Devv

Bluepaper
Business Integration Description

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Devvio

The Devv protocol represents a scalable trustless blockchain which was developed using a set of unique assumptions that offer realistic solutions to the problems of traditional blockchain implementations. Devv's overall approach includes a tight integration with a trust-based entity, Devvio, which oversees Devv's consensus operations and which implements a number of features.

Through Devvio, Devv combines trustless blockchain operations with targeted trust-based features to deliver immediate transactions, privacy protections, a stable cryptocurrency, and the prevention of fraud, theft, and loss. Devv has scalable governance, the ability to have no transaction fees, and a green consensus model. It was designed in large part to allow Developers to build their own blockchain applications with an inexpensive and scalable Blockchain-as-a-Service solution.

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Summary

Devv is a protocol intended to address today's primary blockchain challenges. Our protocol uses assumptions that are uncommon in most blockchain approaches, which leads to elegant ways to address blockchain's challenges. For example, our scaling approach, which uses sharding, is enabled with our consensus mechanism, Proof-of-Validation. Devv's technical description is given in the Devv Greenpaper. We have developed powerful solutions for the common issues of governance, scalability, volatility, platform/value integration, energy use, supply issuances, fees, immediacy, privacy concerns, and protection from fraud/theft/loss.

Overall, Devv's protocol embodies more than just a technical implementation. It encompasses a strategy that integrates governance, the need to grow within long-term regulatory environments, and practical protocol features. The entirety of the approach is as much a philosophical shift in blockchain development as it is a technical one. Devv's trust-based business features are implemented through an entity called Devvio. Devvio combines optional trust-based implementations on top of Devv's trustless blockchain. Devv's approach varies from most other blockchain approaches for three primary reasons:

First, Devv's governance model is based on a system in which three categories of stakeholders exert equal influence over the growth of the protocol. The most significant difference in our governance model compared to that of other blockchains comes from the fact that miners, who often have a significant conflict of interest with respect to community management, do not influence our growth. Where most blockchains are often relatively unstructured in defining their governance given the need to coordinate closely with miners, our governance policies are well-defined and scalable from the beginning.

Second, we do not believe that everyone should be able to become a miner. Miners simply provide consensus, which is a straightforward role. This is a significant assumption, both in the realization that the benefits of blockchains are not lost as a result, but also in the fact that this assumption allows more elegant solutions to address blockchain's challenges. It also addresses Proof-of-Work energy usage and the fact that miners are often paid too much, creating a constant drag on a cryptocurrency's value and on DApp operations as a whole. In our view, issuances should go to the community rather than consensus providers. Our Validator approach enables coordination between nodes providing consensus, which enables a sharding implementation for scaling. Even with this increased ability to scale, Devv is still transparent, immutable, trustless, and secure, with no central authority validating transactions.

Third, the Devv protocol is designed to be trustless, but also to integrate with a trusted source to implement important features often required during real-world transactions. For example, Devv's representation of its cryptocurrency utilizing DevvProtect allows for protection from fraud, theft, and loss. These are significant problems for other cryptocurrencies. However, the need for trust in solving these problems is innate. One must be able to prove one's identity in order to be protected from fraud, theft, and loss. Devv has mechanisms integrated at a core protocol level,

used in conjunction with the trusted source that maintains identities, to offer its users these added protections. These mechanisms are optional, however, so Devv can operate in a completely immutable way, as other cryptocurrencies do. The user can choose whichever implementation is desired.

Given the Devv protocol's ability to scale and address the most significant issues with blockchains, it has many other areas for growth and use over time, such as in general financial payments, identity, records management, and any type of ownership representations. The Devv protocol delivers many advantages over other current approaches in these areas, given its design.

Devvio and the Immediate Node Network - INN

Devvio is a business that both oversees the Devv blockchain's consensus operations and implements a number of the Devv blockchain's features. The Immediate Node Network (INN) is a trust-based network operated by Devvio. It is built on top of the Devv Network. It allows immediate transactions that can be verified in under one second. It also enables a number of additional features such as fraud and theft protection, loss prevention, a stable version of the cryptocurrency, and private transactions. Details on the utilization of the INN, and features innately tied into the Devv Protocol, are provided in various sections below.

Immediate Node Network (INN):
Trust-based,
Private Identities/Transactions,
On-Chain Theft/Fraud/Loss Protection,
Immediate

INN

Tier-2 Blockchains:
Trustless, Transparent,
Immutable, Pseudonymous,
Scalable

Tier-1 Blockchain:
Trustless, Transparent,
Immutable, Pseudonymous
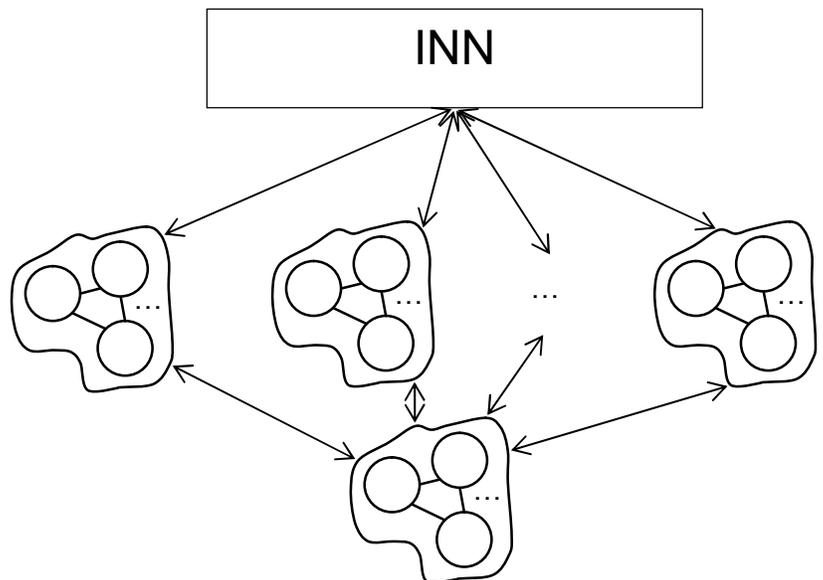
Trustless and Trusted Components of the Devv Protocol

The INN utilizes an escrow implementation of the Devv cryptocurrency called DevvProtect, described below. DevvProtect Wallets and DevvProtect transactions have a known identity associated with them, privately held by Devvio, which in turn enables the INN's optional features.

