

Making the Blockchain Real for Corporate Registries

A DIACC Proof of Concept

This is a companion document to the Proof of Concept (POC) developed through a collaboration between Digital ID & Authentication Council of Canada (DIACC) members IBM and the Province of British Columbia. The goal of the POC is to explore the viability of blockchain technology and its potential to provide value to corporate registry operators, business owners, and their respective delegates.



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About This Document

This document has been developed as a companion paper to a Proof of Concept (POC) service that explored the potential of blockchain technology to provide value to corporate registry operators, business owners, and their respective delegates. The paper was developed by the Digital ID & Authentication Council of Canada (DIACC), IBM, and the Province of British Columbia. DIACC POCs are operated under the neutral governance of the DIACC and provide an opportunity to learn fast by testing viabilities. POCs do not represent an official position of the DIACC.

About DIACC

Created as a result of the federal government's Task Force for the Payments System Review, the DIACC is a non-profit coalition of public and private sector leaders committed to developing a Canadian digital identification and authentication framework to enable Canada's full and secure participation in the global digital economy. DIACC members include representatives from both the federal and provincial levels of government as well as private sector leaders.

The DIACC is comprised of a coalition of public and private sector organizations committed to developing a robust, secure, scalable, and privacy enhancing digital identification and authentication ecosystem that will decrease costs for governments, consumers, and business while improving service delivery and driving GDP growth. A made-in-Canada digital identification ecosystem will reflect Canadian values and priorities, and empower Canadians to conduct a wide range of secure online transactions and interactions both domestically and internationally.

DIACC members work together by sharing resources and perspectives to address the needs of the digital transformation through the development of the Pan-Canadian Trust Framework (PCTF). The PCTF is a set of Canadian principled standards that support open government principles and enable Canada's full and secure participation in the global digital economy. DIACC members collaboratively develop market educating innovation white papers, proof of concepts, and applied research to secure Canada's full and beneficial participation in the digital economy.

About IBM

IBM Canada Limited (a wholly-owned subsidiary of the IBM Corporation of Armonk, New York) is Canada's leading provider of advanced information technology products and services with a track record backed by over a century of business and systems innovation across the country.

IBM is dedicated to helping customers, both private and public, become more productive through end-to-end transformation and innovative application of business and technology solutions. This includes developing long term partnerships in collaborative environments like The Linux Foundation and The Hyperledger Project, among others.

IBM continually engages in world-changing progress and building new ways to outthink some of the world's most complex challenges. Part of IBM's mission is to be the recognized leader in business and information technology services and today is the largest business and IT services organization in the world, generating over \$80 billion in revenue annually.

About the Province of British Columbia

The Province of British Columbia provides services such as education, healthcare, social services and economic development to its 4.6 million residents. Seeking to further economic development, the Government of British Columbia wants to develop innovative public services faster to meet evolving demand and improve its user experience.

To meet the challenge, the province established the BC Developers' Exchange ([BCDevExchange](#)) to take advantage of the innovation of private sector technology companies and entrepreneurs. The BC Developers' Exchange supports collaboration between government and citizens using open source tools, such as online code repository GitHub and technology such as Hyperledger Fabric ([Hyperledger Project](#)). The province works within the DIACC community to support the establishment of Canadian personal and organizational identity standards and increase its understanding of the technologies which may support the broad adoption of trusted, secure digital services.

Executive Summary

The Proof of Concept (POC) was developed as part of a collaboration between DIACC members IBM and the Province of British Columbia. The POC concept leverages a phased approach as a core principle to ensure that individual Provinces can participate at a pace that aligns with their individual contexts, resources, and priorities. To begin the POC, IBM facilitated a two-day design workshop to inform interested parties of the core concepts and open source components of blockchain technology. Stakeholders from IBM, the Province of BC, the Province of Ontario, and the Province of Nova Scotia gathered in-person and via teleconference to share perspectives regarding the operations of corporate registries.

