4.2.1 Digital Cash Model

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Overview

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Almost all Cryptocurrencies implemented so far use the concept of tokens, accounts, wallets, transactions, and distributed ledgers. In essence, these approaches model the way money is handled in bank accounts[1]. However, the CBDC could also be modeled on actual cash (i.e., \$0.01, \$0.05, \$0.10, \$0.25, \$0.50 coins and \$1, \$2, \$5, \$10, \$20, \$50 and \$100 bills), in essence creating a true **Digital Dollar**. The Digital Dollar would create a digital coin for each of the denominations, with no further fractions. For example, a \$100 digital coin would only represent a value of $100.00 US Dollars. Representing more money would be done by collecting more \$100 digital coins, just like a real physical wallet. Representing values less than \$100 US dollars would be done using the other U.S.-denominated Digital Coins (i.e., \$1, \$5, etc). However, the Federal Reserve could issue other denominations that are higher than the \$100 bill if it chooses[2]. In addition, The Federal Reserve could create smaller denominations than the penny (i.e., $0.01). These denominations are impractical and too costly for real currencies but could be useful for micropayments (see **B0040**). The smallest denomination would most likely be limited in granularity to the cost of running the Consensus Algorithms (See the OMG DIDO-RA discussion on Consensus).

The End User could use a Digital Cash Wallet to hold their Digital Cash. These wallets could hold not only US Digital Currencies, but also other currencies, such as Digital UK Pounds, EU Euros, Japanese Yen, etc. The characteristics of Digital Cash are much like real cash, although there are no reasons an End User can not have and use only cash. At some point, in order to manage risk from loss, theft, damage, etc., it is best to put the cash into an account at some financial institution such as a bank, savings, loan, credit union, etc.

One could also allow Digital Cash to be bundled and processed into a Digital Cash Wallet. The Digital Cash Wallet would be very similar to an actual wallet. It would contain a collection of Digital Cash coins or Certificates in an array of Digital Currency Denominations.

Digital Cash Theoretical User Scenario

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> **Note:** The following Digital Cash Theoretical User Scenario is only provided for discussion purposes. Actual User Scenarios would be developed during systems analysis and modeled using a Model-Based Systems Engineering (MBSE) approach and address the problem is far more detail with a team of experts.

> **Note:** Also look at the Digital Account Model Theoretical User Scenario.

In the following example, the CBDC is modeled as a collection of Stablecoins, each one representing a form of physical cash (i.e., \$0.01, \$0.05, \$0.10, \$0.25, \$0.50 coins and \$1, \$2, \$5, \$10, \$20, \$50 and \$100 bills). The End User would actually "own" these Stablecoins and consequently, they would have all the same shortcomings as their physical equivalent. For example, if the Stablecoins are lost, damaged, or stolen, there is no "back-up". Contrast this with a Digital Account Model, where there are all kinds of safeguards protecting the asset.

This lack of protection from loss, damage, or theft becomes a natural deterrent to collecting and saving these as assets, just as with real physical currency. In essence, people are free to keep large amounts of cash in their mattresses, but the risk of loss, damage, or theft is high, thus prompting most end Users to deposit the money in accounts managed by traditional financial intermediaries.

Figure 1 represents a stylized use of a Digital Cash flow of a consumer (End User) buying a product from a retail store.

Figure 1: Simplified Digital Cash Flow

- Table 1 represents the initial contents of a Digital Cash Wallet of an End User. Each Digital Cash coin (Certificate) in the wallet, such as the five /\$100 coins, is signed by the owner of the Digital Cash Wallet. If there are Digital Cash Certificates that are not signed by the owner, they can not be used for the transaction.
- Table 2 represents the initial contents of Digital Cash Till at a store. Each Digital Cash Certificate, such as the ten /\$100 coins, is signed by the store that owns the Digital Cash Till. If there are Digital Cash Certificates that are not signed by the store, they can not be used for the transaction.

Table 1: Example of the initial contents of an End User Digital Cash Wallet.

