Deploying Blockchain & Distributed Ledger Technology for Government Digital Transformation

Overcoming Barriers to Adoption

Victoria L. Lemieux, PhD, CISSP
University of British Columbia

WHAT IS A BLOCKCHAIN AND DISTRIBUTED LEDGER TECHNOLOGY?

- More than cryptocurrencies

- A disruptive type of digital records system that relies upon a distributed ledger for the creation and preservation of authoritative records, that is, records that have authenticity, reliability, integrity and useability (ISO 15489-1: 2016, s. 5.2.2)

- A distributed ledger is a ‘ledger that is shared across a set of [distributed ledger technology (DLT)] nodes and synchronized between the DLT nodes using a consensus mechanism’ (ISO 22739: 2020, s. 3.22)

- A blockchain is ‘distributed ledger with confirmed blocks organized in an append-only sequential chain using cryptographic links’ (International Organization for Standardization (ISO 22739:2020, s. 3.6),

- **A complex system combining technical, data/records and social components**

WHAT IS A BLOCKCHAIN AND DISTRIBUTED LEDGER TECHNOLOGY?

https://youtu.be/ugHFYEcui2Q

ADOPTION OF BLOCKCHAIN AND DISTRIBUTED LEDGER TECHNOLOGY IN THE PUBLIC SECTOR

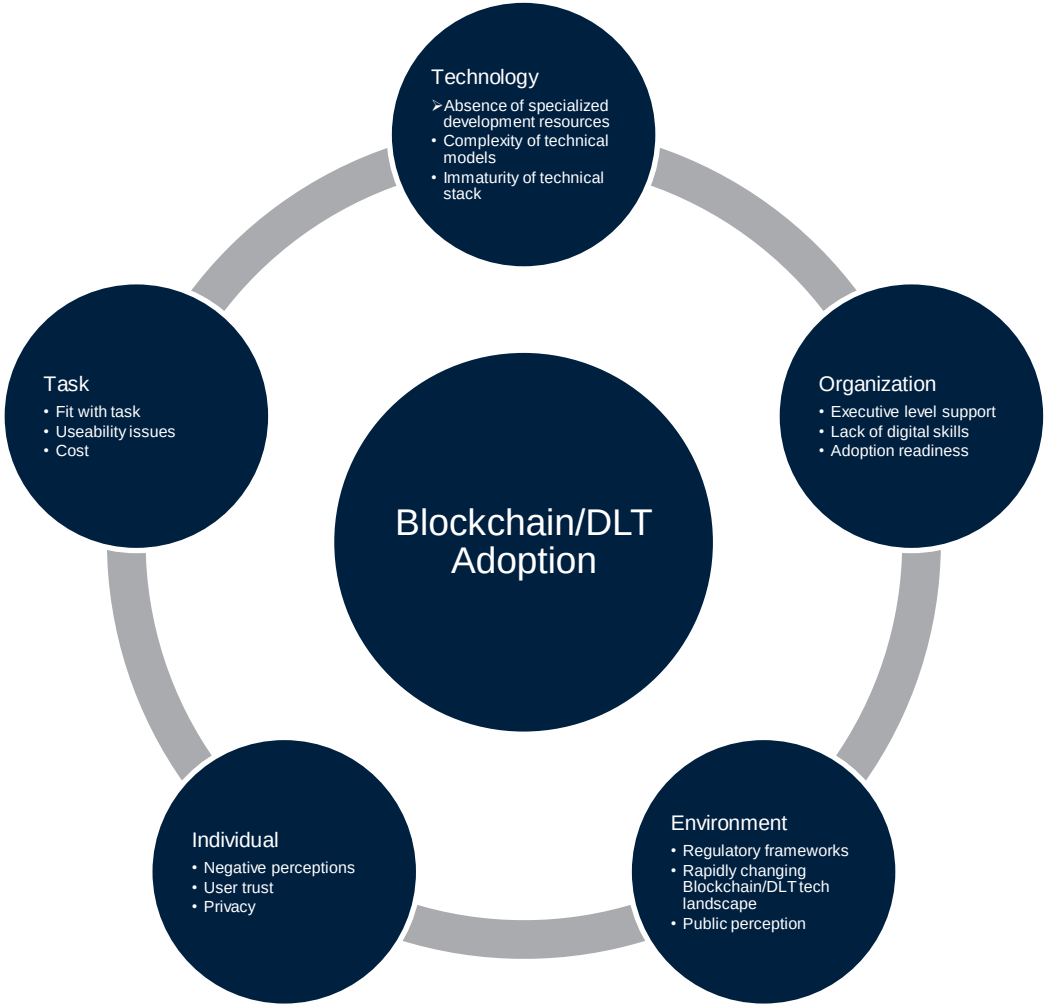
Governments worldwide have been experimenting over several years with the application of blockchain and distributed ledger technology in many areas, for example:

