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Introduction

We applaud the Federal Reserve on its strategic move toward a ubiquitous and interoperable RTGS platform. I am happy to share our experience and adapt our ideas with the Fed and others industry players to help them achieve these objectives. We have already started these efforts through our prior Fed Improvements comments and more recently in our participation in the US Faster Payments Council work groups.

This document includes several comments and suggestions in response to the specific aspects of the FedNow service description.

We believe that a proper roadmap for Banking Into The Future requires more than just an RTGS for interbank processing. This document describes a roadmap from several different aspects to comprise an enterprise digital bank platform and ecosystem design along with a transitional implementation plan.

Interoperable and independent services

Operating and design model

The following diagram from the industry collaborated US Faster Payments Council Directory Work Group (DWG) 2018 final report closely represents the design of what a distributed model for an interoperable directory service can be and what we believe can be most effective for an interoperable directory. This diagram can also apply to interoperable payment clearing and settlement services, which can be independent to the directory service functions and are covered within this document under Smart Transaction Services and Digital Currency Services. The other shared directory services models in the DWG report can also work. Our suggestions revolve around at least one of the shared data models.
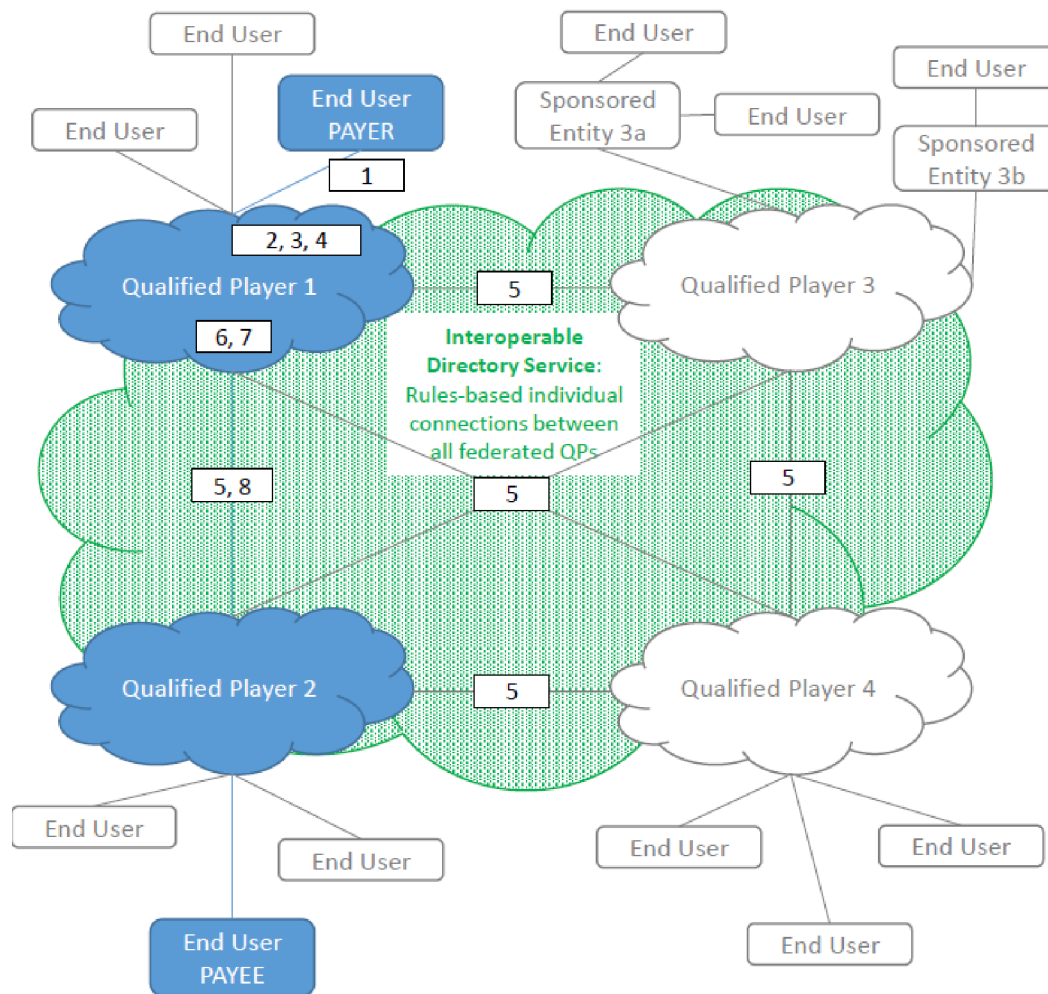
Diagram Legend

Governing Body – This would should be a single governing body over the collection of all of the players included in this diagram.

Interoperable Directory Service – This can either be one or many operators (IDSOs) overseen and regulated by the Governing Body. Each IDSO can operate a centralized or decentralized model of the qualified players that they provide the IDSO service for. If there are multiple IDSO's, then they will each be required to provide interoperable services between each other and to any new IDSOs introduced to the network as determined by the governing body. A single IDSO implementation can also serve the role of the Governing body.

Qualified Players – PSPs and perhaps some of the larger FIs which can provide services for Sponsored Entities

Sponsored Entities – Fis and other smaller PSPs which have KYC level information, but only share minimum End User and alias and accounts to their Qualified Players for processing of their end user directory lookup and payment services.

End User – End customer user aliases & accounts

The DWG report includes 4 models, 2 of which includes shared data and 2 of which did not. The above diagram model, which we recommend, shares information in a secure and one way lookup manner which protects participating PSP's end customer identities.

The other models described in the DWG report also have validity, but either a centralized or decentralized Interoperable Directory Service Operator (IDSO) needs to be open to include directory entries to cover all existing and potential new Qualified Players in order to provide ubiquity. The models that did not include shared directory entries required each Qualified player to connect to all other Qualified Players for each directory service request. These other models are less efficient and potentially create a barrier to entry for some existing and new Qualified Players to get connections with all of the other Qualified Players.

The following sections describe Key Directory Components plus Directory, Smart Transaction, and Digital Currency Services. These design concepts and services are not only applicable for interoperable functionality. They also provide a framework for new real time payment systems, such as how Vments was designed to tightly ingrate all of these functional services. Each of the services can be used independent of each other, where only one or more of them can be used and where other existing or new functional equivalents can be used within or coordinated externally to these functional services, such as where some "legacy" functionality can be integrated or interfaced with these services.

Key interoperable end user and account directory components

The Qualified Players only need directory sharing information as described below as Key Interoperable end user and account components. This excludes KYC level information, which may be necessary for some payment service message formats described under Smart Transactions Services. Therefore access to KYC level personal data requires use of Qualified Player or Sponsored Entities peer to peer request and approval messaging to release KYC level information through their end users in addition to what can be looked up from the following key interoperable end user and account directory components.

