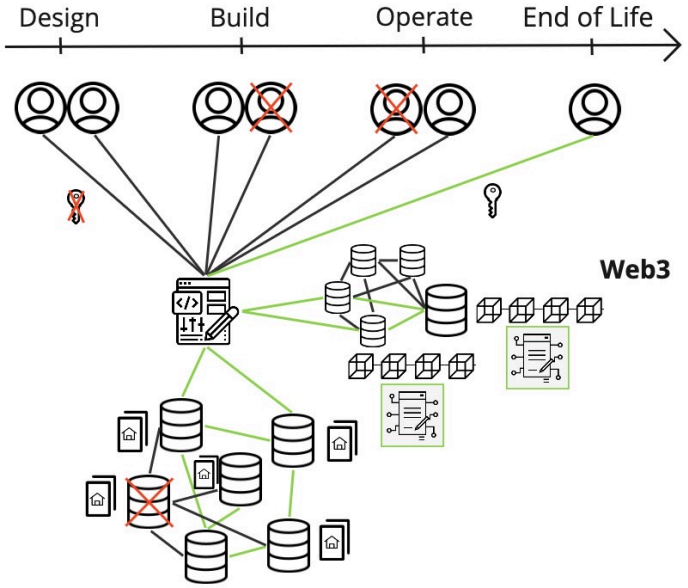
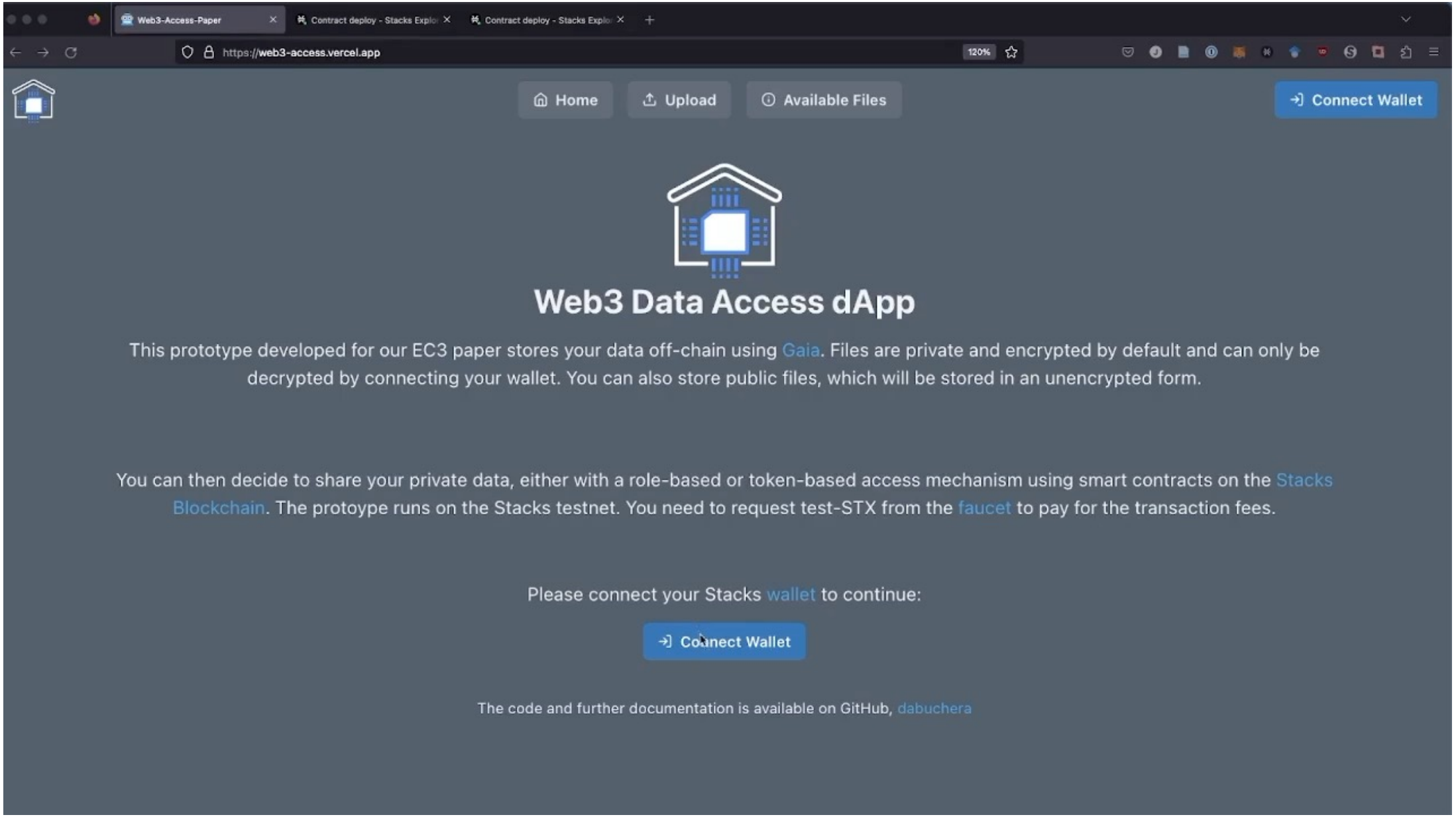
Access