The Corporate Registry POC leverages the Hyperledger open standard, a cross-industry collaborative effort coordinated by the [Linux Foundation](#) to support blockchain-based distributed ledgers. This technology offers a decentralized and cryptographically secure model for recording and sharing transactional information, and supports an automated consensus mechanism within a peer-to-peer network that prevents modification of information, or “blocks”, recorded in the system. Further developments of the POC will maintain an open-standards based approach.

The outcome of the workshop was to create a demonstration of a shared cross-province log of corporate registry actions which could be securely accessed by registries staff to gain visibility to the data for a single incorporated business across provincial silos. A POC solution would be able to demonstrate how blockchain could enable a simple and secure cross province audit log. This could immediately help provincial registry staff improve services by making cross provincial data more easily available and therefore allow for rapid discovery of the issue and its subsequent resolution. Over time this POC could be developed further to potentially replace the key components of the multiple systems used across the jurisdictions to manage corporate registries.

Economic Opportunity

A digital identity (ID) ecosystem that Canadians will adopt relies upon the ability of people and businesses to transact with confidence. A transformative ID ecosystem must enable the existence of verified, secure, and privacy respecting digital identities of individuals and organizations. Additionally, in the business world, transparency of beneficiaries is required. Collaborative work is being done to address the digital ID needs of individuals; efforts to modernise corporate registries are also happening. This POC is unique in that it represents an opportunity to experiment and innovate in a neutral forum, and to connect the strategic contexts of business identities with that of personal identities considering the functions performed when moving from physical to digital processes.

Business Challenge

Corporate registries have a need to share information. An example of this obligation can be found in the New West Partnership Trade Agreement (NWPTA). The NWPTA has been established to improve international and interprovincial trade by reducing unnecessary red tape and business costs.

Businesses faced fewer difficulties recruiting needed workers from the other NWPTA provinces and gained access to more government procurement opportunities on an equal footing with suppliers from the NWPTA provinces. Under the NWPTA, the Governments of British Columbia, Alberta, Saskatchewan, and Manitoba:

- Eliminated residency requirements.
- Made it easier to recognize qualifications of professionals and tradespeople.
- Lowered the thresholds for open and non-discriminatory government procurement to provide businesses with more bidding opportunities.
- Enacted strict, enforceable subsidy rules.
- Introduced monetary penalties against governments that willfully disregard their commitments.

Leveraging the NWPTA as a use case driver, the collaborative POC workshop stakeholders developed the following business problem statement.

*The **time and effort** to create and maintain corporate registry information that is **shared between jurisdictions** (Province to Province, Province to Federal Government, Provincial Government to Municipal Government) **is high**. For example, adding Manitoba to the New West Partnership will create a significant amount of work and new processes and checkpoints. **Is there a way to decrease the effort and improve the experience of both the Registrars and the businesses?***

Solution Description

A two-day design workshop revealed a few significant business challenges that can be independently actioned by corporate registry operators and business owners. Blockchain capabilities could assist with key business issues regarding the misalignment of corporate registry data across provinces leading to process / data issues that result in “unhappy” corporations.

Workshop stakeholders noted that the time and effort to create and maintain corporate registry information that is shared between jurisdictions (Province to Province, Province to Federal Government, Provincial Government to Municipal Government) is high. For example, adding a Province like Manitoba to the New West Partnership may create a