Wallets

Wallets include private and public keypairs, and indicate ownership of Devv. Wallets can be automatically added for accounts on systems that use Devv. Code will be available for individuals to create their own wallets as well.

There are two types of wallets, standard Devv wallets and DevvProtect wallets, which have added protections and which are described below. The Devv API will include wrappers for other cryptocurrencies, as well. These wrappers will create an interface for interoperability between Devv and other blockchains.

Validator Incentives

Validators are rewarded for maintaining consensus. The rewards for Validators are commensurate with the task of running a server, however, and therefore the vast majority, if not all, of new Devv issuances will serve as incentives to the community surrounding Devv. It is expected that Validators will be paid out of Devv reserves or in fiat currencies.

The rewards for Validators are based solely off of maintaining consensus and are awarded per block-pair in the case that Devv is part of the incentive. Block rewards are not affected by which Validators are actually proposing and creating blocks. The reward calculation amount is continually adjusted by Devvio. Validators who are active will share in the block rewards irrespective of who proposed the blocks.

Third-Party Devv Blockchain Utilization

Devv's philosophy includes the use of its blockchain by others to implement representations of ownership. For example, the Devv blockchain could be used by a business keeping a record of loyalty points, a hospital maintaining patient records, a video game utilizing an in-game currency, a company implementing a coin offering, or voting systems as examples. Third-parties will be able to issue their own Smart Coins, which can be wrappers around JSON, an identifier for off-chain processing, or a standard Devv representation similar in nature to the ERC20 token in Ethereum.

Devv's Philosophy

Devv's core philosophy for its blockchain representations is built around a single premise:

Devv's blockchain maintains records of digital ownership

While this is a straightforward premise, the underlying principle lies in contrast with traditional decentralized apps. Devv's philosophy is that ownership representations should be maintained on-chain and processing should be mostly handled off-chain. In the situations where there is a need for on-chain processing, it should only include mechanisms for recording and transferring ownership of digital assets.

The reasoning for this philosophy comes from the fact that blockchains are exceptional at certain, limited tasks but highly unsuitable for others. The original use of blockchains was to solve the double spending problem. Digital representations of value are easily copied, so how can you prevent someone from transferring that value more than once? Blockchains establish an ordered list of transactions which are immutable and timestamped relative to each other, and which therefore can be used to prevent double spending.

However, blockchains suffer from significant drawbacks with respect to centralized databases. Centralized databases have better privacy, significantly better performance, are easier to scale, easier to manage, and easier to program and debug.

Distributed blockchains should therefore be used for two primary purposes:
1. Trustless transactions
2. Extreme robustness/security

If trustless transactions and robustness are not critical elements to an application, there is nothing a blockchain can do that a traditional database cannot.

Smart Contract Philosophy

Given that the Devv blockchain is used to represent digital representations of value, and is intended to implement trustless transactions in a robust way, our implementation of smart contracts is designed simply to improve capabilities in representing those digital assets.

Smart contracts, in the Devv protocol, are implemented either as part of the core protocol itself, or in the form of Smart Coins which provide added functionality.

Core functionalities that create value for the entire Devv blockchain are implemented in the protocol itself. For example, the definitions of what types of Smart Coins are available and how they are processed is part of the protocol. Capabilities associated with DevvProtect (such as chargebacks and recoveries from theft or loss), lending functionality, and the implementation for immediacy (the Dallocation), are also part of the protocol itself. The protocol utilizes Smart Coins for more generic functionalities.

Smart Coins

Smart Coins are an important aspect of the Devv protocol. They represent other types of ownership and identity beyond Devv itself as well as implementations for on-chain processing and operations.

There are a number of ownership and operational representations that are maintained with Smart Coins, and any of these representations or operations are associated with a wallet. These Smart Coins can be held in a wallet in the same way that Devv is held in a wallet, and can be transferred in the same way that Devv is transferred on the blockchain. Smart Coins can be issued by the INN (for example, when new Validators are added), or algorithmically by the blockchain (for example, when ownership is created for a new wallet in a multi-tier blockchain approach), or from users in the system. Smart Coins utilize a composition-based programming philosophy in which groupings of Smart Coin elements combine to produce more sophisticated behavior. Examples of Smart Coins are given in Appendix C.

Smart Coins can have their own transfer rules. For example, the INN can transfer Validator Smart Coins from one account to another. The INN can also transfer Status Smart Coins, ID Smart Coins, or Voting Smart Coins to a wallet, but cannot transfer them out of a wallet. Wallet Smart Coins can only be transferred by a T1 blockchain. Smart Coins can also have special properties, such as rules upon which they are removed from the blockchain state to save space (leaving only their hashed representations in a Merkle tree), whether they are eligible for reversals when sent from a DevvProtect wallet, or other properties required for specialized functionality. Smart Coins can represent fungible or non-fungible digital assets, or can simply be used as part of transfer or ownership mechanisms.