Web3-Access-Paper
Contract deploy - Stacks Explo
Contract deploy - Stacks Explo
https://web3-access.vercel.app
120%
Home
Upload
Available Files
Connect Wallet
Web3 Data Access dApp
This prototype developed for our EC3 paper stores your data off-chain using Gaia. Files are private and encrypted by default and can only be decrypted by connecting your wallet. You can also store public files, which will be stored in an unencrypted form.
You can then decide to share your private data, either with a role-based or token-based access mechanism using smart contracts on the Stacks Blockchain. The protoype runs on the Stacks testnet. You need to request test-STX from the faucet to pay for the transaction fees.
Please connect your Stacks wallet to continue:
Connect Wallet
The code and further documentation is available on GitHub, dabuchera

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Blockchain and Its Connection to Circular Economy

Time Stamping, Storage, Access

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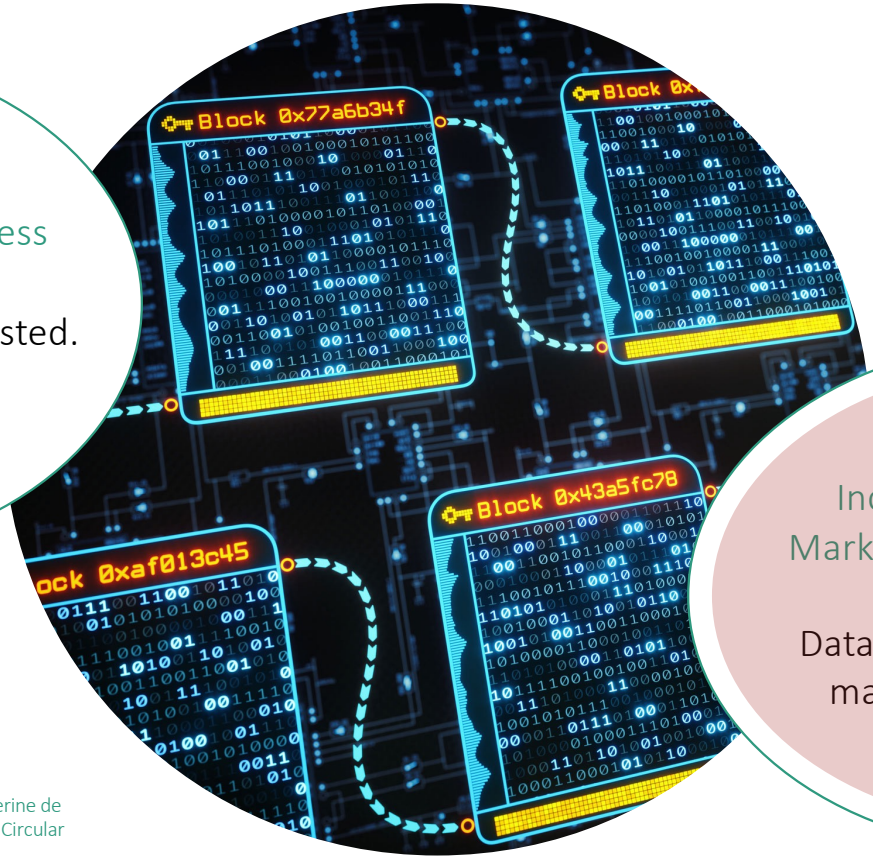

Incentives, Decentralized Marketplaces, Machine Agents

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Incentives, Marketplaces, Machine Agents

Data control by the infrastructure.

Performance incentives for circularity.

Marketplaces to exchange and maintain building data.

Conclusion

So, why do we think it is worth researching on blockchain for a circular built environment?

At the very least, it can be an enabler for more trusted and accessible data throughout the building lifecycle, as well as novel digital circular business models through crypto economic incentives.

Let’s keep in touch!

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Questions?