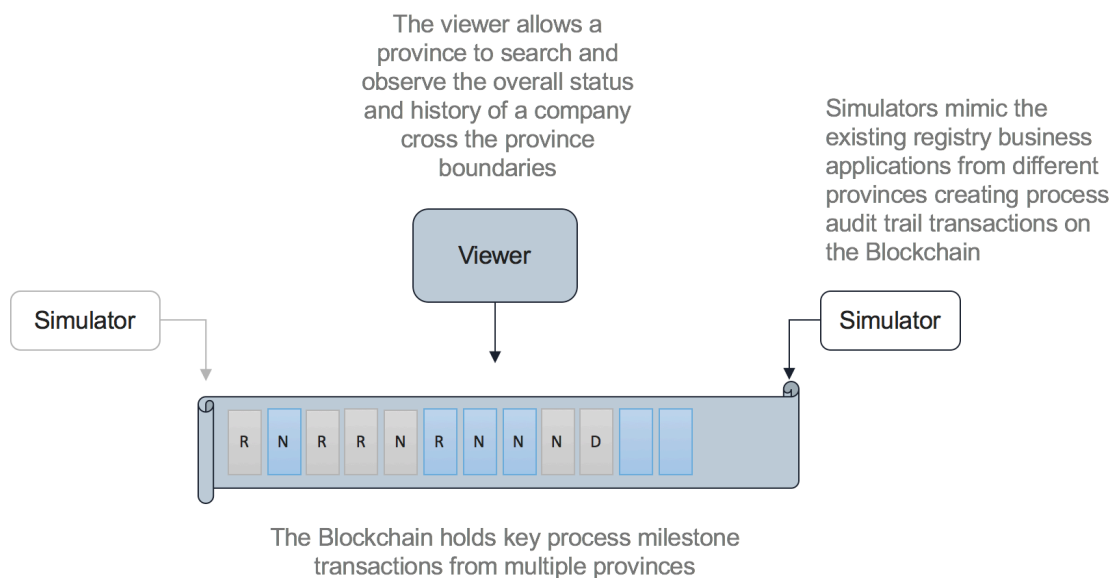
significant amount of work, new processes, and checkpoints. The workshop participants considered ways to decrease the effort and improve the experience of both the Registrars and the businesses.

The workshop also uncovered several challenges and opportunities for provincial corporate registries, particularly when dealing with incorporated businesses operating in several provinces. A key service delivery issue occurs in situations where there is a misalignment of corporate registry data for an incorporated business operating across provinces. The service issues arising from these data misalignments are difficult to solve because the data needed to gain insight into the issue at hand is spread across the various provincial corporate registries and is not visible to registry staff. This results in an “unhappy” experience for incorporated businesses.

The workshop participants designed a POC that would demonstrate how blockchain could act as a cross province audit log. The demonstration developed out of this POC could immediately help business owners to improve services by making cross provincial data more easily available to internal business staff.

The proposed POC solution would leverage a two-week development cycle to develop a blockchain shadow ledger based on the Linux Foundation's Hyperledger industry standard. The Hyperledger standard supports an automated consensus mechanism within a peer-to-peer network that prevents modification of information, or “blocks”, recorded in the system.

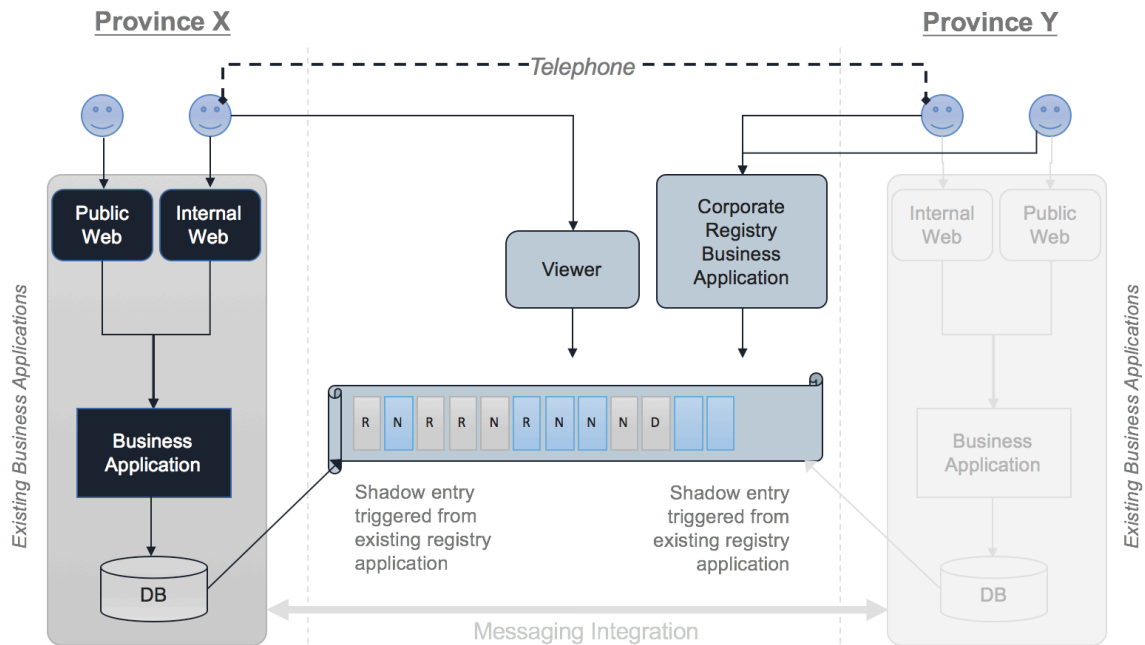
Figure 1 Initial Work: December 5-16, 2016