Cryptocurrency Classes

Similar to the addition of Smart Coins into the network, there can be other fungible representations of value separate from Devv itself. Separate classes of cryptocurrencies can be maintained in the blockchain. One example is a separate cryptocurrency simply maintained on the Devv network, but which represents another type of value or ownership. This could be valuable in a similar way that ERC20 coins are used in the Ethereum network. Devvio can partner with others to have other types of cryptocurrencies included on the Devv blockchain and validated using its techniques.

DevvProtect

Devv will utilize a specific, escrow functionality called DevvProtect to enable more protections on transfers. No user is ever required to send a transaction with DevvProtect as it is a completely optional feature of Devv; however, the use of DevvProtect can provide valuable

protections based on trust of Devvio (in the same way that people trust credit card companies to protect their interests when making online purchases). An account with Devvio is required to use DevvProtect, so that its protections can be verified.

Chargebacks

DevvProtect can be used to handle situations where the ability to have chargebacks or reversed transactions is desired. DevvProtect operates under special rules, different from Devv, but all DevvProtect transactions are validated on the blockchain using the same methodology as Devv. DevvProtect serves as a temporary instrument that represents Devv, but transactions made with DevvProtect can be reversed by Devvio (technically, transactions are not reversed since the blockchain is immutable, but inverse transactions are created). DevvProtect is similar in nature to a particular type of smart contract, but its purpose and use is defined and it is integrated into the core of the protocol.

When a transaction, such as a purchase, is desired to be made with DevvProtect, the sender simply indicates that Devv should be sent with DevvProtect. DevvProtect replaces the Devv in the sender's wallet, and DevvProtect is then sent to the recipient. DevvProtect also includes a timestamp indicating when it was sent and a time period upon which it converts back to standard Devv. The system default is S_d seconds (for example, a number of seconds equivalent to 15 days). This conversion is an automatic transaction computed and validated by nodes. During the S_d seconds before DevvProtect becomes Devv, Devvio has the authority to reverse the DevvProtect transaction (by adding an inverse transaction). DevvProtect cannot be transferred by a recipient after it is received while still in the form of DevvProtect. At any time while DevvProtect is owned, the recipient can send a message declining the DevvProtect, and it will become Devv in the sender's wallet as if the transaction never happened (which is implemented as a transaction). The sender can also send a message that immediately converts the DevvProtect to Devv for the recipient (for example, when a product has been received in good condition).

In this way, DevvProtect can represent a safer method of transferring value. Customers (senders) can send payments knowing that there are safeguards in place in case a seller (recipient) is acting fraudulently. Disputes are handled through a dispute-resolution process mediated by Devvio, similar to credit card disputes. Dispute resolution is based on legal principles such as seller requirements and claims on a platform making a sale.

The DevvProtect time period is automatically incremented when a user indicates suspicion of fraud and initiates a dispute. Devvio can increase the system default value of S_d or further increase a DevvProtect's time period if more time is needed for dispute resolution.

Theft Protection

Special DevvProtect Wallets can be created so that transactions can only be sent using DevvProtect rather than Devv. DevvProtect Wallets must be created through the approval of Devvio, so that identity can be verified. Once users have a verified account with Devvio, they can create new DevvProtect Wallets as needed. By using DevvProtect Wallets, if a user's private key is stolen, and funds are illegally transferred, the transaction can be reversed. A stolen private key for a wallet can be proven, and then the transactions can be reversed and sent to a newly created DevvProtect Wallet. This makes the risk of theft significantly lower for those who choose to use DevvProtect Wallets. DevvProtect Wallets use the system value of S_d when transfers are made, and the check is made against the timestamp versus S_d, as opposed to a lifetime associated directly with the DevvProtect in this case. DevvProtect Wallets cannot send the message that immediately converts DevvProtect to Devv. S_d can be modified at any point by Devvio.

Lost Private Keys

If a user loses a private key, then the user can request that Devvio initiate a transfer from a DevvProtect Wallet into another newly-created DevvProtect Wallet owned by the same user. Similarly, Devv can be transferred to a beneficiary upon a holder's death. As a protection against Devvio transferring DevvProtect inappropriately (which would never occur, but which we allow a user-controlled safeguard against as a precaution), a user can transfer the DevvProtect in the form of Devv into a new Devv wallet (using the private key, which in this case was not actually lost), therefore effectively reversing an INN-initiated transfer.

Summary

DevvProtect provides valuable, but optional, protections for the use of Devv. In summary:
1) Any transaction out of a Devv wallet can be made by a sender (buyer) in DevvProtect if they have a Devvio account. A DevvProtect transaction deducts Devv from the wallet as normal, and the recipient receives DevvProtect rather than Devv. The DevvProtect includes a timestamp on creation and a time period associated with it, upon which it converts to Devv. If a recipient (seller) acts fraudulently, such as by failing to deliver purchased goods, the sender can contact Devvio and while the payment is still in the form of DevvProtect, Devvio can reverse the transaction.
    a. DevvProtect cannot be transferred from a wallet (other than in the case of the initial conversion from Devv).
    b. DevvProtect converts back to Devv automatically at the end of its lifetime. At that point it can no longer be modified by Devvio.
    c. The sender can set the conversion time period when the DevvProtect is created or use the system default.
    d. The recipient can decline the transaction, which returns Devv to the sender's wallet.