- Universal User Profile Id
  - A cryptographic id unique to all end users which can be linked to any number of end user aliases and their accounts.
  - End users aliases have a many to many relationship with their accounts.
  - Accounts can be linked to multiple Universal User Profile Ids where a single account can be accessible by multiple users (e.g. family shared access accounts, business account users).
  - In order to prevent, or at least minimize duplicate Universal User Profile Ids, validation of user aliases and accounts will be done before creating a new Universal User Profile Id. This creates an end user profile which links all of their aliases and accounts. It enables several new end user capabilities as well as cross FI/PSP fraud and AML detection. If no duplicates end user aliases are found when registering a new user, then a new Universal User Profile Id is auto created. If later detected that separately created Universal User Profile Ids have overlapping aliases or accounts, then these separate Ids can be linked to each other.
- PSP Id
  - A unique Id for each PSP that has accounts for these end customer users.
  - This identities a PSP to route payment processing and other PSP to PSP peer to peer interoperable functions.
- PSP User Id
  - The PSP specific id associated to user (or blank or they use alias or account instead)
  - User Id used to initiate a payment through PSP
- PSP Account Id
  - The PSP specific Account Id associated to account (or blank if not applicable when just a User Id is needed)
  - Account Id used to initiate a payment through PSP
- User Alias Type
  - Phone
  - Email
  - Biometric
  - Algorithmic parts of name, zip code, and part of street address
  - Other alias types
- User Alias Value
  - Stored as one way hash id value for lookup purposes only
- Universal Account Id
  - A cryptographic id unique for each account

- Account Alias Type
  - Bank Routing/Transit + Account Number
  - Card number (debit/credit cards)
  - International BIC/other intl account ids
  - Unbanked PSP account id
- Account Alias Value
  - Stored as one way hash id value for lookup purposes only

Directory Services

The following API functions descriptions enable interoperable directory services.

- FI Register/Onboard end customer users & accounts
  - Includes registering multiple end user aliases under a single End User Universal Profile Id
  - Includes linking end user accounts to legacy routing/transit and account numbers (if applicable which may not be for unbanked end users)
  - Includes linking users to accounts along with optional and applicable rights, controls, limits, and preferences.
  - All aliases and other sensitive data would be shared in one way hash ids which are only available for lookup and cannot be translated back to their original values.
  - All shared information would also be encrypted by combination of public and private keys.
- FI Update end customer & account profile info
  - Includes status changes and all levels of profile maintenance
- Lookup/Search
  - By Phone, Email, RT+Bank Acct, Debit/Credit Card Number,and other alias user and/or account types
  - Returns list of Universal User Profile Ids, PSPs, Universal Account Ids to push to or request payments from.
  - The lookup/search function may also be used before using one of the following profile sharing requests and approval to release additional KYC info
- Request Profile Sharing (Limited/Full Profile Info) – Payee PSP direct to Payer PSP
- Approve Profile Sharing (Limited/Full Profile Info) – Payer PSP back to Payee PSP

Smart Transaction Objects

Smart Transaction Objects (STOs) can represent invoices (and credit memos) which can be partially paid or split tender paid by multiple users and accounts. They could also be adjusted/written off by the requestor.

Another type of Smart Transaction is one which is the payment applied against several remit level Smart Transactions, as is typically done with B2B transactions.

Even if there is no request for payment or invoice, the pushed payment details can optionally include line item level and/or remittance details which do not need to cross reference and apply to invoice and credit memo STOs.

STOs include the basic information about the parties of a transaction, their FI settlement accounts, transaction reference numbers, and amounts.

STOs can include additional transaction details using any standard or self- describing format (ISO20022, ACH, EDI, XML, Json, etc...). These details can include invoice line item level details. They can also optionally include attached (or linked to external) documents, such as invoice/receipt images.

STOs can even include details to enable linking to accrual related STOs and/or real time payments pushed to third, fourth, and other parties, such as for taxes, commissions, shipping/delivery, tips, consignment, and other parties related to the original STO…

If the STO is for an invoice, which has a due date and may not get paid immediately, then it can be classified as an open item invoice or balance forward statement invoice. A balance forward statement invoice, includes the unpaid balance of its prior billing period's statement invoice. It updates the prior statement invoice STO as a carried forward balance closing it out in place of the new balance forward statement invoice STO which includes the latest closed billing cycle charges, if any. These open item and balance forward STOs also enable invoice factoring and/or collections.

All of these features were designed in Vments Smart Transactions, which is a comprehensive and flexible framework that can be implemented piecemeal are per client specific requirements and implementation priorities. This provides a long term transitional transformation roadmap that does not require redesign when some of these more sophisticated features may want to be implemented.

Smart Transaction Services

These services leverage the STO design to enable "on-us" or interoperable Smart Transaction Services which can use "on-us" or interoperable Directory Services. The Directory Services can be used before being able to initiate one of the Smart Transaction Services and/or where the Directory Services can be embed within the Smart Transaction Services functions described below.

Interoperable Smart Transaction Services are those where there can be separate payee and payer clearing message formats. There can be translation and mapping services between different formats, such as is done with EDI translation and mapping services. These mapping services may require use of directory services to lookup additional info required to fill out a different message format which requires additional info that the inbound message format did not include (e.g. mapping of ACH to ISO20022).

Interoperable settlement of these Smart Transactions can be performed by an Interoperable Settlement Service Operator (ISSO) which can either as act as a financial intermediary between Qualified Player PSPs or can use Digital Currency Services to enable PSP to PSP direct settlement.

Smart Transaction Services API functions include the following.

