

# CAPCO

## PROJECT AGORÁ

SELECTING A TECHNOLOGY PARTNER

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Driven by the Bank for International Settlements (BIS), Project Agorá seeks to create a secure and resilient digital financial ecosystem. The project involves multiple major banks, central banks and key infrastructure players, and is currently finishing the design phase. As a next step, we are expecting the BIS to issue an RFP in 2025 to select a technology partner for accomplishing the goals set out for Project Agorá.

Project Agorá is a key part of the BIS's broader efforts to build the financial infrastructure of the future by leveraging the strengths of distributed ledger technologies (DLTs) while implementing robust risk management and governance frameworks.

In this paper, we examine the risks associated with permissionless distributed ledger technologies and advocate for permissioned blockchains as the preferred solution to mitigate such risks. Using a structured evaluation framework, we assess five leading platforms — Hyperledger Fabric, Hyperledger Besu, R3 Corda 4, R3 Corda 5, and Digital Asset's Canton — across key criteria: performance, security, governance, and cost. The analysis provides actionable insights for the project stakeholders when selecting an optimal technology partner.



## 1. PROJECT AGORÁ AND DLT

Project Agorá is an initiative of the Bank for International Settlements to create a secure and resilient digital financial ecosystem.

Agorá's primary objectives include enhancing interoperability between financial systems, fostering trust among participants, and ensuring compliance with regulatory standards. It seeks to address the challenges of fragmented financial infrastructures by implementing robust governance frameworks and leveraging the strengths of distributed ledger technologies to solve these issues. Ultimately, it aims to create a stable environment where innovative inclusive financial solutions can flourish while safeguarding against risks.

The list of participants is impressive. It brings together seven central banks (England, France (for the EU), Japan, Mexico, New York (NY Innovation Center of the Federal Reserve), South Korea, and Switzerland), financial market infrastructure players (Eurex Clearing, Euroclear, Mastercard, SIX Digital, Swift, and Visa), and major banks (Amin Bank, Banco Santander, Banorte, Banque Cantonale Vaudoise, Basler Kantonalbank, BBVA, BNP Paribas, BNY, CaixaBank, Citi, Crédit Agricole CIB, Deutsche Bank AG, FNBO, Groupe BPCE, Hana Bank, HSBC, IBK, Intercam Banco, JPMorgan Chase Bank N.A., KB Kookmin Bank, Lloyds Banking Group, Mizuho Bank, Monex, MUFG Bank Ltd, NatWest Group, NongHyup Bank, PostFinance, SBI Shinsei Bank, Shinhan Bank, Standard Chartered, Sumitomo Mitsui Banking Corporation, Sygnum Bank, TD Bank N.A., UBS, and Woori Bank).

Currently, the project is finishing the design phase. We would expect that the BIS will engage in the search for a technology partner through a selection process in the course of 2025. The evolution of distributed ledger technologies has created opportunities for global financial infrastructures but has also introduced risks, particularly with permissionless blockchains. Unlike traditional systems, permissionless DLTs lack centralized governance, raising concerns regarding security, legal compliance, and operational control. These limitations have prompted regulatory bodies and financial institutions to explore permissioned blockchains as a more secure and compliant alternative.

Given Agorá's focus on compliance, governance, and stability, permissioned blockchains provide the most viable framework. The remainder of this paper demonstrates how enterprise-grade solutions can meet Agorá's stringent requirements. Key evaluation criteria are discussed and compared to candidates: Hyperledger Fabric, Hyperledger Besu, R3 Corda 4, R3 Corda 5, and Digital Asset's Canton.

## 2. RISKS ASSOCIATED WITH PERMISSIONLESS BLOCKCHAINS

Before evaluating permissioned platforms, it is essential to contextualize why permissionless DLTs are unsuitable for Agorá's objectives. Research conducted by the Basel Committee in 2024 highlights several critical risks.

In an era of rapid technological advancements, financial institutions, and regulators face unprecedented opportunities and challenges as they explore the application of distributed ledger technologies within the financial services industry. Permissionless blockchains, however, expose banks and financial institutions to risks.

Unlike traditional financial systems, permissionless blockchains are decentralized by design, relying on distributed governance where any entity can participate in transaction validation without centralized oversight. While this decentralization fosters innovation, it also introduces significant risks, ranging from governance challenges to technological vulnerabilities and compliance difficulties.