- Land registration
- Automation of e-government processes
- Food security and supply chain
- E-voting
- Procurement (and fraud prevention)
- Health
- Education
- Identity Management - Individual and Corporate
- Smart cities and IoT
- National Archives and cultural heritage

But very few projects have succeeded in moving from trials to fully operational solutions

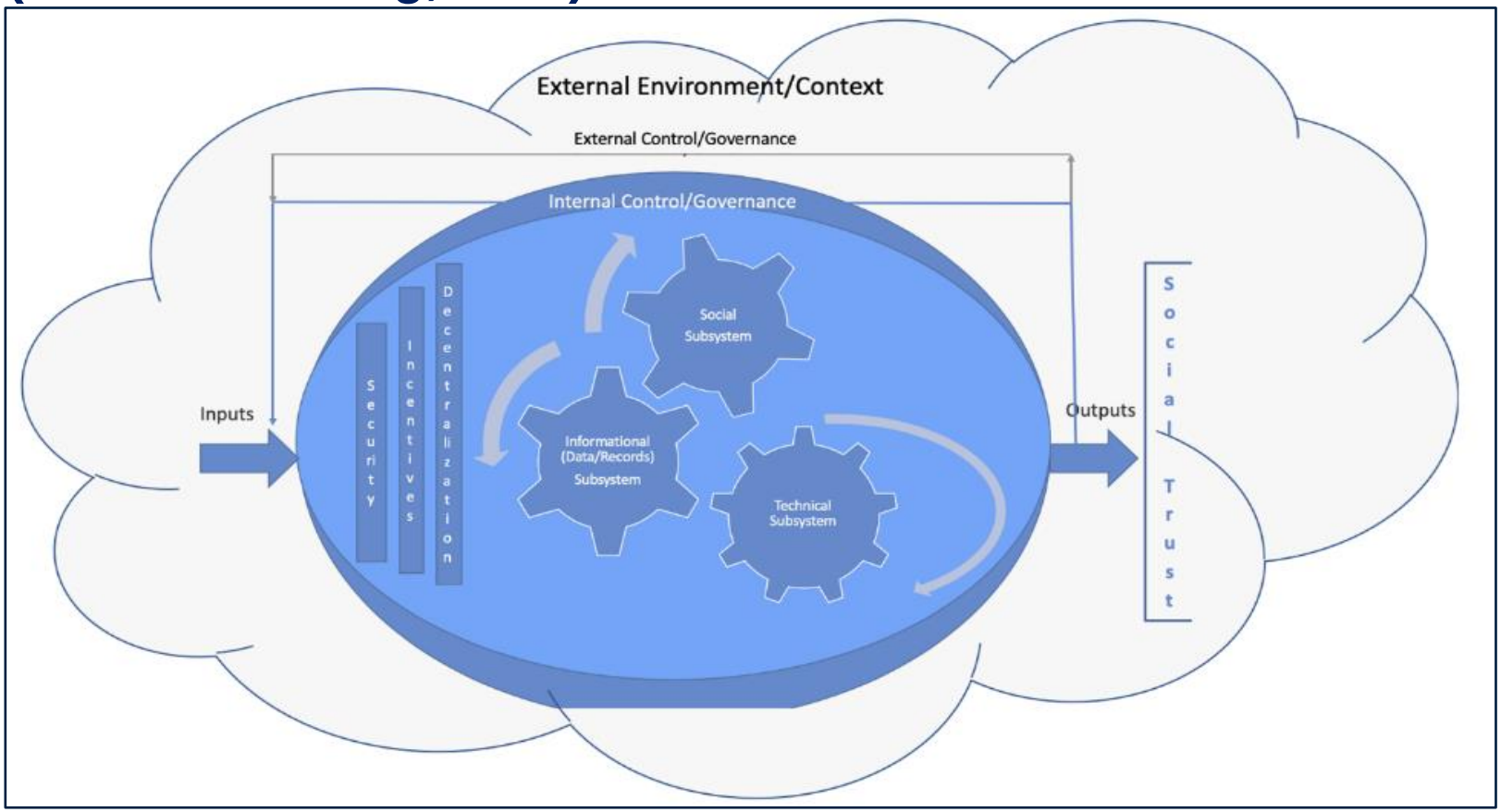
The maturity of blockchain and DLT technology adoption in the public sector remains LOW