Over the course of a two-week development cycle, the design team focused on developing the ability to demonstrate the core concepts required to create a process

milestone audit trail. This step is standalone from all existing systems and processes and is for demonstration purposes only. Over time the concept could be developed to potentially modernize key components of multiple systems used across jurisdictions to manage corporate registries.

Figure 2 – Potential Future State "Phased Registry Implementation"



Demonstration of Benefits

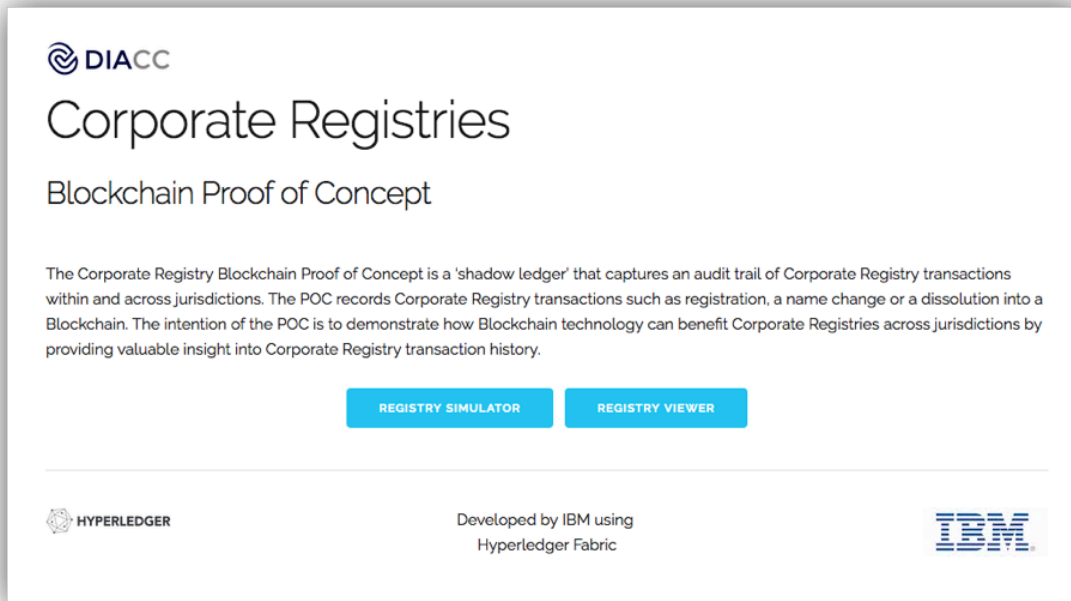
The value of blockchain for corporate registries is in the transactional provenance (longitudinal record) of a corporation, and the immutable aspects of the record due to consensus across nodes/peers that cannot be tampered with.

The demonstration code included a Registry Simulator and Registry Viewer that each include specified functionality. The blockchain proposed in the POC was a "permissioned" Hyperledger blockchain and not an anonymous blockchain like that of Bitcoin or others.

The POC demonstration code can be run locally and can ultimately run on servers of the participating organization's choice including an organization's own server or on a third-party server service provider.

The POC Corporate Registries Simulator can receive data via a batch process which ensures that historical data is captured. Records may also be entered manually through the demonstration code web app point of entry.