e. The sender can send a transaction message (such as when a purchased product has arrived in good condition) converting the DevvProtect to Devv immediately.
2. Users can elect to keep their Devv in DevvProtect Wallets rather than Devv Wallets. DevvProtect Wallets include added protections against theft and loss. DevvProtect Wallets hold a user's Devv as a normal wallet would, but any outgoing transfers from a DevvProtect Wallet must be in the form of DevvProtect.
   a. The time period for a DevvProtect Wallet transfer must be the system default time.
   b. If a user's DevvProtect Wallet private key is stolen and funds are transferred fraudulently, the user can contact Devvio, and Devvio can reverse the transaction and send the funds into a newly created DevvProtect Wallet with a new private key.
   c. If a user loses the wallet's private key, Devvio can transfer DevvProtect into a new DevvProtect Wallet.
   d. As a protection against Devvio transferring DevvProtect inappropriately (which would never occur, but which we allow a user-controlled safeguard against as a precaution), a user transfers the DevvProtect in the form of Devv into a new Devv wallet (using the private key, which in this case was not actually lost), therefore effectively reversing an INN-initiated transfer.
3. DevvProtect Wallets can be utilized to implement other features like Immediate Transactions, Private Transactions, Identity Verification, and Credit/Loans.

Immediate Transactions

Devv can implement transactions immediately through Immediate Nodes on the Immediate Node Network (INN), such as when a transaction is desired to be implemented on credit card rails or a credit card network or when transactions are desired to be immediately approved through a mobile transaction, as examples. Normally, a transaction is received by a standard node, put into a transaction component of a block-pair, and then the validation component of the block-pair will validate the block and therefore the transaction. A deeper block will be more secure as well, though with Proof-of-Validation, even a validated block with priority at the top of the blockchain is relatively secure, particularly with a value of V_p over 50%. This means that a transaction can take the block time, or S_v seconds, before it is validated and approximately $2*S_v$ seconds before it is one block deep, even on a T2. This amount of time can be too slow for transactions that need to be validated immediately.

Immediate Nodes are used to implement a traditional, trust-based account network. However, Immediate Nodes use an operational procedure directly integrated into the Devv protocol for both security and a more seamless integration. Devv owners can use a DevvProtect Wallet to indicate an allocated amount, called the DevvProtect Allocation, or Dallocation. The Dallocation sets aside Devv, DevvFiat (a one-to-one fiat backed cryptocurrency), or other tokens to be verified immediately by the INN. The Dallocation can be utilized for immediate transactions and represents Devv held in the user's wallet that the INN can transfer through its payment channels

based on a user's actions (such as a credit card purchase or mobile app purchase). A user can send an encrypted originating message in order to create the Dallocation for a DevvProtect Wallet, along with an indication of the INN's permissions for sending Devv from the Dallocation. For example, INN transactions can be limited in amounts over a given time period. The amount reserved within the Dallocation cannot be transferred out of the DevvProtect Wallet other than through transactions originating from the INN. Those transactions do not utilize the private key for the DevvProtect Wallet, but instead nodes on the INN use their own private keys to create transactions that can be validated by T2's.

Devvio can therefore allow the ability to guarantee payments immediately, and can allow the processing of transactions such as Point of Sale credit card transactions through standard credit card machines. A POS purchase can trigger a transaction withdrawing an amount from a Dallocation. The INN maintains records of balances of the Dallocations for each DevvProtect Wallet that has a Dallocation. The INN sends transactions to the T2's, which updates account balances on the blockchains themselves. When Immediate Node payments are no longer desired, an owner can instruct the INN to send a transaction to the Devv network releasing the Dallocation into standard Devv amounts within the DevvProtect Wallet. Since Dallocations are in DevvProtect Wallets, theft originating from a hack of the INN would be preventable. Fraudulent transactions from the INN can be reversed since Dallocations are held in DevvProtect Wallets. Overall, this approach allows the INN to guarantee a payment, and the guarantee can be instant.

As opposed to the multi-tier blockchain approach described above, where T2 networks do not consolidate transactions, the INN can consolidate transactions over time before submitting them to the actual Devv blockchain. For example, if Wallet A sends 100 Devv to Wallet B, and Wallet B sends 100 Devv to Wallet C, the INN can send a message to the Devv Network that a transaction of 100 Devv was sent from Wallet A to Wallet C. It can summarize state information within its node accounts before synchronizing with the Devv Network.

Stability

The Devv protocol has the ability to ensure stability through a concept called DevvFiat, a non-volatile one-to-one fiat backed representation of a currency. This is accomplished through the use of the Dallocation. Amounts that are transferred into a Dallocation by a user can be converted through an exchange mechanism into DevvFiat. DevvFiat can take a number of forms such as DevvDollars or DevvEuros, for example. For every DevvDollar that is issued by Devvio, as an example, one US Dollar will be put into an escrow account controlled by Devvio. The escrow account will be audited, and can be publicly verified as to its integrity from the beginning. Those DevvDollars can be transferred within the Devv blockchain for purchases, through Dallocation mechanics. At any point in the future any DevvDollar holder can receive a US Dollar out of escrow from Devvio in exchange for the DevvDollar (which is then destroyed). In this way there are always exactly as many US Dollars in escrow as there are DevvDollars in existence, so the price of DevvDollars will not be volatile and will track very closely to the value of US

Dollars (or DevvEuros to Euros, etc). DevvFiat contained in Dallocation portions of accounts can only be transferred by Devvio, and Devvio collects fees on Dallocation transfers. Fundamentally the Dallocation and the DevvFiat implementation allow stable transfers of cryptocurrency, and create a practical way to use cryptocurrency for more than just a store of value. DevvFiat is used with the Devv protocol's other features such as fraud, theft, and loss protections, or Devv's implementation of privacy.

