TAPx YELLOW PAPER

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Created in collaboration with:

NEWTOWN PARTNERS
BLOCKCHAIN INVESTMENT & ADVISORY

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Abstract

The TAPx forum blockchain system has a number of different decentralized technology requirements that makes use of existing technology currently owned by Tapatalk, as well as other 3rd party technologies, including for Unifying Forum Software, Identity Management, Reputation Management and issuing a native Cryptocurrency.

As part of Tapatalk's commitment to create a decentralized ecosystem for online forums, Tapatalk will contribute to the TAPx project its proprietary Unified Forum API for connecting to all major forum software platforms. The TAPx Forum Commons will open source the API and invest in the creation of an open-source developer ecosystem to further enhance, maintain and support the Unified Forum API..

Based on a review of the functional requirements of the TAPx network, it appears that the best 3rd party technology configuration to use is the native EOS system for Reputation & Cryptocurrency layers and using Civic for the Identity Management layer. The second best option is to use the native EOS Solution for all 3 layers.

In the event that the EOS network does not develop as quickly as is necessary for the go-live of TAPx, then a combination of Civic, IPFS/BigChinaDB and ERC-20 tokens will be a significantly poorer fall fallback option.

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A. Introduction

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The TAPx system has a number of different technology requirements, including:

- **Unified Forum API:** For TAPx to work with forums that run on different forum software and on different infrastructure, TAPx will tap into the Tapatalk Forum API to build the Identity and Reputation modules on top of existing forum software.

- **Identity Management:** For a decentralized system, users require a persistent and trustless identity, while balancing these requirements with the current risks of private key storage and the poor UX of current blockchain-based solutions.

- **Reputation Management:** Where a user's reputation, based on their interactions with content and other users in forums, is calculated and stored.

- **Cryptocurrency:** Which blockchain the network unit of account & medium of exchange token should be issued on.

B. Background on the Layers

Unified Forum API

The Tapatalk Plugin API is a key piece of software that is currently installed and running on over 200,000 online forums worldwide. he Tapatalk Mobile App currently relies on the Unified Forum API to streamline mobile app access to online forums built on traditional forum software. Tapatalk plans to contribute this API to TAPx, and the Forum Commons will then make the Unified API open-source. It is expected that this will enable a large eco-system of casual and professional developers to enhance existing features and build additional new features for use in the TAPx network.
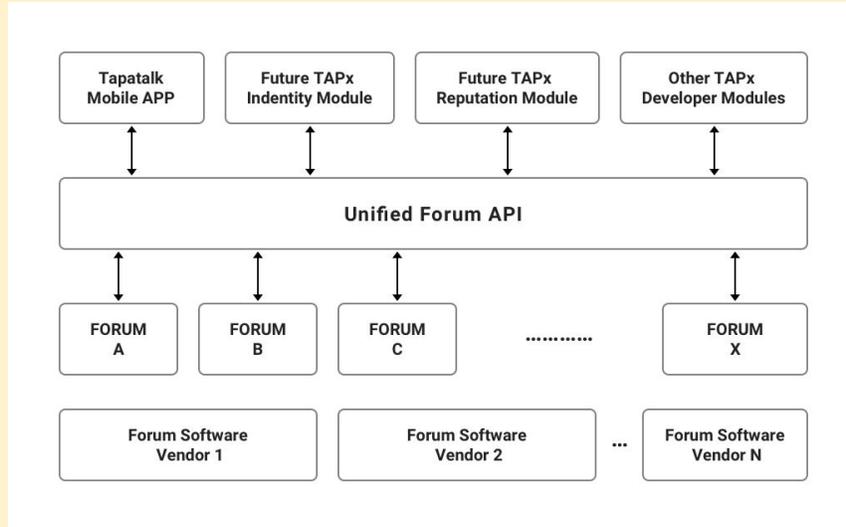
Figure 1: A overview of Tapatalk Plugin architecture