A working paper published by the BIS' Basel Committee on Banking Supervision in August 2024 sheds light on the risks posed by permissionless DLTs. In particular, the paper emphasizes the **(1) operational**, **(2) technological**, and **(3) legal risks** that financial institutions encounter when engaging with these networks. We would like to add an additional risk - namely **(4) liquidity risk**.

**(1) The operational** risk stems from the fact that no single entity controls the blockchain, making it difficult to establish clear lines of governance, accountability, and responsibility. Banks, which are accustomed to centralized governance, struggle with conducting proper due diligence on decentralized systems. The potential for "hard forks", where the blockchain splits into two versions, often as a result of disagreements within the network of blockchain systems exacerbates the operational challenge, as it creates uncertainty around the stability and finality of transactions.

**(2) Technological** risks are also significant. The decentralized nature of permissionless blockchains makes them susceptible to a variety of attacks, such as the infamous 51% attack. In this scenario, a malicious actor gains control of more than half of the network's computing power or staked tokens, enabling them to manipulate transaction data. Although large blockchains like Ethereum, Polkadot, Cardano, or Tezos have so far avoided such attacks, smaller networks (such as Bitcoin Gold, Ethereum Classic, or ZenCash, now Horizon) have not been as fortunate. Additionally, permissionless blockchains are vulnerable to various other technological attacks that exploit weaknesses in consensus mechanisms or smart contract vulnerabilities.

This vision aligns with emerging research on blockchain systems. For example, the study by Daian et al. (2020) on miner extractable value (MEV) highlights how decentralized systems can be prone to market manipulation. This research emphasizes the need for careful governance and oversight mechanisms to prevent malicious actors from exploiting the transparency of blockchains. Similarly, Auer et al. (2022) discuss the role of miners as intermediaries and the risks of concentration in decentralized systems.

**(3) Legal and compliance risks** are equally concerning. Permissionless blockchains pseudonymize participants, masking their identities behind cryptographic keys. This complicates compliance with anti-money laundering (AML) and combating the financing of terrorism (CFT) regulations. Transacting with anonymous parties introduces the risk that financial institutions might unknowingly engage with illicit entities. Moreover, in permissionless networks, transaction fees, or "gas fees" as they are sometimes called, can be paid to validators who may operate pseudonymously, raising the potential for fees to be routed to illegal entities. This introduces what the Basel Committee terms "gas fee risk".

One of the most pressing issues identified by the Basel Committee is the problem of probabilistic settlement, which is common in many permissionless blockchains. Settlement in these systems is not guaranteed with 100% certainty. Rather, over time, the likelihood of a transaction being rejected decreases, but it never fully approaches zero. This introduces a layer of uncertainty into financial transactions, making it difficult for banks to align legal finality with the technical settlement, as orphaned or reversed blocks may occur even after a transaction is considered complete.

**(4)** In our opinion, permissionless blockchains may also face **liquidity risks** due to their limited throughput, leading to slower transaction times and potential congestion during peak usage. A possible solution is the introduction of layer-two solutions. These are designed to enhance scalability by processing transactions off-chain, thereby reducing congestion on the main blockchain, and enabling faster and more cost-effective transactions while still relying on the security of the underlying network. While layer-two solutions can mitigate these issues, they can introduce additional risks as they rely on third parties that may not offer the same security and decentralization as the base layer. This dependence on external parties raises concerns about trust and reliability, potentially compromising the overall liquidity and stability of the blockchain ecosystem. An example of this is the Lightning Network of Bitcoin. The Lightning Network is a layer-two protocol for Bitcoin that facilitates off-chain transactions to improve scalability and speed. It introduces third parties like payment channel operators or hubs that route payments. While the Lightning Network

leverages Bitcoin's security for final settlement, the intermediate transactions and their reliability depend on these operators, which are not inherently part of the Bitcoin blockchain.

Given these risks, permissionless systems are unsuitable for regulated financial ecosystems like Project Agorá. The decentralized and pseudonymous nature of permissionless DLTs undermines the stability, trust, and accountability required for global financial operations.

In contrast, permissioned blockchains, where network participation is controlled and participants are known, offer a more viable solution. These systems provide the governance and compliance capabilities needed to meet the regulatory standards of global financial institutions.

Permissioned blockchains allow for more efficient and secure data management by restricting access only to approved participants. This eliminates the risks inherent in permissionless systems (such as the lack of governance and compliance) while maintaining the benefits of distributed ledger technology, i.e. transparency, security, decentralization, efficiency, and traceability.