DevvFiat can also be used to wrap other assets. A Dallocation can contain DevvBitcoin, DevvEther, or even DevvGold. A Dallocation can also contain DevvBaskets that represent groupings of fiat currencies and other financial instruments which can have even less volatility than the US Dollar.

The ramifications of DevvFiat are significant. With a stable cryptocurrency, many things are possible that otherwise would not be. For example, if a cryptocurrency's value is going up, buyers do not want to use it for purchases. If a cryptocurrency's value is going down, sellers do not want to accept it for sales. Loans or credit will have high default rates when a cryptocurrency's value is going up, and lenders will not want to lend with high volatility in either direction. High volatility prevents the use of cryptocurrency in many practical situations, but with a stable version of a cryptocurrency, it can actually be used for these purposes. Online payments, retail purchases, lending, credit, and foreign exchange all become feasible with DevvFiat, and all of the other benefits of a cryptocurrency then become much more powerful.

Having a stable cryptocurrency truly unlocks the power of blockchain.

Examples of DevvFiat uses are given in Appendix F.

Digital Credit and Loans

Devvio can provide digital credit (i.e. the equivalent of a digital credit card or a loan) with a Credit Smart Coin or a Loan Smart Coin. Transactions are automatically processed from the account holding the Credit Smart Coin or Loan Smart Coin to pay off the balance. These Smart Coins include all parameters associated with loans/credit, such as balance, interest rate, term, payment terms, compliance and status, etc. Balances are updated automatically based on these parameters (in essence, they operate like a specialized smart contract, with the limited calculation related to the loan's status). Credit Smart Coins and Loan Smart Coins cannot be transferred, of course, except by the loan holder. Credit Smart Coins include an available balance like a standard credit card. Loan Smart Coins disappear when they are paid off. Devv received on credit can be used with the Dallocation described above to enable immediate payments. In this combination, credit can be implemented like a traditional credit card. Credit and lending is a particularly valuable concept when combined with DevvFiat.

Privacy

One of the primary disadvantages of most blockchain approaches is a lack of privacy. Devv has a publicly available blockchain that provides pseudonymous privacy. From a purely technological standpoint, an account/wallet can be held without having any identity associated with it. However, anyone can track where amounts go and the current balance of any wallet like most blockchains. In many legitimate and legal situations, a higher level of privacy is needed. For example, one might wish to keep their wallet balance private, if they can be associated with the wallet. It is common that people do not want to publicly announce their bank account balances. Association between an identity and a wallet can happen over time by combining real-world information with on-chain events. Also, for voting purposes, it is often desired to separate one's vote from one's identity. In many cases, even a vote that is associated pseudonymously can be undesirable. One might not want their vote to be able to later be traced back to them.

One approach to solving the privacy issue is to employ a mathematical solution that prevents visibility on transactions, and makes transactions truly anonymous. An example of this is the ZCash protocol which uses zero knowledge SNARKS in which transactions are encrypted, but the blockchain still assures no double spending. For Devv's principles, however, this is not a preferred solution. First, a large part of Devv's philosophy is built around transparency. Since Validators are permissioned, the protection of all users relies on full transparency of the code being used, the rules for the governing foundation, and, for our purposes here, the blockchain itself. A blockchain that can be easily audited in the most transparent way fits the spirit of Devv. Second, another of Devv's principles is to build a practical solution that can evolve as regulations evolve. A true zero-knowledge approach is difficult to reconcile with Know-Your-Customer (KYC) and Anti-Money-Laundering (AML) rules. We believe that a KYC and AML friendly approach is most likely to thrive and grow as government regulations evolve.

All of that said, privacy is important to many users. Devv's approach to privacy is to allow an optional methodology for implementing private transactions in cases where it is desired. Our approach uses a trust-based methodology implemented via the INN. In order to send a private transaction, first a user sends DevvProtect to a privacy account owned by Devvio from a DevvProtect Wallet. Then the user sends an off-chain message to the INN, encrypted both in terms of the transmission itself and using the wallet's private key to encrypt the transaction, instructing where that transaction should be sent. The INN can validate the transmission against the amount received using the wallet's public key, and then send a transaction message to the Devv network implementing the transaction. A user can transfer money anonymously in this way. However, for KYC and AML purposes, it should be noted that Devvio will know the identity of the sender, as DevvProtect Wallets (where the ID is known to Devvio) are used for these private transmissions. The amounts sent can be instructed to happen over a time period to one or more wallets in one or more amounts so that public tracking by amount can be obfuscated. Transactions, which are in the form of DevvProtect, that are reversed by the INN must be routed back through the INN, as the public sender for the DevvProtect will be an INN wallet on the blockchain. A reversal received by the INN must reference internal private records to send the Devv back to the original wallet. The INN is the only entity on the blockchain which can send

outgoing DevvProtect or Devv amounts based on a transfer from incoming DevvProtect amounts.

This approach can be used in a number of situations. A single transfer can be made privately, where the amount sent cannot be publicly tracked to the destination. Devv owners can privately send amounts to other wallets they own to maintain privacy on the accounts they own, particularly if an account's identity was determined. This can also be done to further obfuscate a transaction from being reverse-engineered. For example, a private transaction can have DevvProtect sent to a recipient address and any remaining Devv can be sent to different wallets the sender owns. Private voting can be implemented, where a Vote Smart Coin can be transferred (i.e. a vote cast) privately through the private transmission to the INN, which in turn transfers the Smart Coin to the correct voting account with the correct weighting, consolidated with other votes so that votes cannot be traced back to the original holders. Votes can include an encrypted message that only the sender can decrypt, to later verify that a vote was cast appropriately. In this way users can vote, as well as verify that their votes were correctly placed, but only they know that their votes originated from them.