BARRIERS TO ADOPTION OF BLOCKCHAIN AND DISTRIBUTED LEDGER TECHNOLOGY IN THE PUBLIC SECTOR



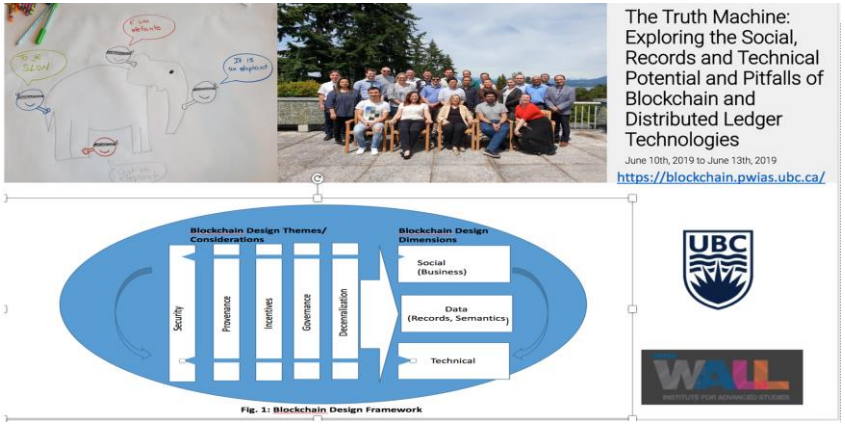
Many of these barriers can be addressed through integrative design

The "Three Layer" Model as a Holistic, Integrative Framework for Blockchain and DLT Solution Design (Lemieux & Feng, 2021)



Views blockchain & DLT as a complex system with the **goal of social trust** comprised of **social, data/records, and technical "layers"** or subsystems + an internal control/**governance subsystem**

THEORY → PEDAGOGY → PRACTICE



Chapter 7
Conclusion: Theorizing from Multidisciplinary Perspectives on the Design of Blockchain and Distributed Ledger Systems (Part 2)

Victoria L. Lemieux and Chen Feng

7.1 Introduction

Models play an important role in the sciences as devices for scientific discovery (Bailer-Jones 2003; Eckert and Hillerbrand 2018). In the introduction to this volume we discussed how our multidisciplinary strategic design workshop began with consideration of a "three layer" model of blockchain and distributed ledger technology (DLT), which we used as a framework to explore five key themes commonly associated with such systems: governance, incentives, security, decentralization, and provenance.

At the outset of our collective intellectual journey, the interactions among these layers[1] were not sharply defined. As our strategic design process and collective chapter writing progressed, however, the scope of each layer and the interactions among them came into sharper focus. We begin this chapter with a discussion of

[1]There was some discussion in the group as to whether these layers should be called dimensions rather than layers. The argument for the use of the term dimensions centered on a concern that it would be confusing for software developers who typically conceptualized of layers as layers in the TCP/IP stack. On the other hand, some saw the use of the term, and its association with software development, as being advantageous in promoting an extended understanding of the software development stack as expanding into social and data/records design considerations. The group came to no definitive conclusion on this issue of nomenclature but, as discussed in this chapter, a deeper understanding of the layers as subsystems of DLT systems has emerged from a synthesis of multidisciplinary perspectives.

V. L. Lemieux (✉)
School of Information, University of British Columbia, Vancouver, BC, Canada
e-mail: v.lemieux@ubc.ca

C. Feng
School of Engineering, University of British Columbia (Okanagan Campus), Kelowna, BC, Canada
e-mail: chen.feng@ubc.ca

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https://doi.org/10.1007/978-3-030-54414-0_7

CASE ANALYSIS: BC MINES DIGITAL TRUST ECOSYSTEM THROUGH THE LENS OF THE THREE LAYERS

- Responsible practices to preserve our planet require innovation, agility, and collaboration.
- Consumers, investors, producers, and governments around the world are choosing to do business with those that demonstrate a commitment to sustainability.
- In the mining sector, British Columbia is committed to increased transparency and trust related to where products come from and how they are produced. This includes provenance related attributes for supply chain, tracing, and environmental, social and governance (ESG) reporting.

https://unfccc.int/climate-action/momentum-for-change/climate-neutral-now/carbon-neutral-government-program-canada
https://bcgov.github.io/mines-digital-trust/