Figure 3 - POC Web App Point of Entry



The demonstration provides basic functions that write to the demonstration ledger including:

- Register – the initial creation of an organizational record; and,
- Amalgamate – the ability to merge existing records.

The functionality to Register and Amalgamate were priority business functions identified by participating corporate registry operators.

Figure 4 - POC Corporate Registries Simulator

Register

Register a corporation in a jurisdiction. This form will create a registry entry on the blockchain for a corporation.

Corporate Information

Jurisdiction: British Columbia Filing Date: 05-01-2017

Corporate Name: ABC Inc Corporation Number: 11111

Director First Name: Bob Director Last Name: Test

E-Mail Address: bob@abcinc.com

Registered Office Address

Street Address: 123 ABC Street

City: Victoria Province: British Columbia Postal Code: V8V 8V8

REGISTER

Amalgamate

Amalgamate two corporations into a new corporation. This form will create an amalgamation entry on the blockchain by dissolving the two corporations and registering a new corporation.

Corporation 1

Jurisdiction: British Columbia Name: DEF Inc

Corporation 2

Jurisdiction: British Columbia Name: XYZ Inc

New Corporation Information

Jurisdiction: British Columbia Filing Date: 05-01-2017

Corporate Name: DEFXYZ Inc Corporation Number: 333333

Director First Name: Barb Director Last Name: Smith

E-Mail Address: barb@defxyzinc.com

Registered Office Address

Street Address: 567 Defxyz St

City: Spuzzum Province: British Columbia Postal Code: V0V 0V0

AMALGAMATE

The ability to manage a particular record is also demonstrated with functions including:

- Report – generate a report from the shadow ledger
- Name Change – change the business record name
- Dissolve – dissolve the business record
- Admin – role based access to the administrative needs of the registry

Figure 5 - POC Corporate Registries Simulator

Report

Perform an annual report for a corporation. This form will confirm the corporations registered office address and add to the blockchain.

Corporate Information

Jurisdiction: Reporting Date:

Corporate Name:

Registered Office Address

Street Address:

City: Province: Postal Code:

Name Change

Change the name of a corporation. This form will add an amendment to the blockchain for the corporate name.

Jurisdiction: Corporate Name:

New Corporate Name:

Dissolve

Dissolve a corporation. This form will add a dissolve record to the Blockchain for the selected company.

Jurisdiction: Corporate Name:

Admin

Perform administrative functions on this page.

The data associated with Transactions and Corporations can be sorted and arranged in real time by adjusting the filter keywords or ticking specific regional boxes.

Figure 6 - POC Corporate Registries Viewer

Transactions

The corporate registries viewer allows you to view the transactions that have occurred for corporations across jurisdictions. In addition you may filter by jurisdiction or by corporate name.

Filter by Corporate Name:

Filter by Jurisdiction:

☒ Select All

☒ Newfoundland and Labrador

☒ Prince Edward Island

☒ Alberta

☒ Northwest Territories

☒ Quebec

☒ British Columbia

☒ Nova Scotia

☒ Saskatchewan

☒ Manitoba

☒ Nunavut

☒ Yukon

☒ New Brunswick

☒ Ontario

☒ Federal Government

| Corporate Name | Jurisdiction | Type | Additional Information | Block | Timestamp |
|----------------|--------------|--------------|---|-------|----------------------|
| DEFXYZ Inc | BC | Dissolve | Dissolved | 6 | 04 Jan 2017 13:28:57 |
| DEFXYZ Inc | BC | Amalgamation | Corporations Amalgamated: 1: DEF Inc BC 2: XYZ Inc BC | 6 | 04 Jan 2017 13:23:11 |
| XYZ Inc | BC | Report | #755 New Street Vancouver BC V6V 4V4 05-01-2017 | 5 | 04 Jan 2017 13:21:08 |
| XYZ Inc | BC | Name Change | Old Name: ABC Inc | 4 | 04 Jan 2017 13:18:39 |
| DEF Inc | BC | Register | 222222 Bill Smith 456 DEF Street Victoria BC V9V 9V9 bill@definc.com 05-01-2017 Active | 3 | 04 Jan 2017 13:17:15 |
| ABC Inc | BC | Register | 11111 Bob Test 123 ABC Street Victoria BC V8V 8V8 bob@abcinc.com 05-01-2017 Active | 2 | 04 Jan 2017 13:15:59 |

Corporations

List of corporations and the status retrieved from the blockchain.