- Request Payment
  - This can be a request to credit push. This can also be used to request pre-authorization of a one time or recurring debit pull.
- Lookup/Retrieve Smart Transaction info
  - Used to lookup details of STOs
- Approve Payment
  - This can be the end user approval to a request for credit push or debit pull.
  - Secondary level approvals in Smart Transactions per user account level controls can be a great feature to use, such as for parental controls over family accounts and corporate management approvals for large approval amounts.
  - If no request for credit push is applicable, then this approval serves as both the request and approval.
    - Vments suggested design implementation for credit push approvals, which did not originate as a request, is to first create the Smart Transaction request to be approved by the credit push party by send them an approval confirmation through one of their preferred approval authenticate methods other then the method that they first identified themselves to inititate the transaction. The approval would be sent to one of their pre-registered end user preferences setup for such. This approach provides and extra level of security and fraud prevention for a second level of authentication to the first level that was used to initiate the credit push.
- Settle Payment
  - This can either be incorporated into the Approve Payment function or done separately when the settlement is not necessarily completed real time. The settlement methods can include any of the following plus others as applicable to be added to this open and ubiquitous framework.
    - Settled via Digital Currency Services (DCS - see section below)
    - Settled via internal "on-us" account transfer
    - Settled via FedNow trans through or outside of this API (once FedNow becomes available and unless FedNow acts as the ISSO)
    - Settled via TCH's RTP trans through or outside of this API
    - Settled via Card trans through or outside of this API
    - Settled via ACH (same or next day) through or outside of this API
    - Settled via FedWire through or outside of this API
    - Settled via other digital fiat cash equivalent (Chase, Citi, Wells, etc...)
    - Settled via EFT through or outside of this API
    - Settled with other fiat based digital currencies with corresponding exchange rates
      - This could also include cryptocurrencies, if and when any of these meet the scrutiny of properly regulated criteria (e.g. other CBDCs, Libra, Bitcoin, Ethereum, other stablecoins, etc…)
      - See section below regarding cross border interoperability for more about this.

- o If the settlement methods between the payer and payee PSPs differ, then the ISSO acts as the financial intermediary or a digital currency can be passed between PSP peers. Vments design for the digital currency is one where it can be re-used without having to settle it on every transaction. The digital currency can also be cleared and settled back into legacy accounts as described in the section Digital Currency Services below. When the ISSO acts as the intermediary, then they have to settle with each of the separate payer and payee PSPs settlement methods.
- Request Refund specific to a Smart Transaction
- Approve Refund Request – same settlement options as described above
- Start Transaction Adjustments (e.g. adjust balance/write-off)

Digital Currency Design

A digital fiat currency does not have to be, and likely should not be cryptocurrency based. It can and should have all of the equivalent functional benefits of cryptocurrencies, but leave behind the issues associated to crypto mining, separate currency, and unregulated wild west that some of these cryptocurrencies are known for. Vments patent pending non-crypto digital currency and Digital Currency Services design ideally integrates with, but can be independent to all of the above design concepts. When all are integrated, this comprises and enterprise platform and ecosystem.

Its designs aspects include the following.

- Non-crypto digital asset representation of the local USD fiat currency (or of any currency)
- Not its own currency nor a crypto stablecoin balanced to the dollar, like Tether and others have done
- Each token has its own value of any quantity of the local fiat smallest physical denomination (i.e. $0.01 or any multiple of it)
- Only issued by the central bank or with central bank controls over allowing participating depository FI/PSPs to issue the tokens, much like they how are regulated today for other prepaid accounts.
- All tokens are backed by legacy fiat reserves held by participating depository FI/PSPs or by the central bank
- Each token knows the current owner's account, token value, issuing FI/PSP holding the reserves, and issued date (so that oldest tokens always get used first).
- Only one owner can own the tokens at a time.
- A transaction is settled using the oldest tokens, where one of them usually would need to be parent child split and the child split token is transferred to the new owner account.
- Each token has its own transfer history, which only ends when a tokens is exchanged out of the ecosystem back into the legacy fiat ecosystem. This exchange has rules and logic for how to clear with the FI/PSPs holding the reserves that originally issued the tokens. FI/PSPs can clear opt to hold and re-use tokens exchanged for legacy fiat funds for tokens that they did not originally issue.
- Can be used offline when each token also records the unique device id that it is currently stored on which can be transferred to another device and then no longer be used from the original device. All offline tokens and transfer transactions auto sync online as soon as one of the pair of offline devices connects online, or is already online at the time of transfer.

Digital Currency use in a credit account

The same digital currency token described above in cash equivalent accounts can also be used to extend credit when the token is issued to a credit account. The account holder then only owes the funds to the FI/PSP once the credit token is used where its then becomes cash in the receivers digital cash account that it was transferred to. The credit account can be billed monthly as is done today, or new shorter billing cycles can enable a transformation of billing cycles to limit risks and not have to require as high credit limits. Once the credit account bill is settled, which can be through legacy means or even better through Smart Transactions and Digital Currency settlement, then the credit issuing FI can issue additional tokens for the amount paid. Then if there were no additional payments out of the credit account, it is restored back to its original credit limit.

A key difference is in the reserve requirements backing the digital currency held in the credit accounts. This would need to follow any similar reserve requirements for all current credit accounts issued. Once the tokens are used and transferred from a credit account, then they need to meet cash account reserve requirements.

Digital Currency Services

Digital Currency Services API functions include the following.

- Issue Tokens
    - This is the starting point for new tokens and is either done by the central bank as a CBDC or through properly licensed depository institutions under regulations similar to other prepaid accounts.
    - This is only used when the next function, "Exchange Tokens for Fiat", is used to load digital currency into and end user's account and the FI/PSP is not holding any tokens issued by other FIs/PSPs in their internal accounts that they can transfer these to their end customer before any new tokens are issued.
    - The issuing FI is required to hold fiat backed reserves to eventually use to settle Token Clearing Requests (see below)
    - Each token has its own issued value. Any number of tokens that add up to, or exceed a transaction transfer amount. If exceeded, then the last of these tokens gets parent/child split where the child split token then can settle the exact transfer amount and the parent token remains with the original transfer from peer.
- Exchange Tokens for Fiat
    - This is where and end user requests having digital currency loaded into their FI/PSP related account in exchange for the equivalent fiat value being taken out of their "legacy" account or in exchange for physical cash.
    - This first uses the "Transfer Tokens (online)" function to transfer any tokens being held by the FI/PSP which were issued by other FI/PSPs holding the corresponding reserves. If additional tokens are required for the exchange request, then the "Issue Tokens" function is used to issue new tokens for the balance of the request.
- Transfer Tokens (online)
    - This is where tokens are transferred between PSPs of end user peers where it settles between these end user peers into their PSP accounts while it also simultaneous settles between these PSPs as if cash were exchanged and deposited into these PSP end user accounts. This digital cash can immediately be re-used, just like cash.
    - The transfer uses tokens that add up to, or exceed the transfer amount. If exceeded, then the last of these tokens gets parent/child split where the child split token then can settle the exact transfer amount and the parent token remains with the original transfer from peer.
    - The oldest issue tokens are always used first on all transfers.
- Transfer Tokens (offline device to device)
    - Each digital currency token is either only online or loaded onto a specific device where it has a online digital twin that knows what device it was downloaded onto. The online digital twin cannot be used until it unloaded from the device.
    - If the devices of peers of a transaction are both offline, then the device specific tokens get recorded as transferred similar to how the tokens were transferred online. Once transferred, the tokens can only be re-used by the transfer to party on the transferred to device. Once either of the devices connects online, then the digital twin token transfer history is updated.
    - There are many more details, controls, and limits related to the use of these device download tokens that I will not elaborate on in this document and which we can share with interested parties.

