Project Hamilton

Frequently Asked Questions

Scope

The Federal Reserve Bank of Boston is releasing frequently asked questions (FAQ) to accompany a technical whitepaper and open-source code released on Thursday, Feb. 3, 2022. This FAQ is focused on central bank digital currency (CBDC) technological research and the structure of Project Hamilton. This technological research helps enrich policymakers' views on CBDC but is not meant to imply that the United States will issue a CBDC. The United States has not committed to issuing a CBDC.

Project Hamilton is a multi-year exploratory research collaboration between the Federal Reserve Bank of Boston and the Massachusetts Institute of Technology's Digital Currency Initiative (MIT DCI) to investigate the technical feasibility of a general purpose CBDC that could be used by an economy the size of the United States.

Phase I of this collaboration involved the release of a technical whitepaper accompanied by open-source code for a hypothetical CBDC platform, referred to as OpenCBDC. This phase focused on technical requirements, such as the platform's ability to handle a certain number of transactions per second.

Phase II of the collaboration will involve development and testing of design options and features to determine technical and performance tradeoffs associated with various designs.

General FAQs on Central Bank Digital Currencies

What is a central bank digital currency (CBDC)?

- Traditionally, central bank money takes two forms: (1) physical currency (cash) widely available for use by individuals, businesses, and others; and (2) reserves held by eligible financial institutions at the central bank.
- CBDC is a generic term for a third form of central bank money that is digital and a direct liability of a central bank.
- CBDCs are generally divided into two categories: (1) A general-purpose or retail CBDC would be widely available for use by individuals, businesses, and others to make digital payments (Project Hamilton's research focused here.); and (2) a wholesale CBDC would be available only to eligible financial institutions, usually as a settlement asset in financial markets, much like central bank reserves. These categories are not necessarily technologically mutually exclusive.

Why is the Federal Reserve interested in CBDC?

- The Federal Reserve has a mandate to promote monetary and financial stability and the safety and efficiency of the nation's payment system.[1]
- The Federal Reserve is committed to ensuring the public has access to a range of payments options to facilitate economic activity.

[1] The Fed - What is a Central Bank Digital Currency? Is the Federal Reserve moving toward adopting a digital dollar?

- The Federal Reserve researches emerging technology that may help fulfill its mandate, such as a general-purpose CBDC.
- Given the dollar's important role globally, it is essential that the Federal Reserve remains fully engaged in careful CBDC research and policy development.

Why now?

- Over the past 18 months, numerous congressional discussions about the viability of a U.S. backed CBDC created a compelling case to study the technical feasibility of a general purpose CBDC.
- Several external developments also added to the case for the Federal Reserve to better understand the technical options for launching a CBDC.
- Recent developments have made CBDC a technical possibility. The Federal Reserve is committed to exploring whether a CBDC and other technological innovations could contribute to the safety and efficiency of the nation's payments and financial systems, but it has made no decisions on whether or how to proceed with a CBDC.

What is the Federal Reserve doing related to CBDC?

- The Federal Reserve is looking at CBDC from a variety of angles to better understand its potential benefits and risks. These include:
    - *Experimentation with technology* to better understand the capabilities and limitations of different technologies that might be used to manage and transfer CBDCs. The Federal Reserve System is conducting research and experiments through two primary groups:
        - The Federal Reserve Board's TechLab
        - The Federal Reserve Bank of Boston's Project Hamilton
    - *Stakeholder engagement with government, academia, and the private sector* to learn about potential use cases, the range of design options, and other considerations.
    - *Collaboration with other central banks,* such as through a group of central banks looking at CBDC under the leadership of the Bank for International Settlements.[1]
    - *Conducting further economic research and policy analysis* to better understand the implications of a CBDC.
- In addition to research being performed at other Federal Reserve Banks, the Board of Governors released a discussion paper on digital payments, including the benefits and risks of a CBDC. The Federal Reserve Board's discussion paper is intended to stimulate broad conversation, and the Federal Reserve Board will ask for public comment on various issues, including payments, financial inclusion, data privacy, and information security.

- The Federal Reserve System's experimentation programs collaborate closely to ensure that their respective work is complementary.

- *Note that a significant policy, industry, and public engagement process would be needed to consider the issuance of a CBDC. This would also require extensive deliberations and engagement with other parts of the federal government and a broad set of other stakeholders.*

What problems might a CBDC help solve?

- CBDCs can be designed to address various goals, depending on each jurisdiction's unique circumstances and existing financial infrastructure. Each relevant authority must determine its own jurisdiction's goals and study whether CBDC is an appropriate method for achieving some or all of them. There are numerous areas where a general-purpose CBDC could have benefits, such as financial inclusion and other payment innovations (including cross-border payments and micro-payments, etc.). However, public consultation and deeper research are needed to determine that more definitively.
- Project Hamilton will contribute to that conversation with data about what is technically feasible, where public policy decisions and goals could influence design and ultimate functionality, and where technological advances may expand the range of policy options.

Does a CBDC need a blockchain to operate like cryptocurrencies?

- While CBDC is often associated with blockchain or distributed ledger technology, a CBDC can function without relying on a blockchain. Project Hamilton is technology-agnostic and looked at blockchain and non-blockchain solutions. The first phase of research borrowed components from blockchain and cryptocurrency systems but discarded some features of each.

Would a Federal Reserve-issued general-purpose CBDC replace physical currency (cash)?