If both privacy and immediacy are desired (i.e. a transaction analogous to a credit card transaction), the user can instruct that each transaction indicated as a Dallocation transaction will move remaining balances in the wallet into a new DevvProtect Wallet. The Dallocation in the new wallet can be adjusted by the INN, amounts can be sent to multiple wallets, or amounts can be sent over time in multiple transactions, in order to obfuscate public determination of the transaction. The user can track their balances and wallets through an INN account. Alternatively, an INN account can also receive Devv that can be transferred with both privacy and immediacy, but which never is reflected on the blockchain itself, such as is often done on exchanges. DevvProtect accounts created algorithmically by the INN will retain ownership records matching the owner so that private ownership knowledge is maintained.

The INN can consolidate many transactions and post summaries to the blockchain at intervals, further aiding with privacy and efficiency. The intervals upon which the blockchain is synchronized will not affect the immediacy of transactions. Transactions and balances can even be held entirely off chain, with internal tracking by the INN in wallets associated with Devvio.

Summary of Transaction Categories

The following categories indicate how a sender can implement a transaction. All of the categories of transactions other than Devv itself are optional, and are used by a Devv owner only when added functionality or safety is desired. A user can determine whether DevvProtect or DevvProtect Wallets are to be used, and whether the INN is involved in any given transaction.

	Trustless	Reversible	Protection from Fraud	Protection from Theft / Loss	Immediate	Private
Devv	YES	NO	NO	NO	NO	NO
DevvProtect Transaction	YES	YES	YES	NO	NO	NO
DevvProtect Wallet	YES	YES	YES	YES	NO	NO
DevvProtect/INN w/ Dallocation	NO	YES	YES	YES	YES	Partial
DevvProtect to INN w/ off-chain instructions	NO	YES	YES	YES	YES	YES

In terms of User Interface, the options can be set up in a straightforward manner. The standard software or any app that allows transfers of Devv can have a straightforward checkbox with a DevvProtect option for sending any given transaction, and a standard "info" icon to provide information on using DevvProtect.

Similarly, when wallets are created with Devv software, the alternative DevvProtect Wallet can be described, with a link to Devvio page for creating DevvProtect Wallets. When creating DevvProtect Wallets, immediacy and privacy options can be described as options. The underlying implementation does not need to be detailed to users. The choices and ramifications in setting up different types of wallets and implementing different types of transactions will be described in a straightforward way.

Conclusion

Devv is a cryptocurrency designed to enable instant worldwide transfers of digital assets. It is intended to address current issues affecting existing cryptocurrencies, and includes a governance methodology that is designed to scale, while maintaining all of the most important aspects of a transparent, open source, trustless cryptocurrency.

Devv makes unique assumptions in the blockchain space, largely in the facts that not everyone can become a miner and that Devvio, a trust-based source, can interact directly with the Devv Protocol. This approach removes many unnecessary complications in blockchain design, and ultimately leads to a more elegant solution for a scalable cryptocurrency. Devv's design allows for practical real-world use, and can scale in terms of governance, regulations, and technical capabilities.

Appendix A: Devvio

Devvio is an entity that oversees the operations of the Devv network to assure consensus. The Immediate Node Network (INN) is controlled by Devvio and is used to oversee consensus operations and add optional Devv features. It is founded on a system of transparency - the rules that Devvio operates under to oversee consensus are available at any time to anyone, all algorithmic operations of the network are available at any time to anyone, and all results of those algorithmic operations (i.e. the blockchain itself) are available at any time to anyone.

Devvio will govern consensus operations based on a set of bylaws that define the procedures for any actions. Examples of the philosophy of that governance are given below. Changes to the bylaws will be determined by three groups, Devvio Inc. (where voting will be carried out by its board), Devv community members (where voting will be proportional to digital sales, blockchain usage, or other measures of value), and Devv owners (where voting will be proportional to ownership). Each group will have equal voting power.

One of the INN's primary roles is ensuring that the network maintains consensus over time. The INN can transmit messages to the network with public-private keypairs. This is accomplished by a distributed number of control nodes in the network. The INN will adjust variables to improve network operations, to counter attacks, and to adjust incentives for Validators over time. Devvio can add or remove Validators as needed. Devvio will determine Validators that represent the goals of Devv, primarily towards providing absolute trustless consensus with no central authority overseeing transactions. Other goals include having nodes run by a broad set of entities, such as worldwide universities, businesses, and Developers.

Below are examples of the Devvio's capabilities in operationally overseeing the Devv platform:
- Adjust variables for consensus
- Add or remove Validators
- Adjust incentive amounts for Validators, up to a bylaw maximum
- Issue awards to early adopters within defined guidelines and parameters. The INN's awards will emphasize efforts such as maintaining a core team of Devv Developers and growing the Developer community.
- Arrange for independent auditors of the blockchain

Below are examples of actions Devvio can take with a quorum defined by the bylaws:
- Increase the bylaw definition of a maximum amount for block rewards.
- Create a hard fork of the Devv blockchain in the cases of provable large-scale fraud or theft, or Validator impropriety. The proof must be made within definitions in the INN bylaws. Hard forks that adjust ownership will be limited to concepts like Validator collusion and large-scale theft, and will be based on a valid timeframe in the blockchain's history.
- Adjust technical mechanisms for consensus

- Implement structural changes to address issues such as scalability and growth. For example, Devvio can responsibly transition the network to incorporate approaches that allow faster transactions.
- Adjust structure to account for regulation within guidelines described in the bylaws.
- Adjust the guidelines for early adopter rewards
- Implement a full or partial fiat currency-based incentive for Validators paid by Devvio

Below are examples of actions Devvio can take only with a supermajority. It is expected that these actions will never occur, so obtaining a supermajority will be difficult:
- Issue more Devv
- Increase the bylaw maximum incentive above a bylaw-defined super-maximum. The super-maximum will be a relatively low amount, as Validator rewards are not intended to act as a mechanism to avoid obtaining an issuance supermajority.
- Adjust the definition of large-scale fraud, leading to a hard fork.