Filter by Corporate Name:

| Corporate Name | Number | Register Date | Jur. | Director | E-Mail | Registered Office Address | Status |
|----------------|--------|---------------|------|------------|--------------------|-------------------------------------|-----------|
| DEFXYZ Inc | 333333 | 05-01-2017 | BC | Barb Smith | barb@defxyzinc.com | 887 Defxyz St Spuzzum BC V0V 0V0 | Active |
| DEF Inc | 222222 | 05-01-2017 | BC | Bill Smith | bill@definc.com | 456 DEF Street Victoria BC V9V 9V9 | Dissolved |
| XYZ Inc | 11111 | 05-01-2017 | BC | Bob Test | bob@abcinc.com | 765 New Street Vancouver BC V4V 4V4 | Dissolved |

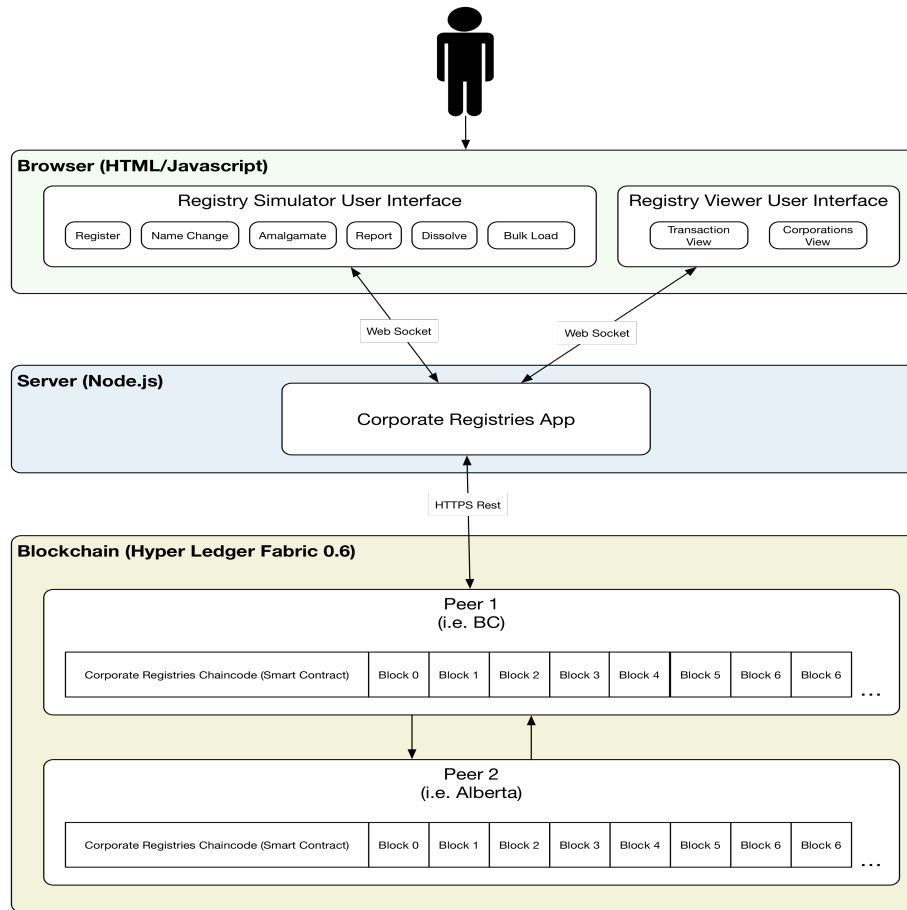
Technical Details

The POC comprises of a web application and an underlying blockchain network. Much of the solution is derived from IBM's open source blockchain offerings found here: <https://github.com/ibm-blockchain>.