- No. Ongoing research explores the potential of CBDC to complement cash and other payment systems, not replace them.
- The Federal Reserve is committed to ensuring the public has access to a range of payments options to facilitate economic activity. Demand for U.S. currency remains strong and issuing and supporting cash is a key function of the Federal Reserve.

Will a Federal Reserve-issued general-purpose CBDC be used as a surveillance tool?

- User privacy is one of the primary considerations in designing a transaction processor. As much as possible, OpenCBDC is intended to be a rigorous privacy-preserving tool that does not leak unnecessary information to third parties.

How does Project Hamilton's Phase One work relate to other Federal Reserve System CBDC research?

- The findings published by the Project Hamilton and MIT DCI collaboration, including the OpenCBDC code, are the result of technological experimentation that helps enrich policymakers' views on CBDC.
- Project Hamilton's hands-on technical research will bolster the Federal Reserve System's understanding of the challenges and tradeoffs associated with building a transaction processing engine for a CBDC. Project Hamilton is designed to explore some questions about a CBDC, but it

will not result in a decision about whether to establish a U.S. CBDC. It also does not deal with the many legal, policy, or regulatory questions associated with a CBDC.

What are the origins of this project?

- Staff and officers at the Federal Reserve Bank of Boston who have private- and public-sector payments and blockchain experience worked with System colleagues on a targeted technological research proposal that employed the expertise of the MIT researchers. The Federal Reserve Bank of Boston has staffed its Project Hamilton team with leading software engineers who are experts in supporting digital currency research.

What is the timeline for Project Hamilton?

- **Phase One** of Project Hamilton is completed. This phase was structured into multiple stages of work, spread over multiple years.
    - Phase One involved the development of transaction processing software, OpenCBDC, which was built to the robust technical requirements of a general-purpose CBDC. This software has been released under an open-source license along with a report outlining Project Hamilton's findings. The minimum technical requirements of the Phase One system were:
        - **Speed** – Clear and settle payments with near-immediate finality – *less than five seconds*.
        - **Throughput and Scalability** – Support the large volume of transactions potentially required of a retail-focused cash alternative – *initial throughput of greater than 100,000 transactions per second* with technical capability to support supplemental scaling solutions and *capability to support hundreds of millions of users*.
        - **Resilience** – Maintain robust 24/7/365 availability and protection of data in the event of network disruption.
        - **Security** – Prevent unauthorized data access and minimize the platform's attack surface.
        - **Flexibility** – Enable experimentation with different design choices and functionality configurations to support multiple possible policy outcomes.

- **Phase Two** will involve development and testing of various design options and features which were out of scope in Phase One. Its purpose will be to determine technical and performance tradeoffs associated with various designs.
    - Areas of research will likely include privacy, auditability, programmability, interoperability, and more.
    - The Federal Reserve Bank of Boston and MIT DCI will jointly publish results of this research, as in Phase One. Exact timing is to be determined and will be widely communicated.

Have the final design choices been defined?

- The Federal Reserve System has not decided to issue a CBDC and has not determined a final design.
- In its research, the Federal Reserve Bank of Boston and the MIT DCI will continue to test various design options and architectures. The choices for research remain open for feedback and contributions. To get involved, click here

Why build a custom system?

- Developing a custom system provides a unique opportunity to identify technological challenges which may require further exploration.
- In addition to developing a custom design with the MIT DCI, the Federal Reserve Bank of Boston will independently evaluate alternative platforms and architectures to ensure familiarity with a wide variety of approaches to CBDC development. Specifically, it will research open-source platforms and private-sector solutions and test some of the more promising platforms in its environment.
- Project Hamilton can use what it learns by developing a custom codebase to provide more information to policymakers and other stakeholders and to better inform evaluations of alternative platforms.

What is "open-source"? And why is Project Hamilton's research software being released under an open-source license?

- Open-source software is software with source code that anyone can inspect, modify, and enhance.
- The Project Hamilton team and the MIT DCI released their findings transparently to advance the global discussion about CBDCs. The technical design of a CBDC is challenging and involves certain key decisions and tradeoffs. The teams hope to receive feedback and contributions from other experts to refine and improve the research.
- The Federal Reserve Bank of Boston and MIT jointly own the IP associated with the OpenCBDC software and have published the software under an open-source license.

Did OpenCBDC use blockchain?

- In practice, what is commonly referred to as "blockchain" is an alchemy of different design characteristics, and not all blockchain-based systems are identical.

- OpenCBDC is not built using a blockchain. However, the research incorporates some techniques used by many blockchains, such as the use of asymmetric cryptography and cryptographically linked blocks of data.

- The research shows that select ideas from cryptography, distributed systems, and blockchain technology can enable unique functionality, such as cryptographic proofs of payment, atomic transfers, and flexible forms of authorization to spend, while maintaining strong performance. However, the research also found that other design choices like permissionless/permissioned blockchains or public records of transactions can come with real tradeoffs around performance and privacy.

- OpenCBDC also incorporates certain techniques used in classical distributed computing to maintain consensus across geographically distributed data centers.

Why is the Federal Reserve Bank of Boston's CBDC work named Project Hamilton?

- The project is named for two Hamiltons: Margaret Hamilton, who was director of the Software Engineering Division of the MIT Instrumentation Laboratory, which developed on-board flight software for NASA's Apollo program, and Alexander Hamilton, America's first Treasury secretary and founder of the Bank of the United States, a precursor to the Federal Reserve System.