- Exchange Fiat for Tokens
  - This is where an end user requests unloading digital currency from their digital FI/PSP related account in exchange for the equivalent fiat value being put into their "legacy" account or in exchange for physical cash.
  - If the FI/PSP was one that issued (and is therefore holding the reserves for) any of the digital currency tokens in this transfer, then this retires the life of the digital currency token and the corresponding amount of the reserves if transferred to the FI/PSP.
  - Any tokens not issued by the FI/PSP are recorded in the FI/PSPs in-house digital currency account where they can either reuse these for "Exchange Tokens for Fiat" requests or they can clear these tokens through "Token Clearing Requests" described below.
- Token Clearing Requests
  - This is for FI/PSP holding digital currency tokens in their in-house digital currency account that they want to clear and settle with the FI/PSPs that originally issued these tokens and can use the corresponding reserves to settle these clearing requests through other existing legacy account transfer means

There can be multiple digital currencies representing the same fiat currency used different purposes, such as for any of the following digital currency specific use cases.

- Inter-bank account settlement using CBDC
- Interoperable PSP account settlement
- End User Peer to Peer settlement
  - Through FI/PSP opened accounts and FI/PSP processing of the peer to peer transactions
  - The FIs are not disintermediated in this approach. They are instead re-intermediated in a different way than how they operate today, thus enabling new business and economic models.

A single digital currency per fiat can be used across all of the above use cases, but where the account types have corresponding limits and controls of how and with what other accounts can be settled with each other.

Cross Border Interoperability

All of the above design and functional services can apply to any currency and country.

The directory design can support international IDSOs and/or country and currency specific IDSOs which can peer to peer interoperate with each other when there is a cross border transaction that requires such. An international IDSO design is made possible when a country and currency code is added as as one of the ket interoperable directory components which identifies the country of the user and the currencies of their accounts.

Vments design includes a digital currency account type specific for this purpose where it can be a cash or credit based account that is for a currency other than the user's home based fiat currency. FIs and PSPs which are licensed to operate in other countries and corresponding currencies can then open accounts for their end customer in any of these currencies. The end user digital wallet then can include accounts across multiple currencies as well as across multiple FI/PSPs. Vments design also includes an FX exchange marketplace where international FI/PSPs can allow their end customers (and/or be open to other FI/PSP customers) to exchange different digital currencies using a bid/ask model as a transformation of the currency legacy based FX exchanges. A cross border transaction can be simplified when the FX exchange is done either before or after a transaction is made using either the payer's or the payee's currency, unless the payee otherwise can reuse the payer's currency for other transactions without having to exchange it for their home currency. This is the key of how a US dollar digital fiat currency, backed by the Fed, can become the replacement for what is threatened for the current US dollar's use and acceptance internationally. The race is on to beat out Libra's and China's threats to become the international US dollar replacement.

The Smart Transactions design also supports cross border transaction interoperability where it can either allow an integrated or interfaced cross border currency settlement or where separate digital currency and country specific ecosystems can each record the same cross border Smart Transaction on both sides of a cross country and/or currency transaction.

Vments Digital Currency design is one which can apply to any currency which equivalent to the fiat currency backing each digital currency token. The ideal scenario is one where other central banks adopt the digital currency services for their fiat based currency. Interoperability does not have to be limited to only those counties and currencies that adopt the same design. It needs to be open to exchange with other digital or legacy based fiat currencies as well.

Master accounts and enhanced sub-accounts

The proposed FedNow solution assumes a continued dependence on the current legacy master accounts and all of the limitations of its design which restricts the ability of enabling the Fed to truly transform and transition off their legacy systems for which they have fewer and fewer resources familiar with and capable of maintaining and supporting. A long term design transformation requires a fresh look at the foundation starting with master account design.

The proposed continued use of the current master accounts continues to require dependence on the current centralized master account design. This also limits FI/PSPs to transform and migrate off of their legacy platforms, some of which are based on 50 year old design limitations.

Continued use of the current master account design also continues, and perhaps increases, the burden for FIs to reconcile their system's to the new real time integration of FedNow master accounts versus having a new decentralized design that FI/PSPs can trust as an immutable book of record and build around this accordingly.

We suggest new more secure and never visible account numbers, not only at the FI level, but also for all of their end customer accounts effectively as sub-accounts to their new master accounts, which is the sum of all of the sub-accounts including FI in-house sub-accounts.

The new accounts effectively comprise their own ecosystem of funds and transactions that recirculate within it, much like RTP has for its participating banks, and other services such as PayPal, Venmo, Amazon, Apple, and others have funds and transactions which recirculate within their ecosystems. These funds can be represented through a digital currency, which does not have to be cryptocurrency based, but which can have all of the equivalent functional benefits and leave behind the issues associated to crypto mining and a separate currency. See the section Digital Currency Services section above where we describe our design approach for non-crypto digital currency and how it integrates into this overall enterprise designed platform and ecosystem.

Our suggested approach is where each of the participating FI accounts in the new FedNow ecosystem can then have the equivalent functionality of the joint accounts and use the liquidity management tools and/or the 24x7x365 FedWire service. These new tools and expanded service hours provide the integration between the current master and new real time FedNow ecosystem. Under these joint accounts, then they can have sub-accounts for each of the end customer plus in-house accounts.

This approach eliminates an unfair advantage to competitive ecosystems, such as RTP, which would have to interface with their currency legacy master accounts via joint accounts versus FedNow real time transactions being directly integrated into the legacy accounts.

The legacy master accounts can continue to use existing batch oriented transaction types as well as be used for overnight reserve balance interest calculations while the new ecosystem has all real time transactions through new master joint accounts and sub-accounts as described above.

The FedNow new ecosystem then becomes the system of record for the new sub-accounts. Legacy bank routing and account numbers can be used to transfers funds in and out of the legacy ecosystem with the new FedNow ecosystem, much like is done with many other real time payment ecosystems, some of which (i.e. PayPal and Venmo) are even using RTP for that exchange of funds to be real time. Leverage of the FedWire, ATM real time rails, and same day ACH are other options for transferring funds in and out of the new sub-accounts where their legacy routing and account numbers can be proxy aliases to transact through the new sub—accounts.