The Unified Forum API is based on the XMLRPC protocol, allowing developers to build clients (such as mobile apps) and services (such as Single Sign On) that can access any online forums that have installed the Tapatalk Plugin. The Tapatalk Plugin currently supports all major online forum software, including commercial forum software such as vBulletin, open source software such as phpBB, as well as other third party forum networks that have implemented the Unified Forum API in-house. Proboards.com, the biggest free forum network on the Internet also makes use of the Unified Forum API.

```xml
<?xml version="1.0"?>
<methodCall>
  <methodName>new_topic</methodName>
  <params>
    <param>
      <value>
        <string>3</string>
      </value>
    </param>
    <param>
      <value>
        <base64>Is this forum on TAPx
yet?</base64>
      </value>
    </param>
    <param>
      <value>
        <base64>Just checking in to see if
this forum will be on TAPx network anytime
soon? That would make my life a lot
easier!</base64>
      </value>
    </param>
```

```xml
<?xml version="1.0" encoding="UTF-8"?>
<methodResponse>
  <params>
    <param>
      <value>
        <struct>
          <member>
            <name>result</name>
            <value>
              <boolean>1</boolean>
            </value>
          </member>
          <member>
            <name>topic_id</name>
            <value>
              <string>4421</string>
            </value>
          </member>
          <member>
            <name>state</name>
            <value>
              <int>1</int>
            </value>
```

```
    </params>                              </member>
</methodCall>                          </value>
                                     </param>
                                  </params>
                              </methodResponse>
```

Figure 2: A sample of Tapatalk Unified Forum API Request and Response

The Unified Forum API provides almost 100 different API methods to access features common to all forum system software, from signing-in to the forums, to accessing private messages and also provides tools that forum moderators use to moderate content and users. The implementation is time-proof with no major security incident since inception over 7 years ago, and is trusted by some of the largest forum communities on the internet, such as MacRumors.com and XDA. It is also used by Google-owned Waze, who make use of the API on their support community forum.

Identity Management

When participating in any online forum, a user's identity plays a key role. Whether anonymous or not, a user's reputation is most likely tied to their online identity and dictates their rights on the forum. Users spend significant amounts of time curating their identity and building up a reputation that is linked to this identity. This cultivated reputation can elevate others' perception of the online actions taken by the user and often grants them more and higher privileges.

Since the Tapatalk plugin is already active on thousands of forums that will eventually comprise the beginning of the TAPx network, TAPx seeks a decentralized forum identity solution that will enable users to 'port' their identity from one TAPx forum to another. Possible technology solutions should also enable TAPx to implement such a system in a decentralized and trustless manner. A centralized analogy would be websites that provide login functionality for users choosing to user their Google or Facebook credentials.

Reputation

Each identity on the TAPx network will have a reputation that is linked to it. This reputation should be verifiable and editable based upon the actions that users take on forums. The reputation may be edited frequently and by a number of different forums on the TAPx network. If a user chooses to share their reputation with a TAPx forum, then they should not be able to revoke 'write-access' to their reputation, while they are a member of that forum and for a reasonable time thereafter. This is so that the reputation system is not vulnerable to nothing at stake attacks i.e. a user with a high reputation score, joins a forum, is granted access to all functionality, attacks the forum and either refuses to grant 'write-access' to the forum, or revokes it before the forum can update it.

Cryptocurrency

The choice of cryptocurrency or fungible token, is concerned with selecting the most appropriate underlying blockchain, based on the desired use cases, exchange adoption, wallet adoption, software standards and the maturity of the developer ecosystem. In this instance, the most appropriate blockchain for the TAPx project is a choice between the leading decentralized application (DApp) platform Ethereum (ETH), and newcomer EOS.

Ethereum's most widely adopted native fungible token standard is ERC-20[1], which runs on Solidity and it has been widely adopted with over 90,000 tokens issued based on it[2]. Its wide adoption has created an ecosystem of support around the ERC-20 token format[3]. This includes support from prominent exchanges, smart contract solutions like OpenZeppelin[4], online[5] and hardware[6] wallets, and a large developer community of over 250,000 developers using the Truffle developer framework. Unfortunately the Ethereum platform is currently a Proof of Work (POW) blockchain with an uncertain timeline for it to switch to a Proof of Stake (POS) consensus algorithm, which creates scaling concerns for projects wishing to deploy DApps on Ethereum. For reference, the Ethereum network can currently only process approximately 15 transactions per second. These network constraints cause decentralized applications to become frozen when the Ethereum network is overloaded. As the network becomes more congested, it becomes increasingly expensive to process transactions. There are a number of scaling solutions that have been proposed for Ethereum, but none has been implemented on the mainnet yet[7].