CASE ANALYSIS: BC MINES DIGITAL TRUST ECOSYSTEM THROUGH THE LENS OF THE THREE LAYERS

https://youtu.be/q0Jml3isSh8

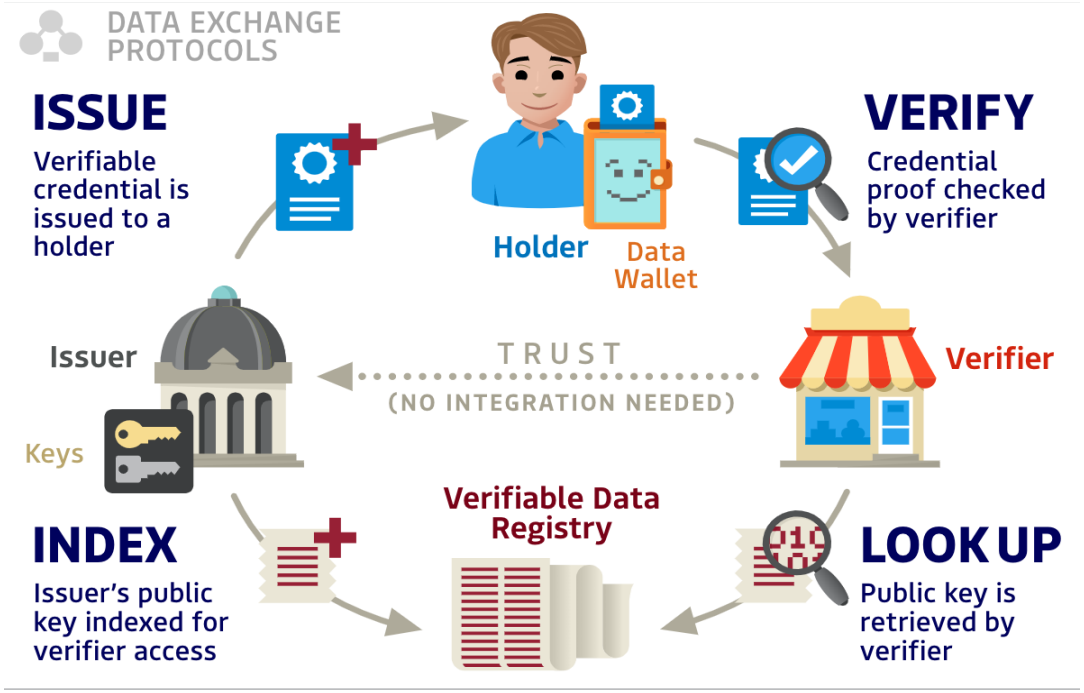
CONTEXT & SYSTEM GOAL: TRUST THROUGH ENABLING THE EXCHANGE OF THE MINES PERMIT AND CARBON EMISSIONS DATA

"What makes the MDT unique is our commitment to interoperability, traceability, and open-source technology. In essence, we see this digital ecosystem as a public good. The technology will enable BC's business community, auditors, and third-party verifiers to leverage government-held regulatory data and contribute credentials to meet the global market's demand for transparency and trust." – Ryan Forman, Executive Director, Strategic Initiatives Branch, Ministry of Energy, Mines and Low Carbon Innovation

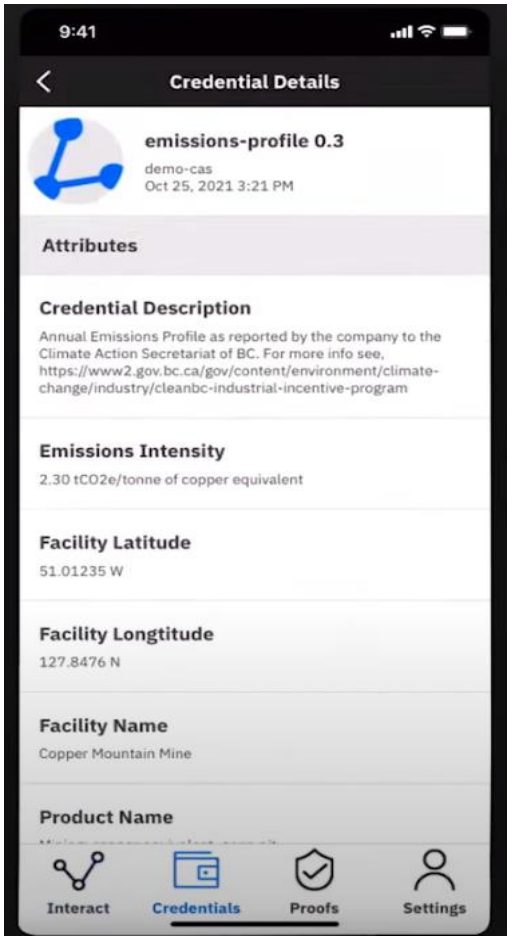
SOCIAL LAYER

Ecosystem prototype participants:
BC Government, Copper Mountain Mines, PwC, IBM, Open Earth Foundation, Advisory Committee of interested parties, including UBC

DATA/RECORDS LAYER



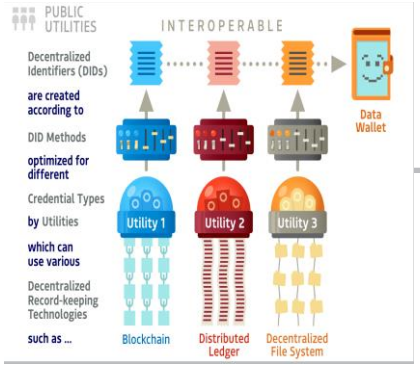
Source: https://trustoverip.org/wp-content/toip-model/