### 3. EVALUATION CRITERIA FOR PERMISSIONED PLATFORMS

To assess permissioned blockchain platforms for Project Agorá, this paper employs a structured evaluation framework of criteria that ensure a comprehensive analysis of all critical dimensions. Each criteria plays a vital role in determining the suitability of a platform for a secure and compliant financial ecosystem. The framework comprises five key criteria: **(1) protocol features**, **(2) performance metrics**, **(3) security considerations**, **(4) cost analysis**, and **(5) governance mechanisms**.

**(1) Protocol features** are fundamental to the operation and flexibility of a blockchain platform. We're talking about scalability, interoperability, consensus mechanisms, access control, identity management, and data privacy. Scalability, which reflects the platform's ability to handle high transaction volumes without compromising performance, is a crucial consideration for large-scale systems like Project Agorá. Interoperability is equally significant, as it enables seamless integration with existing financial infrastructures and facilitates communication between diverse blockchain networks. The choice of consensus mechanisms, such as Practical Byzantine Fault Tolerance (PBFT), Proof-of-Stake, or Proof-of-Work, directly impacts the platform's efficiency, security, and energy usage. Access control and identity management provide an additional layer of security by ensuring that only verified participants can interact with the network. Furthermore, robust data privacy mechanisms protect sensitive financial

information, allowing institutions to maintain trust and regulatory compliance.

**(2) Performance metrics** assess the practical capabilities of the blockchain in real-world scenarios. It includes throughput and latency. Throughput, defined as the number of transactions processed per second, is a key indicator of the platform's efficiency under varying workloads. Latency, which measures the time taken for transaction validation and settlement finality, determines the system's responsiveness. High throughput combined with low latency ensures that the platform can handle the operational demands of a global financial network.

**(3) Security considerations** focus on the platform's ability to resist various types of attacks and adhere to regulatory standards. Resilience against attacks, double-spending, and network manipulation is essential for maintaining the integrity of financial transactions. The platform must also support compliance with anti-money laundering and combating the financing of terrorism regulations and provide strong guarantees of settlement finality, ensuring that transactions are legally and technically irreversible.

**(4) Cost analysis** is critical to evaluating the economic feasibility of adopting a blockchain platform. Implementation costs encompass setup, integration, and any required customizations to meet specific project needs. Operational costs, which include long-term maintenance, upgrades, and scalability expenses, must also be considered to ensure the platform's sustainability over time.

**(5) Governance mechanisms** provide the structural foundation for the blockchain's operation and evolution. Flexible governance frameworks enable accountability and transparency, fostering trust among participants. Mechanisms for multi-stakeholder consultation ensure that all relevant parties can contribute to decision-making processes, allowing the platform to adapt to evolving requirements and regulatory landscapes. This adaptability is crucial for the long-term success of initiatives like Project Agorá.

### 4. FIVE LEADING PERMISSIONED PLATFORMS

Several enterprise-grade platforms, including **Hyperledger Fabric**, **Hyperledger Besu**, **Digital Asset's Canton**, and **R3 Corda**, present strong options for Project Agorá.

**(1) Hyperledger Fabric:** Known for its modular architecture, Fabric supports plug-and-play consensus and privacy features, making it a versatile choice for financial institutions. Its permissioned nature ensures that only verified actors can participate in transaction validation and ledger updates, making it ideal for secure, high-throughput environments.

**(2) Hyperledger Besu:** A permissioned Ethereum client, Besu offers flexibility with its support for both public and permissioned blockchains. Besu's permissioned mode ensures high transaction throughput and the ability to regulate access, providing a middle ground between decentralization and control. In terms of the potential to scale the network across multiple jurisdictions and sectors around the world, this technology looks to be a great fit.

**(3) Digital Asset's Canton:** Built to provide privacy and interoperability across networks, Canton is suitable for cross-border financial applications. Its privacy features and sophisticated access control mechanisms make it a solid fit for creating a trusted financial ecosystem.

**(4) R3 Corda 4:** Corda 4 is designed with enterprise needs in mind, emphasizing privacy and security. As a permissioned blockchain, it enables organizations to share data on a need-to-know basis, ensuring that sensitive information remains confidential. Its focus on legal enforceability and transaction finality aligns well with the regulatory requirements of financial institutions.