EOS has a fundamentally different architecture to Ethereum. EOS is a Delegated Proof of Stake (DPOS) system that is more centralized in terms of how it processes blocks of transactions, which enables it to process more transactions per second. In EOS, instead of miners competing to process transactions as is the case in a POW blockchain, there are 21 trusted block producers that are voted on by the token holders. These trusted block producers can process a higher rate of transactions per a second compared to Ethereum, due to several aspects of the EOS architecture[8]:

- The Delegated Proof of Stake (DPoS) mechanism allows for a small set of network validators to be selected democratically. These delegates do not need to mine a block through cryptographic work for consensus, meaning many more transactions can be processed per block.

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[1] https://theethereum.wiki/w/index.php/ERC20_Token_Standard
[2] https://etherscan.io/tokens
[3] https://media.consensys.net/the-state-of-the-ethereum-network-949332cb6895
[4] https://openzeppelin.org/
[5] https://www.myetherwallet.com/
[6] https://www.ledgerwallet.com/
[7] https://www.coindesk.com/information/will-ethereum-scale/
[8] https://blockgeeks.com/guides/eos-blockchain/

- Smart contracts on EOS can be executed using parallel processing. This means many types of smart contracts can be executed by validators more quickly than on networks without parallel processing (such as Ethereum).

- Asynchronous smart contracts, which will allow smart contract operations and on-chain transactions to occur simultaneously.

Some pre-alpha tests on EOS ran at a rate of over 50,000 transactions per second[9]. Importantly, all EOS transactions are free. This is because EOS treats access to network resources through an 'ownership' model: if you hold X% of the total circulating supply of EOS tokens, you have access to X% of the network resources[10].

C.   Requirements

In the case of TAPx, in order of importance, the combination of the four technology layers that comprise key elements of the TAPx system must:

1. Enable users to port their identity and reputation between TAPx forums

2. Be cost effective for network operations

3. Be scalable

4. Allow reputation to be adjusted by the TAPx network programmatically, but also manually by forum owners, under certain circumstances

5. Be easy to use for forum users, with a simple User Interface

6. Be easy for forum owners to install, activate and test the effect of joining the TAPx network

7. Be ready for DApps to build on top of it.

Unified Forum API Layer

Bootstrapping Adoption

TAPx can bootstrap and accelerate forum adoption of the blockchain network, by expanding the Tapatalk Plugin to include additional TAPx features. Since the Tapatalk Plugin is already adopted by over 200,000 online forums, forum owners can easily opt-in to the TAPx network without installing any additional pieces of software that would take months to build, test and distribute.

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[9] https://steemit.com/eos/@dantheman/web-assembly-on-eos-50-000-transfers-per-second
[10]https://steemit.com/eos/@cryptofreedom/a-smart-contract-platform-without-transaction-costs-or-the-need-for-gas-will-finally-make-dapp-development-practical-an

Single Sign On

The Single Sign On (SSO) module currently available from inside the Tapatalk Plugin will be upgraded to support the TAPx Identity Module to bridge the gap from legacy forum authentication to the blockchain-based Identity. The Tapatalk SSO service is currently used by over 20 millions users to store their multiple forum identities within Tapatalk and allows them to sign on to different forums with just a single Tapatalk ID.