Screenshot of Digital Wallet showing Emissions Profile Credential

TECHNICAL LAYER

Verifiable Organizations Network (VON)



Source: https://trustoverip.org/wp-content/ toip-model/

Sponsor: The Verifiable Organizations Network (VON) started by the governments of British Columbia, Ontario, and Canada

Goals: To assemble an open software stack that helps business people establish trusted and enduring digital relationships to help governments cut red tape

Approach • Think through the problem carefully • Find like-minded groups to share development • Choose the most suitable open-source framework • Contribute code to extend Hyperledger Indy Results

Protocol: Built on top of the open source Hyperledger Self-Sovereign Identity Stack, in particular Hyperledger Indy and Hyperledger Cloud Agent Python.

First demonstration project: Orgbook BC, announced January 2019 • Includes digital IDs for 529,000 companies and 1.4 million credentials • Similar services coming soon from other jurisdictions

Resources

Cost: approx. $1.6mill USD / year.

Staffing:

5 on the the development team

4 on strategy / information / policy

Source: https://twitter.com/BCGovNews/status/997893430448713728

Case analysis: Personal Health Wallet through the lens of the three layers

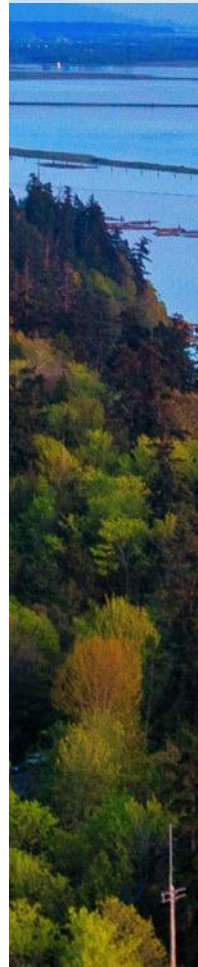
THE PROBLEM

Imagine being able to present a complete medical history to your healthcare professional – from test results and prescription history to treatment records.

- Currently, Canadians' vital health data remains mostly unconnected, preventing diverse healthcare professionals to see all or part of a patient's medical history.
- Integrating this data brings technical challenges, as well as raises privacy concerns about who can have access to the information, and how they get access.
- The platform will help overcome growing trust barriers that make it difficult for healthcare researchers and providers to access real-world data to drive improvements in healthcare research and artificial intelligence. Putting individuals in control of sharing their own data can help break down these barriers.

HOW WE ARE SOLVING IT

Giving people secure control of their own healthcare data is the goal of the Personal Health Wallet consortium made up of Molecular You, StonePaper and the University of British Columbia. *The consortium has been supported with co-investment from Canada's Digital Technology Supercluster*.