Banks can optionally maintain a copy of these sub-accounts and transactions into their legacy systems and accounts while they begin to build new replacement functions to their accounting and compliance requirements off of the sub-accounts and transactions in the new ecosystem and platform that can take them and FedNow into the next century. This allows FI/PSPs and the Fed to eventually phase out their legacy systems and accounts, some of which are 50 years or more old and are locked into current legacy design restrictions that this suggested approach provides a transitional roadmap off of.

An implementation architecture which FedNow can eventually evolve to is to allow FI/PSPs to participate as a part of a private distributed ledger to the initial centralized design and operation of FedNow. The initial implementation can be designed and implemented as a distributed ledger made up of and operated by the various Fed reserve bank branches.

This design and roadmap goes beyond the relatively simplified improvement on the current ecosystem, which only addresses some of the desired long term results and viability before it too is considered legacy.

Legacy bank routing and account numbers can also be used as proxies to the new never visible and more secure FedNow sub-accounts. See more about proxies and end user identification and access below where we discuss directory models and services.

Once all FI/PSPs perform all of their transactions on the new ecosystem, then the Fed can use the real time balance as of end of day of funds in the new ecosystem to calculate interest on overnight a reserves percentage of the funds across all of the sub-accounts under each FI, including those which are FI/PSP in-house accounts. This then can eliminate the need for transfers in and out of the legacy master accounts for end of day reserve requirements.

Since accounts can have multiple owners and beneficiaries, individual end users can be each also have their own unique and never visible digital identity which can be linked to the new sub-accounts as owners, beneficiaries, and users. End users can have any number of proxy/alias identity types and ids linked to their user ids (e.g. email, phone, biometric, merchant/biller specific, and other existing or new identify types). See the section about "Key Interoperable end user and account directory components" above for more about this. End users can have individualized access and usage rights, controls, and limits which can be extensions to the interoperable directory design.

Transaction Limits

The single $25,000 limit proposed should be designed to be more flexible and variable based on transaction type.

For example consumer retail transactions and bill payments do not even need such as high limit. B2B transactions may require higher limits, especially for their payables and receivables. Interbank transactions which eventually can be used to replace FedWires would require yet higher limits. Real time P2P transfers might only need to be limited to $500.

Vments proposed design can extend the directory design to enable limits to be set per user, account, and transaction type. The Governing Body can set up the max limits by transaction type. FedNow FI/PSPs can then set there end consumer and business customer limits per account within the max limits. Then end users can setup their own user, account, and even device level limits within those set by their FI/PSP. This design also extends to cover end user preferences under their profile and down to their account and even device level.

Transaction Approval Controls, Methods, and Preferences

This is where the extension of the Directory Services can include end user level controls, identity and approval authentication methods, and preferences. All of these can be at the user and account level within limits and rules as set by the FI/PSP, whose limits and rules are within Governing Body limits and rules.

All transactions ideally would require 2-factor authentication, one for identification of the user and another for approval. Optional secondary level approvals as described above under Smart Transaction Approvals would also be possible under this framework.

Fraud and AML Detection and Prevention

The new centralized or distributed implementation of sub-account level information tied to end user profiles which can look across their FI accounts enables cross FI AML and Fraud detection not possible in todays FI centric environments.

Vments has designed a real time flexible suspicious rules engine which can be adapted per FI/PSP as well as at the central bank level looking across accounts for single or linked FI/PSP. It also includes a blacklist feature in its design to lock out parties that attempt fraud or other in-appropriate use or hacks of the system.

# Legacy transformation enabled through new platform framework

Any-time ACH

ACH can be transformed to an FI peer to peer Smart Transaction where the ACH formatted data specific to ODFI and RDFI peers can be any time sent and retrieved. Then optionally, but ideally, these Any-time ACH exchanges could be settled using Digital Currency Services as described above. They could otherwise be deferred net settled using simple FedWire and/or current ACH CCDs, where all of the detail level ACH data was already processed through the Any-time ACH FI peer to peer exchanges. The digital currency option can reduce or eliminate the counterparty risk for the deferred net settled, especially if the digital currency is CBDC backed.