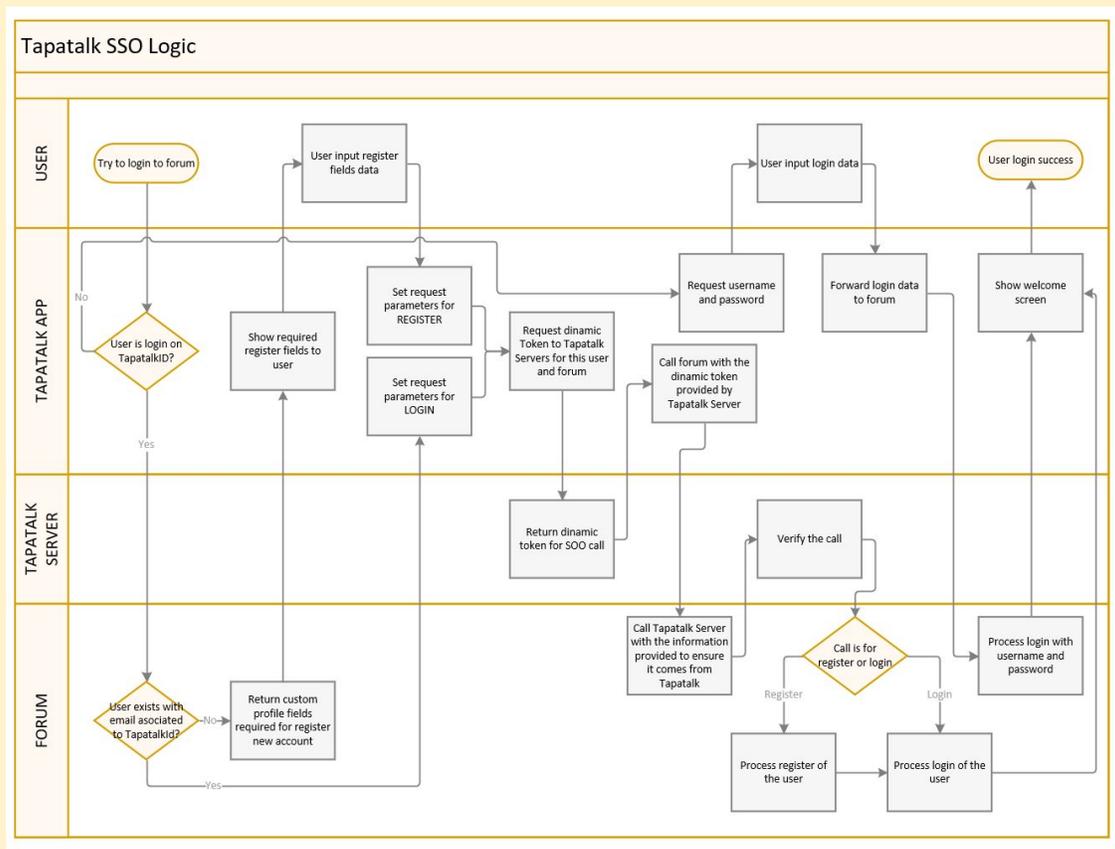TAPx plans to license the Tapatalk SSO technology to fast-track development of blockchain-based Identity module.

Figure 3: Tapatalk Identity Module interacting with individual forums via SSO.

Forum Moderation and Governance

The Tapatalk Plugin currently supports advanced forum moderation features such as Banning and Unbanning forum members, the ability to flag inappropriate posts and to notify forum moderators to take action, such as deleting or approving posts, or moving discussions to different sections in the forum.

TAPx plans to expand the original Tapatalk forum moderation and governance tools by connecting them to the new Identity and Reputation modules, so that forum governance will become further decentralized.

Member Engagement, Email and Push Notifications

The Tapatalk Plugin includes a Unified Notification module that supports both Email and Mobile Push Notifications to keep members and moderators informed and engaged. For example, when a post approval is needed, an email or push notifications will be dispatched to the moderators to act. Another example is the Private Messaging services between members, where Tapatalk can instantly notify both members of any new messages.

Engagement and Notifications will be especially important in the TAPx network where Rewards and eCommerce transactions will take place. Imagine if a member tips someone else for their help in an Q&A thread - we would want to have the member instantly notified when he receives the tip tokens. TAPx will be able to leverage this existing technology to fast track the development the Reputation and Incentive modules.

Identity Management Layer

uPort

uPort is a decentralized identity management system on the Ethereum platform. A uPort identity consists of an identifier, which is a proxy contract at a particular Ethereum address, owned by a user. All requests to validate or update identity will go through this proxy contract and, by extension, the user. In this way, there is a mechanism for data access and requests (the contract), and an implicit identity (the address of the contract itself).

The identifier, combined with the uPort registry, provides a powerful tool for identity management. The uPort registry is accessed through a registry contract which, in turn, is accessed through a proxy contract, and stores off-chain attributes or data relating to the user identity. This off-chain data, for example, is data stored on IPFS in JSON format. IPFS[11] or the Interplanetary File System can be thought of as a decentralized cloud storage provider. This architecture enables information associated with identity, such as reputation, to be stored off-chain and shared only with user permission.

Unfortunately, the owner of the uPort identity can modify data in the uPort registry linked to their identity - it is a self-sovereign identity. For objective data, such as reputation, which needs to be updated by a third party and not directly by the user, something like a claims registry (see ERC-780 below) would have to be implemented for forums to declare the reputations of users.

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[11] https://ipfs.io/

uPort has also proposed a new "lightweight" identity, ERC-1056[12], which is intended for much cheaper account creation. However, as of July 2018, this standard has not been merged.