CONTEXT & SYSTEM GOAL: TRUST PRIVACY-PRESERVING AND SECURE HEALTH DATA SHARING

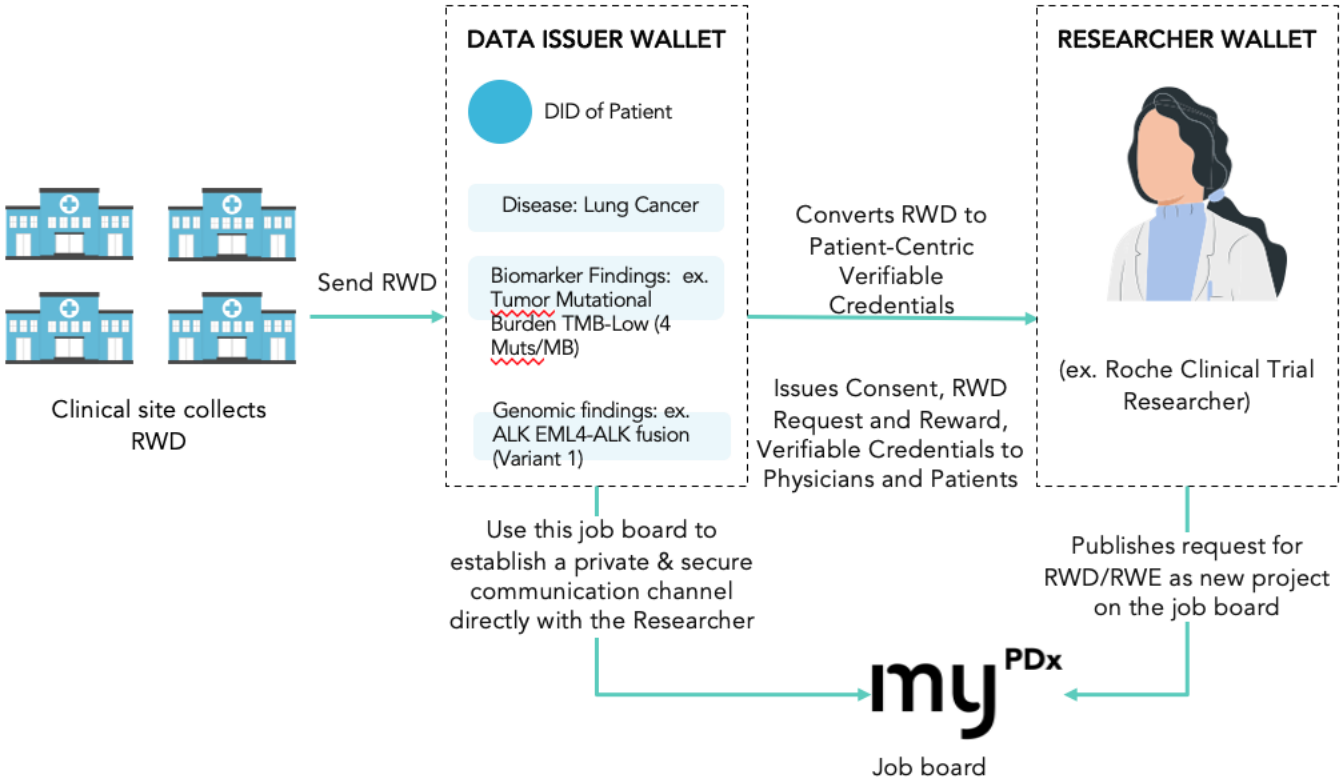
INTENTION TO ADOPT BLOCKCHAIN IN HEALTHCARE GROWING GLOBALLY

~ WORLD ECONOMIC FORUM

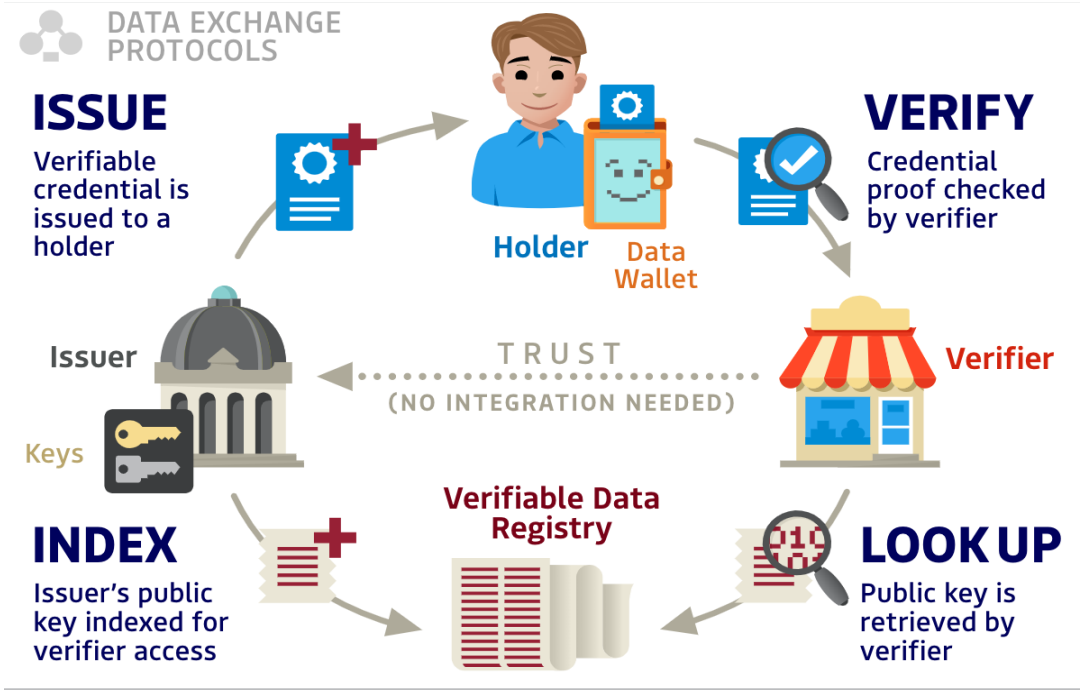
- 72% those healthcare companies surveyed by the WEF in 2020 state that they will adopt blockchain for health information management by 2025
- Advantages of blockchain in healthcare and life sciences: *trust, transparency and data integrity, enabling collaboration*
- Healthcare and life sciences professionals are grappling with how to access RWD/RWE, manage consent and keep individual health data secure as they look to leverage health data to improve health outcomes

Source: World Economic Forum (2020), Future of Jobs Report, https://www.weforum.org/reports/the-future-of-jobs-report-2020