Denomination	Quantity	Sum
\$100.00	5	\$500.00
\$50.00	15	\$750.00
\$20.00	6	\$120.00
\$10.00	9	\$90.00
\$5.00	3	\$15.00
\$2.00	0	\$0.00
\$1.00	10	\$10.00
\$0.50	4	\$2.00
\$0.25	8	\$2.00
\$0.10	4	\$0.40
\$0.05	5	\$0.25
\$0.01	7	\$0.07
TOTAL		\$1,489.72

Table 2: Example of the initial contents of a store's Digital Cash Till.

Denomination	Quantity	Sum
\$100.00	10	\$1,000.00
\$50.00	10	\$500.00
\$20.00	10	\$200.00
\$10.00	10	\$100.00
\$5.00	10	\$50.00
\$2.00	5	\$10.00
\$1.00	20	\$20.00
\$0.50	10	\$5.00
\$0.25	40	\$10.00
\$0.10	50	\$5.00
\$0.05	100	\$5.00
\$0.01	500	\$5.00
TOTAL		\$1,910.00

In this example, the End User's Digital Cash Wallet is used to purchase an item in a store that lists for \$488.78.

Table 3 provides a possible withdrawal from the End User's Digital Cash Wallet. If the withdrawal is

accepted by the Digital Cash Wallet's owner, the Digital Cash certificates ownership is changed to the stores.

Table 3: The Digital Cash from the wallet required to make the \$488.78 purchase.

Denomination	Quantity	Sum
\$100.00	4	$400.00
\$50.00	1	$50.00
\$20.00	1	$20.00
\$10.00	1	$10.00
\$5.00	1	$5.00
\$2.00	0	$0.00
\$1.00	3	$3.00
\$0.50	1	$0.50
\$0.25	1	$0.25
\$0.10	0	$0.00
\$0.05	0	$0.00
\$0.01	3	$0.03
TOTAL		$488.78

> **Note:** there are many ways the \$488.78 could have been achieved using the Digital Cash Wallet provided in Table 1. This is one way. In an actual implementation, the contents of the composition of cash could be modified by the End User as long as it summed to the \$488.78, just as would occur in a real wallet.

- Table 4 represents the contents of the Digital Cash Wallet of the End User after the transaction.
- Table 5 represents the contents of the Digital Cash Till of the store after the transaction.

Table 4: Example of a Digital Cash Wallet and its contents for an End User after transaction.

Denomination	Quantity	Sum
\$100.00	5	$100.00
\$50.00	15	$700.00
\$20.00	6	$100.00
\$10.00	9	$80.00
\$5.00	3	$10.00
\$2.00	0	$0.00
\$1.00	10	$7.00
\$0.50	4	$1.50
\$0.25	8	$1.75
\$0.10	4	$0.40
\$0.05	5	$0.25
\$0.01	7	$0.04
TOTAL		$1,000.94

Table 5: Example of a Digital Cash Wallet and its contents for a store after transaction.

Denomination	Quantity	Sum
\$100.00	14	$1,400.00
\$50.00	11	$550.00
\$20.00	11	$220.00
\$10.00	11	$110.00
\$5.00	11	$55.00
\$2.00	5	$10.00
\$1.00	23	$23.00
\$0.50	11	$5.50
\$0.25	41	$10.25
\$0.10	50	$5.00
\$0.05	100	$5.00
\$0.01	503	$5.03
TOTAL		$2,398.78

Example

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There are three categories of requirements alluded to in the White Paper and identified within the Object Management Group's CBDC WG White Paper Analysis:

- **Digital Cash Model** - these are requirements with CBDC characteristics most closely aligned with the simple coin cash model
- **Digital Account Model** - these are requirements with CBDC characteristics most closely aligned with the Digital Account Model (i.e, savings, checking, investment, direct pay, credit, debit cards, etc.)
- **Research Areas** - these are requirements with CBDC characteristics most closely aligned as “research” models such as Stablecoins

In this discussion, only the desirements were identified during the White Paper Analysis are considered. Table 6 represents the allocated of requirements germane to the Digital Cash Model.