Below are examples of actions Devvio can never take:
- Create or force invalid transactions
- Modify Devv balances
- Reverse Devv transactions (other than DevvProtect transactions implemented as a choice of the sender, which are technically new transactions)
- Prevent the blockchain and its operation from being fully transparent
- Prevent the Devv source and operations from being Open Source
- Prevent the Devvio bylaws from being fully transparent

The INN issues cryptographically secured messages that are recorded in the blockchain to implement changes. In order for messages to be considered valid, and in order to prevent a single point of failure, messages must be received from multiple sources (equal to a system variable, which cannot go below a minimum amount), each with its own public-private keypair to validate messages. Some system variables can be required to change gradually along increments, or be required to have a larger percentage of INN nodes to implement a change, to avoid disruptions in how the system operates. At a time no earlier than 5 years after the Devv launch, Devvio reserves the right to issue Devv to Validators at a rate of no more than 2% inflation. It is envisioned that over time Devvio will have a presence in many countries, will have Bylaws defined in many countries, and that network messages will originate from many different countries. It is also envisioned that INN locations will be able to remove themselves from the network, such as in a situation where a country's regulations prevent a certain type of operation of the Devv network. In this way, a single country's laws cannot have an undue effect on the overall operation of Devv.

INN Voting
The INN will implement voting through the Devv blockchain. For a vote, the INN will give notice which block on T1 (which can be a current block or a future block) will define voting amounts, and how many blocks voting will be open. The T1 maintains the master record in terms of voting. Voting amounts will be based on Devv holdings in wallets at the specified opening block.

After that block has been validated, voting Smart Coins are sent by the INN to the network for all voting members. The INN sends Smart Coins to each wallet, with an amount associated with vote weighting (such as the Devv ownership for the wallet or community standing). Those Smart Coins can then be sent to voting wallets, where tallies are collected. Each voting wallet represents an alternative in the vote. Voting privacy can be implemented with a private transaction using the INN.

Appendix B: DLT Comparisons

The following table gives a comparison between Devv and several Distributed Ledger Technology approaches. Additional detail is given in the footnotes below.

	Devv	Bitcoin(2a)	Ethereum	Ripple
Digitally transfer value with no double spending	✔	✔	✔	✔
Fast/easy worldwide transfers	✔	✔	✔	✔
Transparency	✔	✔	✔	✔
Immutability	✔ (1e)	✔	✔	✔
Trustless transactions	✔	✔	✔	✔
Security through Decentralized P2P Network	✔	✔	✔	✔
No central authority overseeing transactions	✔ (1h)	✔	✔	✔
Resistance to collusion	✔ (1i)	✔ (2i)	✔	✔
Anyone can be a miner	🚫 (1j)	✔	✔	🚫
Long term governance model	✔	🚫 (2k)	? (3k)	✔
Ability to scale larger than credit card networks	✔	🚫 (2l)	🚫 (3l)	? (4l)
Consensus Algorithm	Proof of Validation	Proof of Work	Proof of Work (3m)	RPCA
Green solution that avoids high energy mining	✔	🚫	🚫 (3n)	✔
New issuances go to community rather than miners	✔	🚫	🚫	✔ (4o)
No transaction fees	✔ (1p)	🚫	🚫	✔
Protection from fraud, theft, and loss	✔ (1q)	🚫	🚫 (3q)	🚫
Immediate transactions	✔ (1r)	🚫 (2r)	🚫 (3r)	🚫 (4r)
Private transactions	✔ (1s)	🚫 (2s)	🚫 (3s)	🚫
Turing complete smart contracts	🚫 (1t)	🚫	✔ (3t)	🚫
Development Platform	BaaS (1u)	🚫	Smart Contracts (3u)	🚫
Representations of Assets	✔ (1v)	🚫	✔ (3v)	✔

(1e) – Devv transactions are immutable. Once they are validated one block deep on a Tier 2 network they cannot be modified. The optional form of DevvProtect, however, uses an escrow-like mechanism in which transactions can be reversed. If the transaction is not made in this optional format (i.e. the transaction is Devv itself, which is always available as the primary option), then DevvProtect rules do not apply and immutability is guaranteed.

(1h) – Although Validators are permissioned, there is no central authority overseeing transactions. The blockchain itself is public. Validators only provide consensus on the ordering of transactions in blocks, but transactions are cryptographically secured, any two parties can independently verify a transaction. Anyone can independently verify and audit the entire blockchain.

(1i) – Although Validators are permissioned, the risk of collusion is arguably less than that of Bitcoin given its consolidation of miners. Please see Appendix G for some additional description of resistance to collusion.

(1j) – An important philosophical difference between Devv and many other solutions is that Devv Validators are permissioned. We believe this will lead to a significantly more efficient and agile system, while maintaining the most important aspects of a public blockchain.