ERC-725

ERC-725 is a standard for managing identity on the Ethereum blockchain, as an alternative to uPort. It's designed to fulfil two broad functions[13]:

- to identify a particular user or object, and allow this user to execute transactions and participate in DApps using this on-chain identity.

- to reflect claims associated with this identity, in combination with the ERC-735 standard. Claims are meant to be public, provable attestations from third parties about some characteristic of a given identity.

Each identity is represented by a smart contract on the Ethereum blockchain. Therefore, much like with uPort, the owner of the private key of the smart contract's address (which, in this context, would be the TAPx user) has complete control over executing actions associated with his or her identity. The ERC-725 smart contract is very simple in structure, holding no additional metadata regarding the user.

The primary drawback to ERC-725 is that user account creation could be an expensive exercise considering the size of Tapatalk's userbase, which would comprise a large part of the initial TAPx network for participating forums. Every ported Tapatalk network user will need an individual ERC-725 account, each represented by a smart contract. However, once an account is created it is unlikely the ERC-725 smart contract will ever need to be changed as it would not reflect any constantly-changing metadata relating to the user.

ERC-725 (and its sibling, ERC-735) is a reasonably new protocol[14] but has already seen one use case in the Origin Protocol. The Origin Protocol is a protocol for building marketplaces on the blockchain for listings of goods and services. They have decided to use the ERC-725 standard for managing identities in these marketplaces[15].

Civic

There are additional third party decentralized solutions such as Civic. Civic is a decentralized identity management platform that allows users to control their identity information, while enabling objective data to be verified by a Validator and preventing the user from editing or influencing such an attestation. An encrypted attestation of this data is stored on the blockchain. When a user wishes to prove that some element of their identity has been validated, they simply

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[12] https://github.com/ethereum/EIPs/issues/1056

[13] https://github.com/ethereum/EIPs/issues/725

[14] According to the EIP 725 issue, it was introduced in October 2017.

[15] https://medium.com/originprotocol/managing-identity-with-a-ui-for-erc-725-5c7422b38c09

reveal only the relevant information to a requestor, who is able to verify this hash against the attestation.

Civic is blockchain agnostic and can be deployed in a solution using either Ethereum or EOS. It already has a live single sign-on product. While Civic is most frequently seen as a solution for validated (real) identities, not self-sovereign or multiple identities per user, the functionality to use Civic to manage self-sovereign identity is already available. The immediate scale of the TAPx network enabled through the Tapatalk plugin could be a desirable showcase of Civic's technology being used in this way.

Native EOS Identity Management

EOS has built-in functionality for user accounts and permissions associated with those accounts to be used with DApps[16]. For each EOS account, there are various "permission" roles which dictate which other accounts can execute certain actions. For example, a multisig account has an "owner" permission, which can have multiple accounts, each with a certain voting weight. The sum of the owner accounts' weights needs to exceed a certain threshold for an "owner" action to be executed by those owner accounts. This functionality could be used to enable third party systems to manage certain attributes of the account, such as for reputation. While EOS accounts themselves don't appear to have attributes which can store arbitrary data, it appears possible that they could be used as a channel through which this reputation data can be mutated by approved parties, such as TAPx or forum owners.

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[16] https://github.com/EOSIO/eos/wiki/Accounts-&-Permissions

```
$ cleos get account tester
{
  "name": "tester",
  "eos_balance": 0,
  "staked_balance": 1,
  "unstaking_balance": 0,
  "last_unstaking_time": "1969-12-31T23:59:59",
  "permissions": [{
      "name": "active",
      "parent": "owner",
      "required_auth": {
        "threshold": 1,
        "keys": [{
            "key": "EOS7d9A3uLe6As66jzN8j44TXJUqJSK3bFjjEEqR4oTvNAB3iM9SA",
            "weight": 1
          }
        ],
        "accounts": []
      }
    },{
      "name": "owner",
      "parent": "owner",
      "required_auth": {
        "threshold": 1,
        "keys": [{
            "key": "EOS4toFS3YXEQCkuuw1aqDLrtHim86Gz9u3hBdcBw5KNPZcursVHq",
            "weight": 1
          }
        ],
        "accounts": []
      }
    }
  ]
}
```

Figure 10: A breakdown of the EOS account structure in JSON format.