Any-time ACH starts with ACH detail clearing exchanged for a digital currency that Vments calls Virtual Fiat Money (VFM).
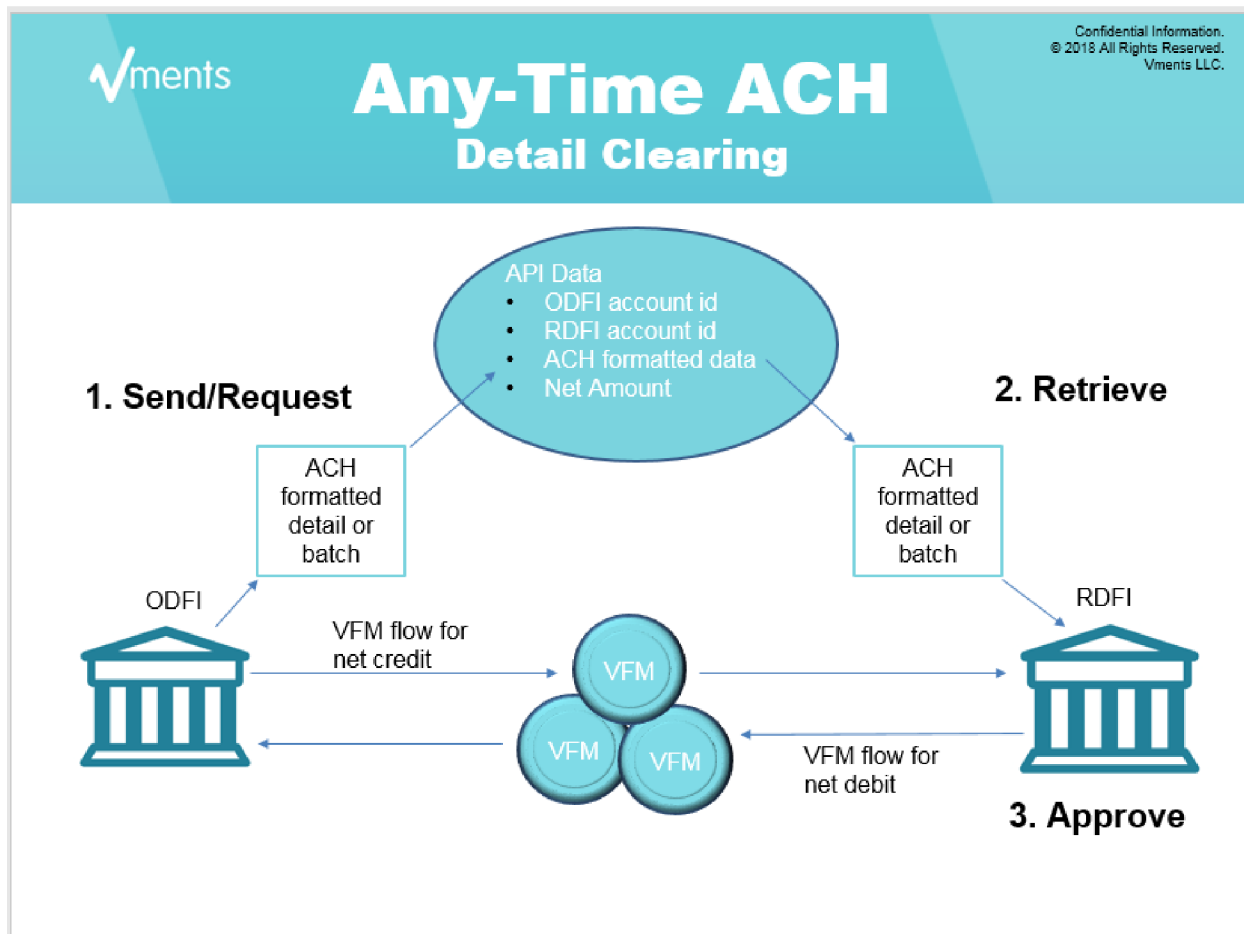
The VFM can be re-used or optionally cleared and settled with the FI/PSP that originally issued it in bulk as shown below. This is what the same as was described earlier in the document under Digital Currency Token Clearing Requests.
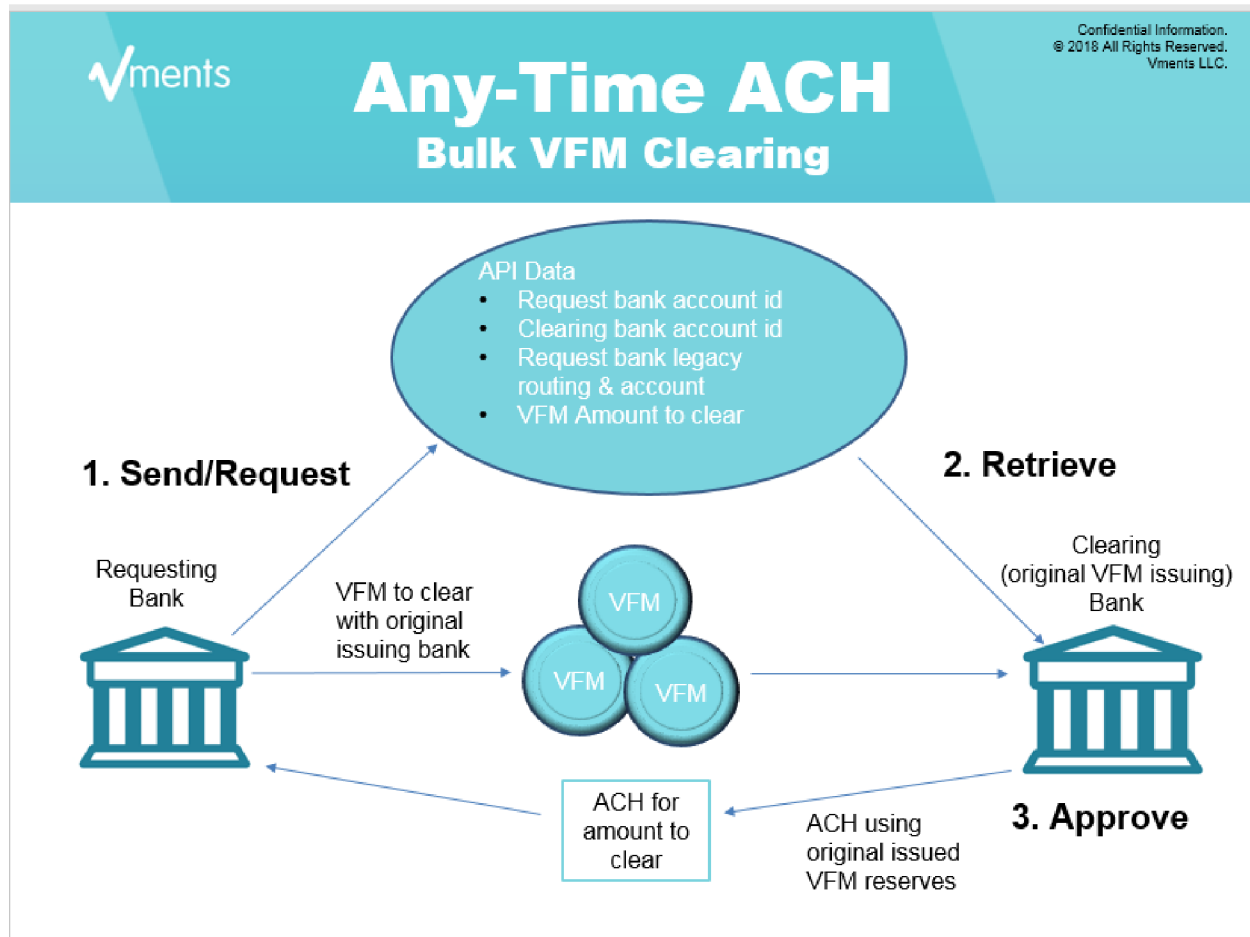
Since banks already send and receive ACHs, this approach could be a relatively easy integration opportunity to transform this legacy beyond same and next business day to any time and then even eventually to real time. This could be the low hanging fruit of an initial limited implementation of the framework design described in this document.

Real time checks

Checks converted to ACH can piggy back on the Any-time ACHs described above. Checks that cannot be ACH converted and must be settled through IRDs can also be processed through a Smart Transaction similar to how the flows is described for Any-time ACHs.

DDA account conversion and integration with new real time accounts

Implementation of a new real time digital cash account can start as a conversion and integration with existing DDA (and other depository) accounts. When a DDA is converted, the balance in the account is transferred to a new digital sub-account (as described above) and the DDA is linked to this account as a proxy/alias for real time transactions. The DDA would be left open with a zero balance.

Existing legacy DDA debits (all types; checks, Debit card, ACH, bill payments, wires, ATM & teller withdrawals, etc…) would be modified to first check the new real time digital account balance for available funds. The funds in the digital sub-account would be real time transferred to the FI/PSP in-house sub-account which would then transfer funds to the legacy DDA where the debit transaction can settle against and return back to zero balance.

Existing legacy DDA credits (all types, Debit card credits, ACH, wires, ATM & teller deposits, etc…) to the DDA would be used to convert and transfer the funds to the new digital sub-account and return the legacy DDA back to zero balance.

