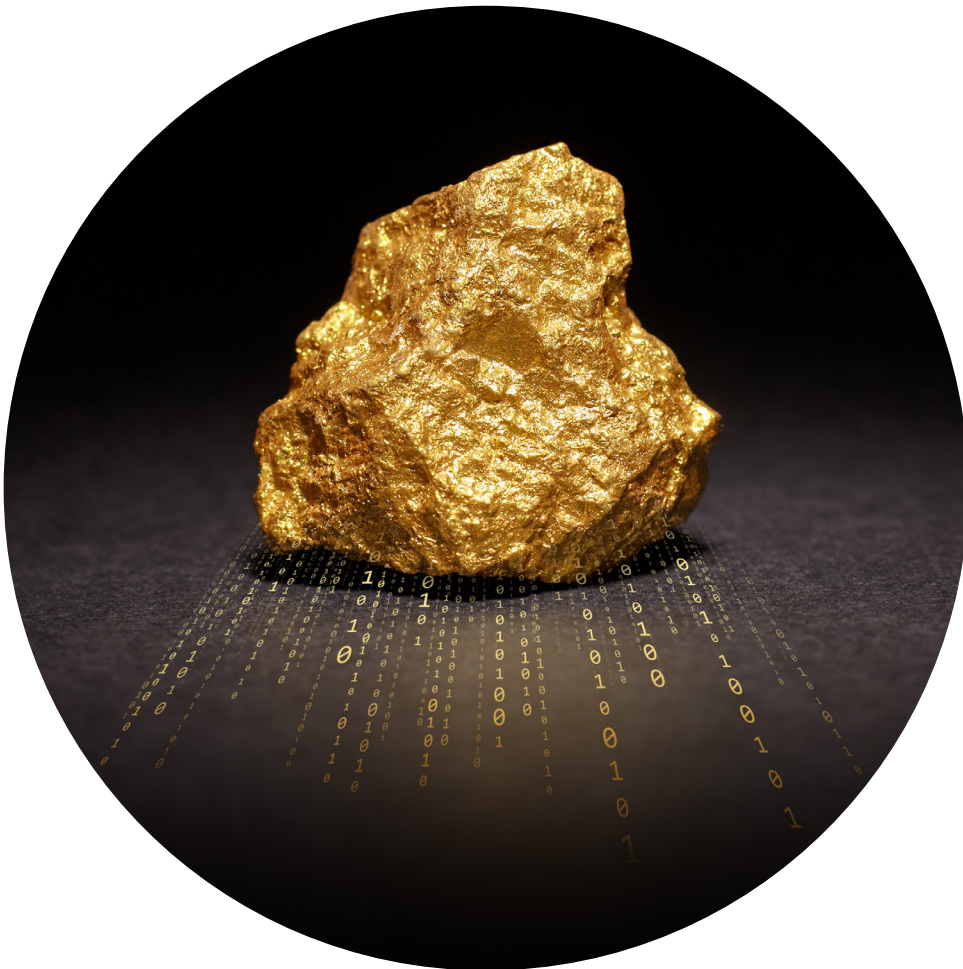




The Future of the Refining Industry

How applying distributed ledger technology (DLT)
is a transformative step for precious metals



Introduction

There is a growing demand for responsible and transparent supply chains that reflect the importance of Environmental, Social and Governance (ESG) considerations in the marketplace. Manufacturers, jewelry producers, consumers and bullion investors are increasingly demanding to know the provenance and production methods of the metals they procure.

The Royal Canadian Mint (the Mint) in collaboration with aXedras (a leader in the field of digital solutions) is adopting a distributed ledger technology (DLT) based platform to digitalise B2B processes across the entire supply journey from mine to vault, and ultimately to the end consumer. This brings greater transparency and trust into the precious metal asset class, which unleashes unimagined opportunities for all stakeholders involved.

As a London Bullion Market Association (LBMA) Good Delivery Refiner (GDL), the Mint is one of the front runners that is investing in digital provenance tracking and the transparent exchange of high-integrity product information. The adopted integrity solution will leverage DLT to track and record the origins, transformation and custody hand offs of gold, silver and platinum precious metals and grain through a digitalized method.

Customers can receive the required evidence and access to responsibly sourced material, with the option to select from segregated material streams.

The Mint's leadership in adopting leading-edge technologies allow precious metal buyers to have confidence in the authenticity, integrity and provenance of the products offered by the Mint.



Decentralised architecture and infrastructure are adopted whereby each member stays in control of its data following real-world business transactions. The system takes advantage of R3's Corda Enterprise solution, which is a scalable, permissioned P2P DLT.