A Corporate Registries user interacts with the POC through a web browser such as Firefox or Chrome. A Node.js server delivers web content to the user in HTML and JavaScript. Communication from the browser to the server is done via a web socket and allows for constant dual-channel communication between the web server and the browser. The communication from the Node.js server to the backend blockchain network is delivered via a RESTful HTTPS service. The blockchain network implements the smart contract in GoLang and uses version 0.6 of the Linux Foundation's Hyperledger Fabric.

Care was taken during development to make the solution responsive so that the app displays appropriately on any sized mobile device or desktop monitor.

Figure 7 - High level solution architecture



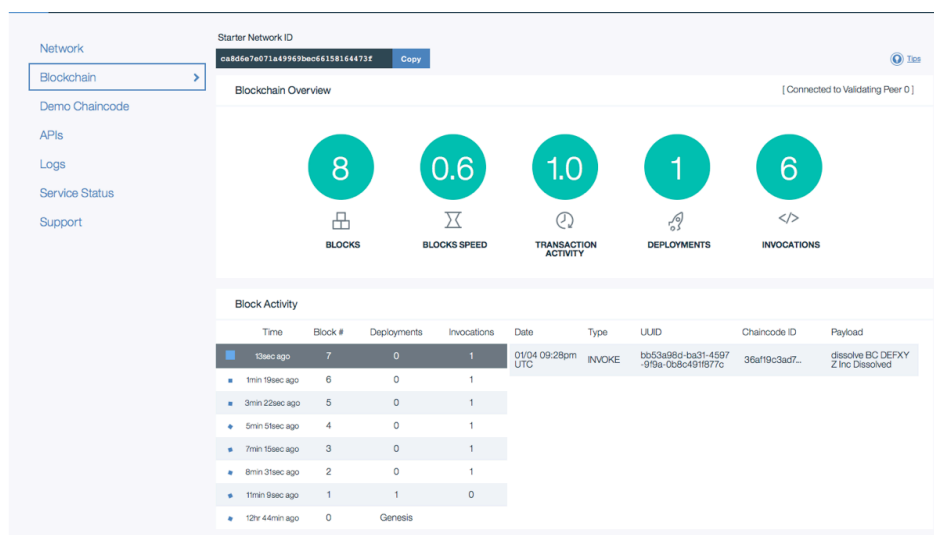
The POC can be hosted locally or in the cloud.

For local hosting, any platform capable of running Node.js and Docker is required (Mac, Windows, Linux, Unix, etc.). The web server and app run in Node.js and the blockchain network runs on a Docker image.

The POC can also be hosted in the cloud by a third party provider such as IBM's Bluemix environment. For example, in IBM's Bluemix environment it is possible to host both the web server and host the blockchain service.

Detailed installation instructions for both a local installation and a cloud installation can be found at: <https://github.com/DIACC/POC-corporate-registries>

Figure 8 - Blockchain Example on Third Party IBM Bluemix



Summary

The POC companion paper was developed as a collaboration of Digital ID & Authentication Council of Canada (DIACC) members IBM and the Province of British Columbia. The POC is operated under the neutral governance of the DIACC. The POC leverages the Linux Foundation industry standard Hyperledger.

The “learn fast” experimentation approach of this POC revealed significant potential for blockchain to assist in areas of challenge for Corporate Registries particularly across jurisdictions. Blockchain is not proposed as a replacement of all systems; rather, the technology has the potential to replace some elements of current registry systems - primarily where specific actions need recording, and providence of those actions is key.

Development of a blockchain-based solution would be iterative and managed via an Agile project management methodology, and would require collaboration across parties that are interested and committed to participation. Additionally, the iterative process was leveraged to enable potential expansion of the demonstration to a production environment for those who wish to leverage this industry standard based approach. Requirements are being gathered to guide resources toward potential future sprints.

DIACC works with member stakeholders to share resources, accelerate progress, and engage participants for inclusion of their business requirements.

For more information regarding DIACC POCs please contact info@diacc.ca.