Ideally Digital Currency is used for all of the transfer to and from the new digital sub-accounts.

Debit and Credit card proxies/alias

When the underlying account is a new never visible digital account that existing accounts can be converted to, then these card number can just become proxy aliases to perform real time transactions bypassing these legacy accounts until these card account become no longer relevant

Wires

Conversion of wires to new real time rails would be a great use case to help transform and sunset this legacy transaction method once those rails support applicable transaction limits for this type of transaction. Use of Smart Transaction and Digital Currency Services would be ideal for this transformation. Use of Directory Services can be used to help real time validate receivers versus the current processes used for this.

Another option is where Smart Transactions can be used to add additional controls and security to the request and approval workflow where existing wire transaction data can be attached to these Smart Transactions.

International wires are optimal when the receiver currency differs and that currency is also digital fiat and can be exchanged either before or after the transaction and the exchange rate is not part of the wire transaction and the sender or receiver can shop for the best rate from an digital FX marketplace as described earlier. The wire can also handle the FX exchange as part of the wire's Smart Transaction settlement. If the sending or receiving currency is not one which is digital fiat, then then the FI one of the transaction can opt to handle the exchange.

Smart Transaction secondary level approvals would also help prevent fraud.

Core Banking transition off of legacy

As more and more use cases are transitioned off of legacy accounts into new digital real time accounts, corresponding core banking functions revolving around these legacy accounts can be initially supplemented and then eventually replaced.

Cash back and rewards

Cash back can be transformed to real time similar to how Apple has done where they provide real time cash back rewards for use of Apple Pay and the new Apply Card. The cash back is credited immediately into Apple Cash accounts setup through Green Dot.

Reward points can be other currencies under this framework design implemented in a separate private network of FI/PSP and Merchants. The transformation of these reward point currencies is to enable them to be transferred peer to peer between end consumers. Incorporation of these currencies into the FX marketplace described above for fiat currencies allows these to be exchanged lust like exchanging one fiat currency for another.

Liquidity and credit

Use of the Digital Currency Services reduces and potentially eliminates liquidity required for FI/PSP counterparty risk, especially when a CBDC which can be equivalent of cash is implemented. Even if the digital currency is one issued by another FI/PSP under the Central Bank acting as the Governing Body in this design, then it can still be looked at as cash since it can be re-used without having to settle it with the FI/PSPs that original issued it and are holding the reserves in legacy accounts. As described above, digital currency held in an in-house sub-account issued by other FI/PSPs can optionally be bulk cleared and settled with the FI/PSPs that issued it and are holding the corresponding reserves in legacy accounts (see the diagram applicable to this under the Any-time ACH section).

The new sub-account design also enables the Fed to eventually use the balance total of all of the sub-accounts to determine the FI/PSPs reserve amount that can be used for overnight T-bill investment credit.

Use of the credit account feature described in this document can be applied for real time intra-day credit issued by the Fed to FI/PSPs for liquidity management.

Irrevocability versus Smart Transaction Refunds

Since a real time transaction is being considered as irrevocable, that does not mean that there can't be a Smart Trans Refund request and approval which would be the electronic equivalent of the end customer peers of an in person cash transaction.

Vments designed Smart Transaction requests to include refund terms which merchants and vendors can set within guidelines and rules establish between then and their FI/PSP which fall under guidelines and rules established by the Governing Body in this design. If refund terms are not honored by a merchant/vendor, then in that case an FI/PSP can opt to provide dispute resolution services along the lines of chargebacks in today's environment. This allows for transformation of current chargeback rules and procedures which can provide significant savings incentives to FI/PSPs that absorb the huge costs of handling all of these disputes and chargeback that the majority of which can be switched to be between the customer and merchant/vendor peers of a Smart Transaction.

Vments also designed a dispute resolution marketplace which FI/PSPs can opt to participate in for their customers at no charge or otherwise re-capture these costs through new optional real time payment insurance fees in addition to or integral within current recurring fees for some accounts, especially those with reward points or cash back.

This type of transformation can enable significant changes to the economic and business model related to merchant services today.

Daily and business day opening/closing times

The proposed 9pm ET closing is 6 pm on the west coast, which means transactions posted after 6 pm PT would be treated as the next day. This is even earlier for Alaska and Hawaii.

Should this eventually be extended to midnight ET to accommodate other time zones or perhaps 6 pm local time zone of each FI's headquarters or of the time zone of the sub-account owners? This would make if across all of the time zones the US covers. It would also make it quite simpler if it was midnight local time.

The new real time design is one which can also look back at ay points in time to know what balances were are any point in time for all accounts. The hard cutoff time approach is no longer necessary when this is taken into consideration.

FedWire expanded service hours

This is important in order to help with liquidity management of joint accounts and the new sub-accounts with legacy master accounts. It will also be helpful to have these extended hours for other uses that otherwise have to wait if they miss the current more limited service hours. Eventually FedWire can be transformed or replaced as the FedNow matures and is able to be used for all that FedWire is currently used for.

Relevant perspectives about other progress around the world

Libra, China, and other cryptocurrencies

Take a good look China's digital currency race against Facebooks' Libra and recognize that the stakes and requirements to protect or US dollar currency and our banking system as we know it today are more than RTGS. Over 40 countries are researching and working on their answer to a digital version of their fiat currency to counter the threat of un-regulated and sometimes underground use of cryptocurrencies. The race is on for digital currencies that could rule the world for global trade and commerce and could replace the use of the US dollar's strength globally.

The following article describes the closest design match to Vments that we have seen in the market or in the news to date.

> https://www.coindesk.com/new-head-of-chinas-digital-currency-says-it-beats-facebook-libra-on-tech-features?utm_source=&utm_medium=&utm_campaign=

Here is a blurb from the article which triggered our alert to a match to Vments which we would like to see the US be able to respond to and join in the race.

> "PBoC's digital yuan will be able to be transferred between users without an account and without a mobile or internet network, the report cites Mu as saying. Providing a user's mobile phone has a wallet, the digital currency can be transferred to another person by placing the two phones in physical contact. Presumably, this feature is enabled by near-field communication (NFC).
>
> "Even Libra can't do this," Mu said.
>
> PBoC's digital currency also doesn't need a bank account to be used, and is "free from the control of the traditional bank account system," Shanghai Securities News cites Mu as saying. He further suggested it allows users to preserve their privacy when using the system.
>
> However, the digital currency will be delivered via commercial banks like fiat currency. The banks must open accounts with the PBoC and buy the token at 100 percent value. After that, users may open digital wallets for the digital currency through the banks or commercial organizations.
>
> According to the report, Mu added that the main reason for developing the digital currency is "planning ahead" to protect monetary sovereignty and China's legal currency

Takeaway comments from "The Future of Money - *Central Bank Coin*"

Following are some quotes, and corresponding takeaway comments, form a speech by Agustín Carstens, General Manager, Bank for International Settlements. The speech was at the Central Bank of Ireland, 22 March 2019

The speech was documented in as pdf called, "The Future of Money - Central Bank Coin". It was very relevant to all that has been discussed relative to central bank digital currencies (CBDCs).