The figure above is an example of an account structure from the EOS Github[17]. It may be possible to give a "reputation" smart contract @publish or @active rights to the account. The primary issue with the EOS identity management solution suggested here, is that the EOS network itself, including the identity management components, have not been live for very long and are thus largely untested from a security perspective. Further, a single sign-on solution must be developed for EOS before it could be used on the TAPx network. This would require work by the TAPx team to build out components of the EOS system.

Reputation Layer

ERC-735

ERC-735[18] is intended to be used in conjunction with ERC-725 and acts as a "claims protocol" related to ERC-725 identities[19]. A claim is issued by an issuer regarding a particular ERC-725 smart contract address. The issuer could be an arbitrary smart contract or another ERC-725 identity. A claim includes a cryptographic signature proving that the issuer has indeed issued

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[17] https://github.com/EOSIO/eos/wiki/Command-Reference

[18] https://github.com/ethereum/EIPs/issues/735

[19] It may be possible that claims can be associated with any type of public address, but it has logically been designed to work with ERC-725.

this particular claim. The human-readable claim data can be stored anywhere, and is reflected in a URI field of the ERC-735 claim.

This naturally lends itself to an implementation of reputation in the TAPx network. TAPx (or any registered reputation issuer, such as a forum) could have a known ERC-725 identity. This identity can then issue claims about the reputation of a user (who has their own ERC-725 identity). This claim could be stored anywhere, such as on IPFS or BigchainDB.

The drawback of ERC-735 is that it appears claims are issued on-chain. This would mean reputation updates would still be a costly process, and may also still not scale well on the Ethereum network. For example, Origin Protocol[20] has a tool with a simple ERC-725/735 identity and claims implementation[21]. An update of a field to a value of 5000 using the ERC-735 contract for an ERC-725 identity costs about 0.0004 ETH (or $0.18) as of 13 July 2018. If a forum is pushing reputation updates to TAPx monthly, and has one hundred thousand active users with changing reputation, the total cost would be in the range of $10,000 - $20,000 monthly.

ERC-780

ERC-780 is another "claims protocol" known as the Ethereum Claims Registry[22]. Introduced in November 2017 by the uPort team, its function is similar to that of ERC-735 in reflecting claims associated not only with uPort identities, but any Ethereum address.

Claims are issued by an issuer about a subject, through specifying a key-value pair (the key here would be reputation, while the value would be the reputation value). The registry itself will be a smart contract deployed at a particular address. ERC-780 can also be used with uPort's lightweight proposed identity, ERC-1056[23].

Much like ERC-735, these are on-chain claims and therefore have similar drawbacks. Fortunately, uPort is designed to interact with both ERC-780 and JWTs (Json Web Tokens), which are designed to be used for off-chain claims. Unfortunately, as of July 2018, ERC-780 has not been merged into the Ethereum codebase.

IPFS or BigChainDB

A widely deployed current centralized data storage solution for Tinder, Facebook and many forums is MongoDB. MongoDB is a type of NoSQL (not only SQL) database program that is flexible and provides ease of access. In MongoDB, there is a 'collection' of users. In this collection, each user has their own 'document'. This user document is very flexible and can contain any specific detail that is pertinent to a user, without other users also having to contain this information. The figure below would be an example of a collection. For each specific user,

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[20] https://www.originprotocol.com/
[21] https://erc725.originprotocol.com/
[22] https://github.com/ethereum/EIPs/issues/780
[23]https://medium.com/uport/erc1056-erc780-an-open-identity-and-claims-protocol-for-ethereum-aef7207bc744

we can define whatever schema we would like to. This means that each user account can contain different data types for different forums and affords maximum flexibility.
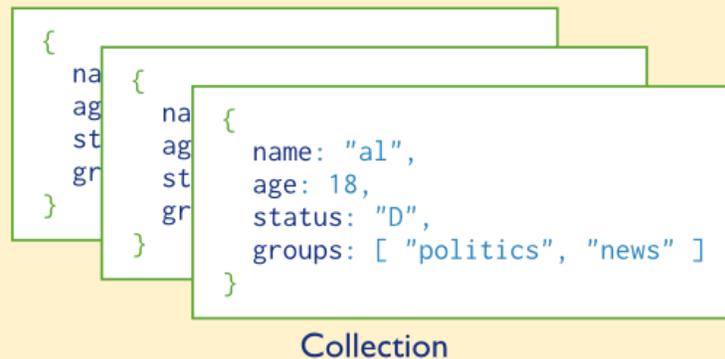


```
{
    name: "al",
    age: 18,
    status: "D",
    groups: [ "politics", "news" ]
}
```

Collection

Figure 11: Visual representation of a collection of users in MongoDB.