How the System Works

Distributed Ledger Technology

Key transaction information will be stored within secure and immutable records at each hand off point. This in turn will help Mint customers and other stakeholders to demonstrate transparency and trust, giving their buyers more confidence in the quality and provenance of their products.

The platform developed by aXedras is a DLT based business network that connects all stakeholders of the global precious metal industry. It is a decentralised, secure and member-based platform which is based on industry-wide data standards: business partners

are empowered to interact and exchange data and documents with each other peer-to-peer (P2P). Compared to a typical public "blockchain", there isn't one big blockchain containing all data and/or transaction hashes, but "individual blockchains" per product. Whenever a custodian or customer receives a physical precious metal product, the parties can also access its associated digital twins' information around provenance. Confidentiality remains at the heart of the system as the notary service does not see the content of transactions. To enhance confidentiality the system adopts a private DLT versus a public, permissionless blockchain.

Digital Twins

The logic of digital twins is implemented throughout the system. They can represent physical precious metal products with static data defining them, or process flows with dynamic data updating their associated digital twins (e.g. Relocation).

To digitally represent supply of precious metals sourced by mines or coming from secondary sources, a unique Provenance Record is issued. This Provenance Record can define and document the relevant provenance, ESG and compliance information about the supply material. Provenance Records can be issued by the supplier of the material and are digitally transmitted to the refiners who are processing the received precious metals (e.g. doré, bullion, coins, scrap). Provenance Records representing the sourced material are then further processed into digital intermediary products following segregated, comingled or mass-balanced production lines.

To digitally represent a refined precious metal product, an Integrity Certificate, with its unique aXedras ID, is created at the point of production by the refinery.

Afterwards, each Integrity Certificate acts as a unique data carrier for its corresponding physical product and is used within the system to exchange and store data referencing the given product.

The Integrity Certificate contains descriptive data of the physical product: for example, unique identifiers, the linked provenance data or a reference to unique security feature such as BULLION DNA™ as an additional authentication layer. The combination of unique identifiers stamped on the surface of physical bullion serves as the physical-digital-linkage between the precious metal product and the associated Integrity Certificate.

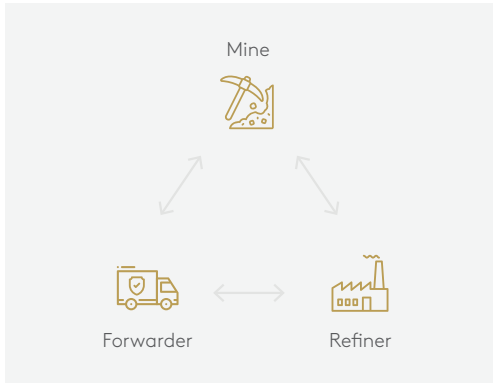
Digitalized B2B processes for shipments, or vaulting of source material or refined precious metal products not only make the whole business much more efficient through standardization, but they also seamlessly keep the digital twins - the Provenance Record for sourced material and the Integrity Certificates for refined products up to date, relating to the relevant business commit points. The exchange of data and documents is standardized and structured in a P2P manner.



The image shows a 1 kilo gold bar on the left. Lines connect specific features on the bar to a table on the right. The table is titled 'Digitized Product' and is divided into two sections: 'Integrity Certificate' and 'Provenance Record'. The 'Integrity Certificate' section lists: Brand (Royal Canadian Mint), Metal (Au), Month and year of production (mm/yyyy), Format weight (1,000 g), Fineness (999.9), Security feature (BULLION DNA™), and Product No. (N239349). The 'Provenance Record' section lists: Traceability method (Comingled), Source material (Mined), Country of origin (Canada), and Supplier (Name of mine).

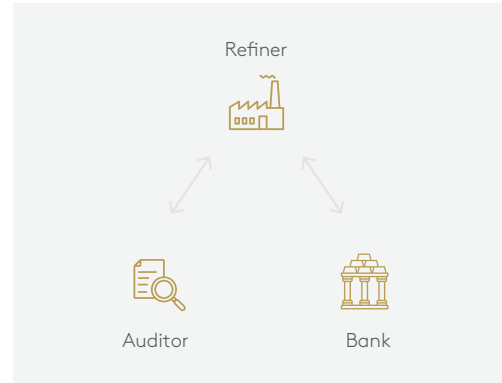
Digitized Product	
Integrity Certificate	
Brand	Royal Canadian Mint
Metal	Au
Month and year of production	mm/yyyy
Format weight	1,000 g
Fineness	999.9
Security feature	BULLION DNA™
Product No.	N239349
Provenance Record	
Traceability method	Comingled
Source material	Mined
Country of origin	Canada
Supplier	Name of mine