> "Cash is public money, issued by the central bank. The others represent private money. That is, liabilities of either a commercial bank, the phone company, or a big tech firm."

What if the central bank allowed the depository institutions to issue digital currency using the central bank system where the funds are backed by funds held in new reserve accounts (and corresponding sub accounts in the central bank system? These funds would be equivalent to cash backed by the central bank while at the same time they represent a balance sheet liability for the issuing banks. Then the central bank could also calculate interest on a reserve portion on these deposits in this new real time ecosystem where transfers between this new ecosystem and the legacy master accounts with the central bank would be a transition plan until everything were run through the new ecosystem. The interest would only be on the digital cash held in FI/PSP sub-accounts where the digital cash was issued by other banks since the digital cash issued by each bank in the new ecosystem could be used for legacy reserve account overnight T-Bill interest. This was also the primary economic model for Libra's consortium of major industry players (other than FIs which could not participate) where the reserves backing the digital money in the Libra ecosystem could be short term invested and T-bills and other equivalents.

> "If more trans were to settle in detail, there would be less need to settle interbank, especially if the digital money, preferably CBDC were able to recirculate versus having to interbank settle."

With the new ecosystem of end customer sub-accounts, this is exactly how Vments is designed where interbank transfers are only necessary when a bank want to transfer funds out of the new ecosystem into their legacy master accounts. If no interest is calculated on the new ecosystem accounts, then each bank would likely clear and settled the digital cash in their in-house sub-accounts with each of the banks that issued the digital cash and are holding the reserves for such in their legacy reserve accounts. This is described in this document as bulk VFM clearing under the Any-time ACH section.

> "A wholesale CBDC would be restricted to a limited group of users and used for interbank payments and other settlement transactions. A retail CBDC would be widely accessible to everyone."

Both are possible where they can be different currencies in Vments design with exchange rate of 1 between them.

> "open bank accounts directly with the Central Bank of Ireland."

They are not thinking that the sub-account can be opened in the central bank system by partipating FI, which is how this would work in Vments design.

> "it would be easier to replicate the attributes of cash – if so desired – in a token-based version of CBDC than in an account-based one. But the digital token technology is still broadly untested, whereas the technology for an account-based CBDC"

Vments design is a combination of both account based and digital cash token design.

> "The current system has two tiers. The customer-facing banking system is one tier, and the central bank is the other"

Vments design combines both tiers

Financial Inclusion

There are over 30 million unbanked and underserved in the US and billions around the world. Ubiquity should consider financial inclusion versus the exclusionary stance that FedNow limits to just those who have bank accounts.

This is where our proposed design of new sub-account ids which can optionally be tied to bank accounts as proxy aliases for backward and forward compatibility. These sub-accounts can otherwise be linked to prepaid accounts, such as those already widely used in the prepaid account industry that services the unbanked and underserved through networks of MSB agent locations that enable cash in and cash out locations.

Many of these alternative financial services were already enabling real time transfers of funds for nearly 20 years even before we started calling some of the technologies coming out of this industry FinTech as it started to apply some of these originally unbanked technologies to the mainstream including those with bank accounts.

Vments founder and architect, Steven Wasserman, was a co-founder of one of these FinTech companies (IPP later renamed to Softgate Systems) that served the unbanked and under-banked since 1992. That company grew to a network of over 30,000 MSB agent locations around the US and provided real time bill payment and prepaid account top-ups. Softgate was acquired by a Canadian company, which a year later sold out to PayPal. Steve's other experience for over 30 years was in the ERP industry, providing electronic banking interfaces connecting corporates to their banks and other payment and B2B services. Much of this FinTech and ERP experience was incorporated into Vments enterprise design which we are sharing aspects of for consideration of the Fed's development of FedNow.

Other Fed/Governing Body Services

The above is what enables the Fed (or other Governing Body) to provide services for their FI/PSPs to use for their end customer transactions. Then there are similar, but a different level of services specific to use between the Fed/Governing Body and the FI/PSPs for their setup, maintenance, and management of the PSP & FI master and sub-accounts with the Fed or other clearing house. These functions include, but are not limited to the following.

- FI/PSP/IDSO/ISSO onboarding
- Fraud and AML monitoring (as described in corresponding section above)
- Payment message translation (i.e. convert ACH into ISO20022 and visa versa)
- FI/PSP development and integration sandbox
- Certified development, integration, and implementation software and services marketplace

Roadmap to Banking Into The Future

An initial limited and simplistic centralized interbank implementation as was proposed for FedNow may not serve the following needs.

- A longer term solution which could be outdated too soon before, or shortly after, its fully implemented limitations require a re-design
- Global compatibility and interoperability as other counties adapt digital currencies and new platforms that many of the FI/PSPs that operate in the US as well as in these other countries will have to support legacy interfaces in the US as they transform elsewhere.
- Supporting continued use of the US Dollar as a globally accepted and used currency, but now more secure and better tracked
- Improved security and less fraud prone accounts and processing services

The peer to peer design has many benefits including facilitated and reduced reconciliations using shared and immutable data and more scalable distributed node processing, fault tolerance, and no single point of failure.

The core of the peer to peer design can be initially implemented under a centralized central bank operator for their FI/PSPs, and then transitioned to enable the FI/PSPs to operate their own node of the network as they modernize their systems.

The peers in an initial limited implementation could be use the sub-account design described above, where the sub-accounts are initially setup just for interbank FI/PSP in-house reserve balance accounts for Sponsored Entities operating through Qualified Players. During the interim, the centralized operation can cover a limited implementation of what the full design capabilities enable a roadmap to enable implementation of the next level of sub-accounts for end user customers without requiring a re-design.

The end customer level implementation could also just be implemented by and at the FI/PSP level as they implement their integration into the distributed transition from centralized to decentralized operation. We call this a roadmap to Banking Into The Future and look forward to helping the Fed and others in the industry to plan out their journey along this roadmap.

Vments was designed to incorporate all of the above features into its comprehensive and enterprise functional design which we are happy to share and work with the Fed and others in the industry to incorporate aspects of this into its design and implementation roadmap. For further information contact

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