**(5) R3 Corda 5:** The fifth iteration of Corda enhances the platform's capabilities, particularly in scalability and performance. Corda 5 maintains its strong focus on privacy while introducing features that improve interoperability with other systems. This makes it a good fit for a seamless and secure global financial infrastructure, allowing institutions to engage confidently in a shared ledger environment.

## 5. COMPARATIVE ASSESSMENT OF PLATFORMS

This section evaluates these five permissioned blockchain platforms against the established framework criteria and subcategories, providing an in-depth analysis of their suitability for Project Agorá.

(1) Hyperledger Fabric stands out for its modular architecture, allowing institutions to customize consensus mechanisms and tailor the platform to their needs. The platform delivers high scalability, with a throughput of approximately 3,000 transactions per second, and maintains low latency, making it well-suited for high-volume financial systems. Its strong interoperability enables integration with legacy systems and other blockchain networks, although it may require additional effort for seamless communication across diverse ecosystems. Fabric's identity management framework ensures robust participant verification, aligning with regulatory requirements. Data privacy is supported through channel-based communication, allowing transactions to remain confidential within designated groups. Implementation costs are moderate

due to its open-source nature, and operational costs are manageable, making it an economic choice. Fabric's governance structure is flexible, allowing institutions to define their policies and operational frameworks, which is critical for adapting to changing regulatory environments.

(2) Hyperledger Besu offers a balance of scalability and interoperability, supporting approximately 1,000 transactions per second. Its compatibility with Ethereum networks provides robust interoperability, making it ideal for cross-network communication. The platform supports various consensus mechanisms, including PBFT, which enhances efficiency and fault tolerance. Besu's access control and cryptographic identity management mechanisms ensure secure operations and compliance with regulatory standards. Data privacy is a key strength, with options for private transactions and enterprise-grade encryption. Implementation costs are relatively low, but operational and scalability costs can increase with extensive customization. Besu's governance structure is flexible, providing enterprises with the ability to balance decentralization and control, which is crucial for fostering trust and collaboration.

(3) R3 Corda 4 is designed specifically for financial institutions, prioritizing privacy and compliance. Its scalability, at approximately 600 transactions per second, is lower than Fabric and Besu's but sufficient for private networks. Interoperability is moderate, requiring additional integrations for cross-platform communication. Corda 4's notary-based consensus mechanism ensures transaction finality and legal enforceability, critical for regulated environments. Access control is strong, with mechanisms that restrict data sharing to need-to-know participants. The platform's focus on data privacy is unparalleled, ensuring confidentiality through its architecture. Implementation costs are competitive, and operational costs are optimized for private deployments. Governance is centralized, providing strong auditability and oversight, making it ideal for institutions that require stringent control over network operations.

(4) Building on the strengths of its predecessor, R3 Corda 5 introduces significant enhancements in scalability and performance. With throughput exceeding 1,500 transactions per second and improved latency, it is better suited for high-demand applications. Its interoperability has been optimized, allowing seamless integration with diverse financial systems. The platform retains its robust privacy features and legal enforceability, ensuring compliance with regulatory frameworks. Implementation costs are higher than Corda 4 due to its advanced capabilities, but operational and scalability costs remain efficient. Governance structures support multi-stakeholder collaboration, enabling the platform to adapt to diverse financial ecosystems and regulatory landscapes.

(5) Digital Asset's Canton emerges as the most advanced platform in terms of interoperability and privacy. Its high scalability, with a throughput of approximately 2,000 transactions per second, and very low latency make it ideal for global financial systems. Canton's privacy-centric consensus mechanisms ensure compliance with AML and CFT standards while maintaining data confidentiality. The platform's access control and identity management frameworks are robust, providing strong security against unauthorized access. Implementation costs are relatively high, reflecting its advanced capabilities, but its long-term operational efficiency justifies the investment. Canton's governance framework is multi-stakeholder-oriented, fostering trust and collaboration among diverse participants, which is critical for a global initiative like Project Agorá.

The comparative analysis highlights the strengths and weaknesses of each platform across the evaluation criteria. Hyperledger Fabric demonstrates its modular and flexible architecture, making it a cost-effective solution for organizations seeking customization and scalability. However, its moderate interoperability and reliance on additional integrations for cross-platform compatibility may limit its suitability for Project Agorá's global ecosystem. Hyperledger Besu offers strong interoperability due to its Ethereum compatibility, alongside adaptable consensus mechanisms, but its scalability and operational costs can vary significantly with customization requirements.