Ecosystem



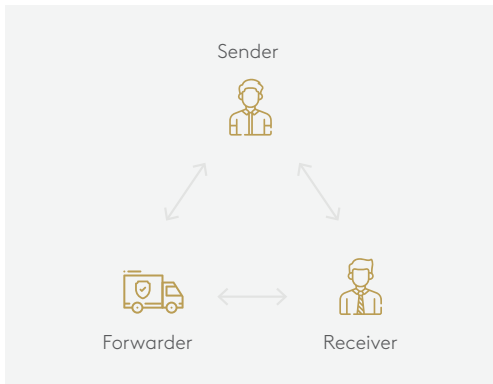
Sourcing

- Streamlined exchange of data and documents around deliveries of supply material
- Digitized data on an immutable ledger for simplified and standardised reporting



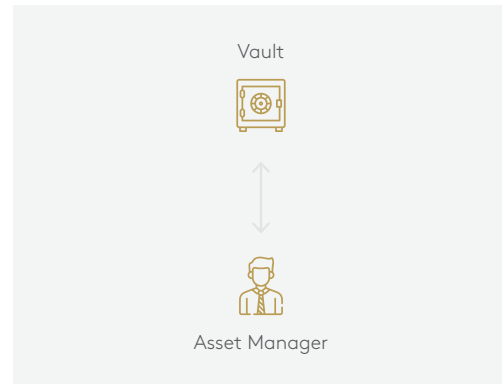
Production

- Smart contracts prohibit double spending of digitized provenance data
- Several production mapping methods in place to cover different production processes (e.g. mass-balance)



Relocation

- One tool to trigger, release, monitor and accept shipments
- Digital bar lists and shipment documents for more efficient processes



Vaulting

- Digital bar lists for simplified stock-in and stock-out processes
- Access to digital inventory to check holdings including all data available



Benefits within the Ecosystem

1

Digital Transformation

- Mutually agreed taxonomy as a foundation for efficient B2B information flow and transactions
- Digital transformation of operating and B2B processes
- Elimination of data silos, recurring paperwork and process fragmentation/duplication
- Streamlined support for reports and audits based on digital data

2

Interoperability

- Seamless data transfer through standardised interfaces between members' IT systems
- Connection and access to third party solution providers (e.g. existing ERP)
- Agnostic approach to cover current and innovative technologies such as security features

3

Benefits for a Mine

- Records the details on the origin of the mined materials and adherence to market standards and certifications on an immutable ledger. Provenance data shared with the processing refinery to preserve the information for the downstream market
- Digitizes the trilateral shipment process including the carrier and receiving refinery
- Streamlines reporting activities based on standardized data, and processes according to unified data standards

4

Benefits for Investors

- Added peace of mind regarding a holdings' provenance, chain of custody and ESG background
- DLT-based proof of evidence for purchased material
- Direct and independent verification of a product's characteristics via independent and immutable DLT

5

Benefits for Banks and Dealers

- Digital "Know your Asset" standard to help adhere to compliance regulations and disclosure obligations regarding the precious metals under management
- Help to comply with regulatory codes:
 - Usage of provenance data and the new level of product transparency for ESG and/or sustainability reports (e.g. Sustainable Finance Disclosure Regulation)
 - Receipt and transfer of provenance and chain of custody data with downstream customers (e.g. EU conflict minerals regulation, other supply chain due diligence laws)

6

Benefits for Manufacturers

- Receive digital and standardized provenance information for supply material
- DLT-based supply chain traceability solution to help comply with existing and emerging reporting and disclosure regulations
- Issue digital twins representing finished products containing detailed information around the precious metals' origin

Summary

A sustainable organization is recognized as one that delivers economic, environmental and social benefits to all its stakeholders, both in the short and long term. The Royal Canadian Mint is delivering on this promise with the implementation of a DLT platform in collaboration with aXedras. The advantages of DLT are widely known as being secure, transparent, immutable and decentralized, making it a trusted solution to reform the precious metals industry. Through DLT, the Mint is responding to the growing global demand for greater transparency in tracking provenance, product integrity and traceability.

Investors, financial institutions, dealers and distributors of Mint bullion investment products, as well as fabricators, will be able to access secure, standardized and digitalized information about the provenance, and integrity of the production standards related to their products. Mines, recyclers and other precious metals suppliers who trust the Mint with the refining of their material will benefit from a myriad of business-to-business process enhancements, such as seamless immutable data transfer and easy access to reports, audits and more.

The manner in which the precious metals industry manages supply chain and delivers on ESG commitments must evolve, and the Mint is proud to lead the industry in bringing more trust and transparency to the refining and manufacturing of precious metals.

To learn more about how to join the platform, please contact our sales team at www.mint.ca/en/contact-us.

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