An ideal solution for TAPx would then likely be a decentralized MongoDB solution. There are numerous projects that are trying to produce hybrid Database-Blockchain solutions that share some of the data flexibility characteristics of MongoDB. Projects range from those incorporating very specific aspects of MongoDB (such as the unstructured capabilities of IPFS[24] or the ability to verify whether data in a database was tampered with or not[25]) to completely augmenting MongoDB (BigChainDB[26]). Many of these projects are unfortunately in the development phase, so the timeline for an minimum viable product (MVP) is uncertain. Even with an MVP, it would still take time for projects to test their functionality and scalability before they would be realistic options to be used in large scale DApps like TAPx.

Notwithstanding this constraint to the readiness of the technology, we explore one of the more well-documented projects here, called BigchainDB. BigchainDB is fundamentally a database which utilises a blockchain to achieve certain security features. It allows decentralized ownership of data on the database, while still maintaining a traditional database structure.

Below is a table from the BigchainDB whitepaper[27] outlining some of the benefits of BigchainDB when compared to typical distributed databases.

BigchainDB is a collection of network nodes, each running a MongoDB database. Users exercise ownership over the data in the database by using their private key to sign a "CREATE" or "TRANSFER" transaction of an asset in the database. There are also metadata tags for assets which can be updated with every transaction.

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[24] https://ipfs.io/
[25] https://dzone.com/articles/sealing-mongodb-data-on-the-blockchain
[26] https://www.bigchaindb.com/features/
[27] https://www.bigchaindb.com/whitepaper/bigchaindb-whitepaper.pdf

	Typical Blockchain	Typical Distributed Database	BigchainDB
Decentralization	✓		✓
Byzantine Fault Tolerance	✓		✓
Immutability	✓		✓
Owner-Controlled Assets	✓		✓
High Transaction Rate		✓	✓
Low Latency		✓	✓
Indexing & Querying of Structured Data		✓	✓

Table 2: Comparison of blockchains, distributed databases and BigchainDB.

Unfortunately, these databases comprising the BigChainDB network cannot have entries mutated or removed, which may limit the suitability of BigchainDB for TAPx. There may be ways around this, for example, where database entries are added to reflect changes, rather than for entries to be edited. An 'aggregation' could then be constructed by finding all the changes relating to a particular ID. Alternatively, the aggregation could be stored as a metadata tag. These are however workarounds and are native features. BigchainDB defines the appropriate use cases for its technology as "wherever there is a need for immutable, tamper-resistant data representing digital assets."[28]

A similar solution, IPFS, is also mostly immutable[29] and so reputation updates would require a new file that reflects the update to be stored and propagated through the IPFS network. Uploading these files will have an unknown cost once FileCoin is introduced.

Native EOS Identity Management

The native identity management features available in EOS would likely be suitable as the base layer for identity and reputation management, once more adequately security-tested, and is also predicted to have a high enough throughput and low enough latency to make dynamic updates to identity and reputation possible. Ideally, the forum normalized reputation of each user (and forum they are a part of) would be stored on-chain. As there would no write cost, each user's identity could link to a reputation contract which would allow for the necessary data to be stored and not be editable by the user themselves.

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[28] BigchainDB whitepaper
[29] https://github.com/ipfs/faq/issues/156

Cryptocurrency Layer

ERC-20

ERC-20 is the Ethereum network fungible token standard. It is currently the best fungible token solution for new issuers, as it has been widely used in most token generation events (TGEs), with the largest and most well-developed ecosystem of exchanges, wallets, developers and projects.

EOS Token

EOS will have a token format that is very similar to that of the ERC-20 standard[30][31]. While EOS is built on C++ and Ethereum on Solidity, the structure of the token contract are logically quite similar. Both allow creators to specify a symbol and maximum supply, and include the standard methods for issuing and transferring tokens. However, there is little knowledge about future development of more specific standards and how this development might occur. Depending on the use case, this may be something that TAPx would first need to create & submit for inclusion into the EOS codebase.