SOCIAL LAYER



DATA/RECORDS LAYER

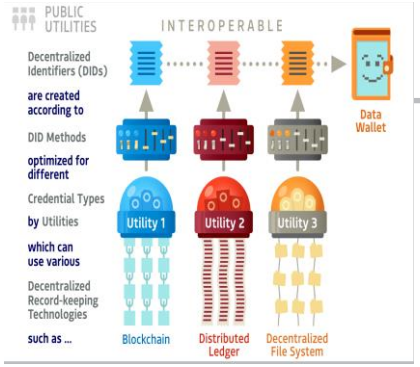


Source: https://trustoverip.org/wp-content/toip-model/

Screenshot of Digital Wallet showing Biomarker Credential

TECHNICAL LAYER

Verifiable Organizations Network (VON)



Source: https://trustoverip.org/wp-content/ toip-model/

Goals: To leverage an open software stack that helps people establish trusted and enduring digital relationships to help promote a learning health system

Approach • Think through the problem carefully • Find like-minded groups to share development • Choose the most suitable open-source framework • Contribute code to extend Hyperledger Indy Results

Protocol: Built on top of the open source Hyperledger Self-Sovereign Identity Stack, in particular Hyperledger Indy and Hyperledger Cloud Agent Python software development kit provided by the BC Government

Resources

Cost: approx. $1.2mill USD / over 2 years of funding. Canada's Digital Supercluster supported the project with co-investment.

Project Team

Molecular You

Leadership
Robert Fraser
Victoria Lemieux
Mike Edwards

Development
Ravneet Kaur
Hugo Cheng
Vlad Ryanazov

Design
Grace Goh
Devansh Parikh
Eric Tsoi

Project Management
Andrew Cottle

UBC

Leadership
Victoria Lemieux

Mitacs Student HQP
Hoda Hamouda
Danielle Batista
Meng Kang
Barbie Singla
Daniel Park
Artemij Voskobojnikov
Anadi Pandharkar
Zakir Suleman
Henry Kan

April Nguyen (Emily Carr)

StonePaper

Leadership
Romeo Ware
Bonnie Kim
Lisa Soodeen
Matthew Rappard

Project Management
Rolton Edwards
Erwin Joaquin

Development
Negin Mashregi (Intelense)

BC Government

Leadership - HL Expertise
Ian Costanzo
Stephen Curran

Transitional Justice Home, Land and Property (HLP)

Peer Social Transitional Justice HLP is **an Open Source software project** to develop a mobile application that **enables displaced people to document their existence for the purposes of identity assertion & asset restitution** - Ensuring that when they return home UN/NGO Transitional Justice teams can process their claims, or, if they are unable to return, ensure they are properly compensated for the homes, land and property they have lost.

Objectives

- Enable displaced people to create a record of their homes, properties, farms, businesses and/or possessions in order to assert a claim should they have to flee and their property is taken from them.
- Create a record consisting of photos, documents, coordinates and audio and video attestations.
- Ensure that the record is stored in an encrypted, decentralized, time-stamped and “hashed” tamper-resistant fashion such that data cannot be viewed or tampered by hostile parties/governments.
- Ensure that the contents of their record can be “published” to a tamper-proof portfolio for review by third-parties such as UN teams operating under a transitional justice framework.

How Three Layer Model Aligns with the GovTech Approach

The GovTech approach emphasizes three key aspects of public sector modernization

Whole of Government Approach

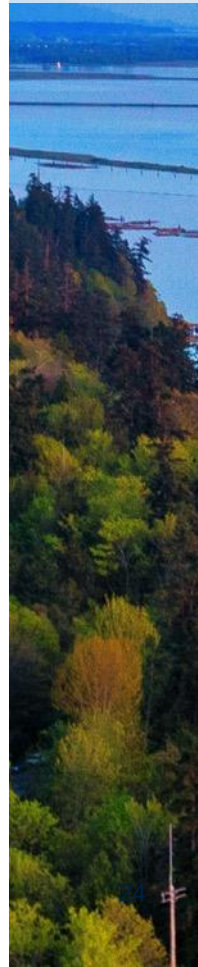
- Systems thinking and development of integrated approaches to policy-making and service delivery
- Promotes accessible, transparent and efficient government

Citizen-centric

- Design of solutions that consider device and internet access and other limitations
- Reaches all intended beneficiaries

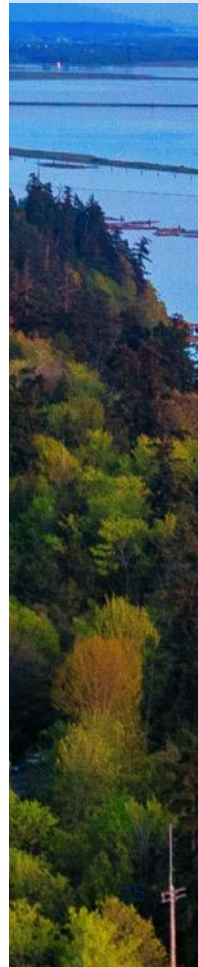
Simple & efficient services

- Promotes access to services through sustainable adoption of technology
- Stronger governance and engagement with targeted beneficiaries