R3 Corda 4 focuses heavily on privacy and compliance, providing unparalleled data confidentiality and legal enforceability. While its throughput is lower than other platforms, it remains an excellent option for smaller, private networks. R3 Corda 5 improves on its predecessor, offering enhanced scalability and interoperability, which positions it as a versatile choice for diverse financial ecosystems. Its multi-stakeholder governance model and strong privacy features align well with Project Agorá's requirements.

Digital Asset's Canton stands out for its advanced interoperability, privacy-centric consensus mechanisms, and robust stakeholder collaboration framework. While Canton incurs higher implementation costs, its long-term scalability and operational efficiency justify the investment for large-scale, global financial networks. Its very low latency and compliance with regulatory standards make it a frontrunner for Project Agorá's ambitions to create a secure and efficient ecosystem.



THE COMPARATIVE ANALYSIS IS SUMMARIZED IN THE TABLE BELOW.

| Criteria categories          | Criteria               | Hyperledger Fabric | Hyperledger Besu | R3 Corda 4   | R3 Corda 5        | Digital Asset Canton |
|------------------------------|------------------------|--------------------|------------------|--------------|-------------------|----------------------|
| <b>(1) Protocol features</b> | Scalability            | High               | Moderate         | Moderate     | High              | High                 |
|                              | Interoperability       | Moderate           | High             | Moderate     | High              | Very High            |
|                              | Consensus Mechanisms   | Flexible           | Adaptable        | Notary based | Improved Notary   | Privacy Centric      |
|                              | Access control         | Strong             | Strong           | Strong       | Strong            | Very Strong          |
|                              | Identity Management    | Strong             | Strong           | Strong       | Strong            | Very Strong          |
|                              | Data Privacy           | High               | High             | Very High    | Very High         | Very High            |
| <b>(2) Performance</b>       | Throughput (TPS)       | ~3000              | ~1000            | ~600         | ~1500             | ~2000                |
|                              | Latency                | Low                | Moderate         | Low          | Low               | Very Low             |
| <b>(3) Security</b>          | Attack Resilience      | High               | High             | Very High    | Very High         | Very High            |
|                              | Regulatory Compliance  | Strong             | Strong           | Vey Strong   | Very Strong       | Very Strong          |
| <b>(4) Cost Analysis</b>     | Implementation Cost    | Moderate           | Low              | Competitive  | High              | High                 |
|                              | Operational Cost       | Moderate           | Moderate         | Competitive  | Medium            | High                 |
|                              | Scalability Cost       | Manageable         | Variable         | Low          | Medium            | High                 |
| <b>(5) Governance</b>        | Governance Flexibility | Flexible           | Flexible         | Centralized  | Multi-Stakeholder | Multi-Stakeholder    |
|                              | Stakeholder Management | Strong             | Strong           | Strong       | Very Strong       | Very Strong          |

For this analysis Digital Asset's Canton and R3 Corda 5 emerge as the most robust options for Project Agorá. Canton excels in interoperability, privacy, and governance, making it ideal for complex global ecosystems. Corda 5 balances scalability, privacy, and cost efficiency, making it versatile for diverse applications. Both Canton and Corda 5 meet these criteria, making them the optimal choices for enabling a secure and interoperable global financial ecosystem.

## 6. CONCLUSION

This paper establishes a framework for evaluating permissioned blockchain platforms for Project Agorá. The framework highlights critical dimensions such as scalability, interoperability, consensus mechanisms, security, cost, and governance, which are pivotal for choosing a suitable technology partner. By examining the risks posed by permissionless DLTs, this paper underscores the necessity of adopting permissioned blockchain solutions to meet the stringent requirements of regulated financial ecosystems.

Through the comparative assessment, Digital Asset's Canton and R3 Corda 5 have emerged as leading candidates due to their superior interoperability, robust privacy features, and alignment with global compliance standards. Canton's advanced privacy-centric consensus mechanisms and unparalleled interoperability make it ideal for a globally interconnected financial ecosystem. Similarly, R3 Corda 5's enhanced scalability, cost efficiency, and strong stakeholder governance position it as a versatile solution for diverse financial applications.

As the BIS moves forward with its RFP, it is imperative to rate platforms that balance innovation with regulatory compliance, scalability, and security. By doing so, Project Agorá can pave the way for a resilient, inclusive, and efficient global financial infrastructure, reinforcing the foundational principles of trust and collaboration in the digital age.

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