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[30] https://theethereum.wiki/w/index.php/ERC20_Token_Standard
[31] https://github.com/EOSIO/eos/blob/master/contracts/eosio.token/eosio.token.hpp

Technology Choice

The figures below shows the different layers, possible technologies, how they can be combined to produce an appropriate solution and how these configurations stack up against each other.
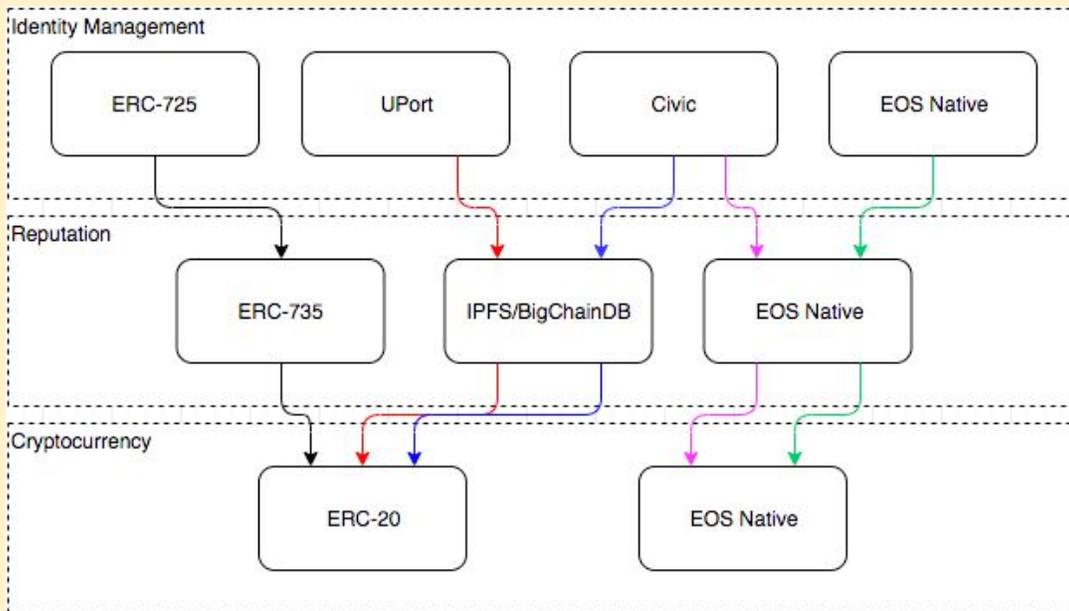

Figure 12: Different possible technology configurations

Technology Layer	uPort Solution	ERC-725/735	Hybrid2	EOS Solution	Hybrid3
Identity Management	uPort	ERC-725	Civic	EOS Native Solution	Civic
Reputation	ERC-780 + IPFS/BigChainDB	ERC-735	IPFS/ BigChainDB	EOS Native Solution	EOS Native Solution
Cryptocurrency	ERC-20	ERC-20	ERC-20	EOS Token	EOS Token

Table 3: Different Technology solutions for each required technology layer.

	Weighting	Configuration Options				
		uPort Solution	ERC-725/735	Hybrid2	EOS Solution	Hybrid3
Portability	20%	8	8	8	8	8
Cost-effective	20%	2	4	4	8	9
Scalability	20%	3	3	3	10	8
Adjustable Reputation	15%	8	8	6	9	8
Immediate User Simplicity	15%	5	5	6	3	6
Technology Readiness	10%	3	5	7	2	4
Weighted Total	100%	4.85	5.45	5.5	7.2	7.5

Table 4: Matrix ranking: Different Technology configurations scored against requirements

Based on a review of the technology and the requirements of the TAPx network, it appears that the the best technology configuration is to use the native EOS system for Reputation & Cryptocurrency layers and using Civic for the Identity Management layer. The second best option appears to be to use the native EOS Solution for all 3 layers. It is important to note that this is based on EOS's forward looking statements about how the system will work and expectations for how quickly the ecosystem development funds will be deployed and lead to tangible benefits to the EOS network. There is a material risk that EOS may not scale from a technology and perspective in the way envisaged and this will only become clearer over time, as the EOS ecosystem develops.

In the event that the EOS network does not develop as quickly as is necessary for the go-live of TAPx, then a combination of Civic, IPFS/BigChinaDB and ERC-20 tokens will be a significantly poorer fall fallback option. Unfortunately this alternative has known transaction scalability issues and high on-chain transaction costs on the Ethereum blockchain. It is possible but similarly uncertain that these known issues are overcome within the required timelines by the successful deployment of a POS consensus algorithm on Ethereum.