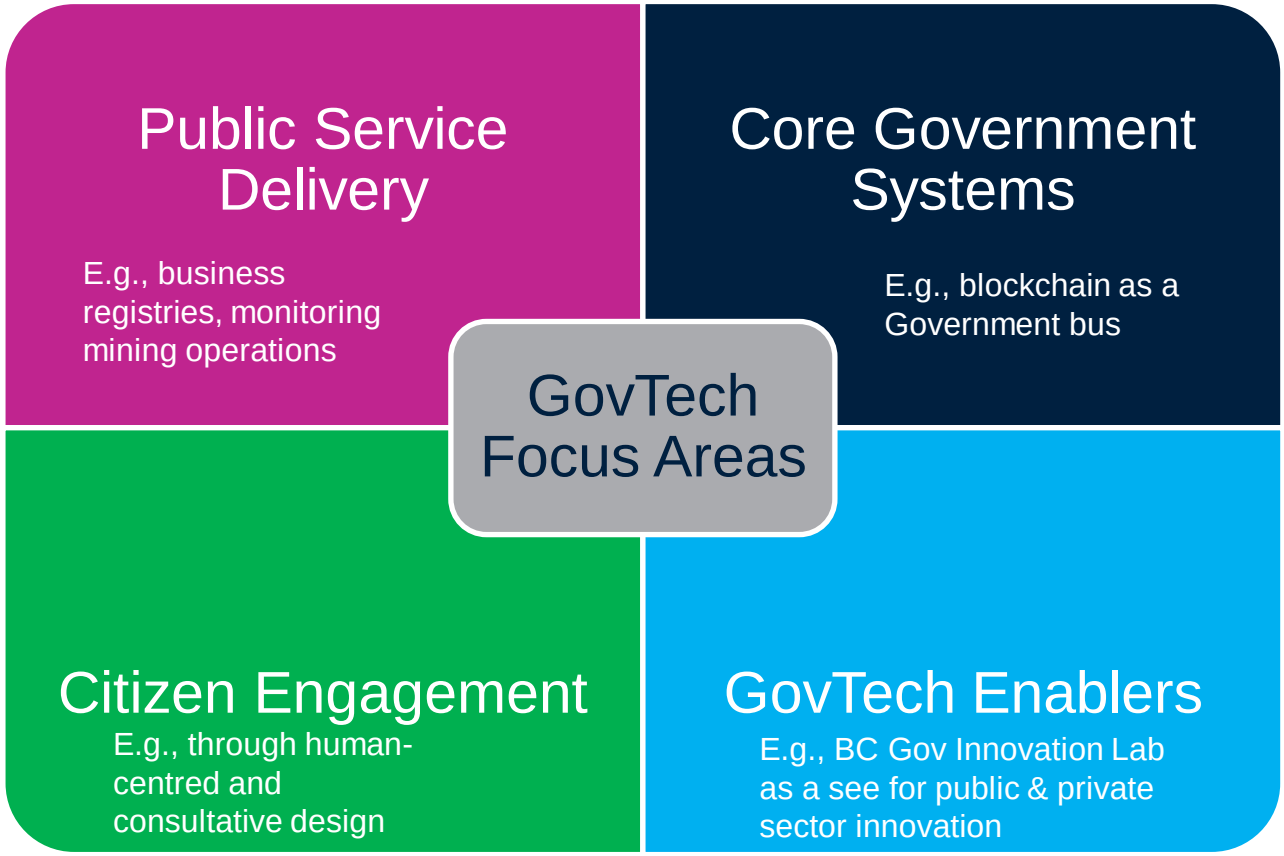


How the BC Mines Digital trust ecosystem and My Personal Health Wallet Projects Exemplify the GovTech Approach

Effective use of disruptive tech	• Blockchain as an enabler of radical transformation
Local GovTech Ecosystems	• Local GovTech ecosystems for entrepreneurs and startups
Effective Use of Public Data Platforms	• Promotes use of public data by individuals and firms
Greater use of Public-Private Partnerships	• Private sector skills, innovations and investments



How the BC Mines Digital trust ecosystem and My Personal Health Wallet Projects Exemplify the GovTech Focus Areas



KEY TAKEAWAYS

- Still many barriers to adoption of blockchain & DLT
- Barriers can be addressed with a holistic, integrative design framework
- The “Three layer” model provides such a framework
- BC Gov Digital Mines and MY Personal Health Wallet exemplify a holistic, integrative approach to design and the transformation that can be achieved with integrative design and the GovTech approach

Q & A