Table 6: Mapping a subset of Digital Cash Model requirements identified within the White Paper Analysis conducted by the OMG's CBDC WG

Category	**Desirements**
Benefits	B0003, B0004, B0007, B0009, B0013, B0018, B0020, B0022-1, B0022-2, B0022-3, B0024, B0028, B0029, B0034, B0036, B0040, B0042
Policies and Considerations	P0004, P0027, P0029
Risks	R0013
Design	D0001, D0006, D0007, D0009
B = Benefit Considerations	
P = Policy Considerations	
R = Risk Considerations	
D = Design Considerations	

Example Discussion

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Table 7 provides a summary of using a Digital Dollar Model instead of a Digital Account, Cryptocurrency or Stablecoin Models.

Table 7: Example of mapping a subset of requirements identified in the White Paper Analysis conducted by the OMG's CBDC WG.

Desirement No.	Desirement Text	Comment
B0003, P0003	**Complement, rather than replace, current forms of money and methods for providing financial services**	The Digital Coins are intended to work in parallel with existing systems and to follow much the same lifecycle as current paper money. The same institutions would fulfill the same roles they currently do but have added roles and responsibilities for Digital Currency.
B0004, P0004, D0012	**Protect consumer privacy**	Since the journal is kept with each individual Digital Currency rather than on a globally accessible ledger (i.e., journal) then the consumers' privacy is more obfuscated. It becomes more like paper money.
B0005, P0005	**Protect against criminal activity**	Once criminal activity is detected, the Digital Dollars collected as part of the investigation can provide invaluable information for the prosecutors as to the origins of the money.
B0009	**Provide faster and cheaper payments (including cross-border payments)**	Digital Coins can be sent using normal encrypted electronic transfer for files.
B0013	**Provide immediate access to transferred funds**	Once the Digital Coins are transferred to a payee, the money can be spent exactly like cash
B0030	**Support benefit payments directly to citizens**	Not only can the payments be made directly to the citizens, but the payments may be colored by category: rent, medicine, food, communication, etc.
B0040	**Provide micropayment support**	Micropayments are financial transactions involving very small amounts of money and usually occur online. A number of micropayment systems were proposed and developed in the mid-to-late 1990s, all of which were ultimately unsuccessful. [3)]. The smallest amount of money that can be paid as a micropayment must be more than the cost of obtaining Consensus (See the OMG DIDO-RA discussion on Consensus)
B0046	**Enable rapid and cost-effective delivery of:** **1. wages,** **2. tax refunds** **3. other federal payments**	Digital Coins would be immediately available.
R0001	**Risk of affecting financial-sector market structure**	Since the Digital Coins would follow the existing Currency Lifecycle and the major financial institutions will have the same roles as they currently have, there should be minimal disruption to the existing financial structure
R0010	**CBDC has a Risk of significant energy footprint similar to Cryptocurrencies**	The use of Digital Coins does not require the costly Consensus Algorithms, the energy cost should be insignificant.

Desirement No.	Desirement Text	Comment
D0001	**Design should be for a non-interest-bearing CBDC, for example, would be less attractive as a substitute for commercial bank money**	Digital Dollars would be for all intents and purposes be the same as current paper money. It does not accumulate interest until it is deposited in a financial institution.

1)

99% (if not all) issued Initial Coin Offering (ICO) tokens on top of the Ethereum implements the ERC-20 standard.
https://www.omgwiki.org/dido/doku.php?id=dido:public:ra:xapend:xapend.b_stds:defact:ethereum:eip:erc_0020

2)

The Federal Reserve Board currently issues \$1, \$2, \$5, \$10, \$20, \$50, and \$100 notes. The largest denomination Federal Reserve note ever issued for public circulation was the \$10,000 note. On July 14, 1969, the Federal Reserve and the Department of the Treasury announced that banknotes in denominations of \$500, \$1,000, \$5,000, and \$10,000 would be discontinued due to lack of use. Although they were issued in 1969, they were last printed in 1945.
https://www.federalreserve.gov/faqs/currency_12600.htm

3)

Micropayment, Wikipedia, Accessed: 16 March 2022, https://en.wikipedia.org/wiki/Micropayment