(1p) – Devv does not innately need to charge transaction fees. Devvio may charge a small fee like Ripple does to avoid spam or DoS attacks. These potential fees can vary on network load.

(1q) – Devv uses Devvio, a trust-based entity, to implement fraud, theft, and loss protection with the DevvProtect concept as described above.

 (1r) – Devv uses Devvio, a trust-based entity, to implement immediate transactions with the Dallocation concept as described above.

(1s) – Devv uses Devvio, a trust-based entity, to implement obfuscation of transactions for its privacy solution as described above. It is intended as a mainstream approach to privacy that governments will approve of, given requirements such as Know-Your-Customer and Anti-Money-Laundering regulations. The trade-off in this approach is that it does not give the same level of anonymity that zero knowledge proofs provide, for example, such as in solutions like Dash, Monero, and Zcash (e.g. zk-SNARKS). Governments can demand access to private records through their court systems, similar to a recent demand of Coinbase's Bitcoin records by the IRS, so Devv transactions made for illegal purposes can be discovered within its privacy system. We believe this is a strength of our approach, as we believe the satisfaction of governmental regulations will ultimately add to Devv's ability to grow and thrive.

(1t) – Devv's philosophy with respect to Smart Contracts is that the majority of processing should happen off-chain. The primary purpose in utilizing valuable blockchain resources is to maintain digital representations of value. Devv's Smart Coins are different than Smart Contracts in that they are not Turing complete, and they are intended to primarily enhance maintaining records of representations of value. Also, Smart Coins need to be implemented by Devvio before they are applied on-chain. The trade-off in this approach is that DApps cannot be implemented directly on the Devv blockchain, however, nearly all DApp equivalents can be implemented effectively by maintaining transparent code that interacts with on-chain asset representations. Devv's T1 network was designed to be ultra-efficient and simple for any type of

BaaS implementation. T2 networks utilize oracles to implement Smart Coin functionality. Smart Coins are composed into DAGs to implement more complex functionalities.

(1u) – Developers can develop their own solutions using the Devv blockchain by composing Smart Coins into Directed Acyclic Graphs (DAGs). Payments for use of the blockchain is made to Devvio rather than through an on-chain payment system like Ethereum's Gas payments.

(1v) – Devv can represent assets such as with the DevvFiat concept described in Appendix F. This is similar in nature to Ripple's Assets. DevvFiat itself is similar to Tether, except that DevvFiat is implemented within Devv's Dallocation concept. Devvio will implement a system where assets underlying DevvFiat are audited and trustworthy from the beginning to assure integrity.

(2a) – Bitcoin comparison includes comparisons with other similar approaches like Litecoin or Bitcoin Cash.

(2i) – Given the consolidation of mining pools and large mining facilities, there is more risk of collusion than originally envisioned in the Bitcoin design.

(2k) – Bitcoin has struggled in implementing even minor changes to the protocol, and is reliant on miners which have an inherent conflict of interest. The trade-off is in added censorship resistance, but the long-term governance cost and risk is high.

(2l) – It is possible that off-chain approaches like the Lightening Network can scale Bitcoin, but these are largely untested in real world use, and the scaling occurs off-chain.

(2r) – There are third-party off-chain solutions that can allow immediate Bitcoin transactions, such as companies that provide Bitcoin debit cards.

(2s) – Bitcoin transactions are pseudonymous. Additionally, there are other techniques like tumblers or Coinjoin which can add additional privacy.

(3k) – Ethereum has demonstrated the ability to govern growth so far. For example, Ethereum already had a hard fork after The DAO was hacked. However, Ethereum is reliant upon miners who have an inherent conflict of interest which creates risk in long term governance.

(3l) – Ethereum is evaluating various sharding approaches to address scaling issues.

(3m) – Ethereum is looking to move to Proof of Stake.

(3n) – If Ethereum moves to Proof of Stake it will be more efficient than Proof of Work.

(3q) – Smart contracts can of course be built for specific use cases that implement an escrow structure similar to Devv's. There is no innate escrow capability for Ether itself, though, in its baseline operation.

(3r) – Third-party or other off-chain solutions could be used to implement immediate transactions for Ether or ERC-20 tokens, such as the Raiden network, in similar ways that are done for Bitcoin.

(3s) – There are zero knowledge proof implementations built on the Ethereum Network such as ZCoin, and off chain solutions like Keep.

(3t) – Ethereum's Smart Contract approach is Turing complete. This allows the implementation of Distributed Apps (DApps) on the Ethereum network. However, the trade-off is that it creates significant potential for security weaknesses and flaws, and adds a large amount of expense to operations, as they are on-chain.

(3u) Ethereum allows the development of any type of application on its platform, where the implementation is paid for with Gas (Ether).

(3v) Assets can be represented through Smart Contracts.

(4l) – Ripple can currently sustain approximately 1500 transactions per second. Ripple describes that they can reach any needed scalability by decoupling payment and settlement, which is akin to Devv's approach. The specifics of how they would implement that strategy, and how it would tie in with RPCA, are unknown.

(4o) – There is a large amount of XRP available to Ripple to issue. It is unknown exactly how it will be issued over time.

(4r) – Ripple can process transactions in several seconds, which can be thought of as immediate in many situations. They do not utilize the same concept as Devv's Dallocation, though.

Appendix C: Smart Coin Examples

The following are examples of possible Smart Coins. Smart Coins represent status or operational functionality on the blockchain and are typically implemented along with compositional Oracles.

Wallet Smart Coins: An indication of which T2 blockchain, in a multi-tier blockchain, owns (i.e. has responsibility for) a given wallet.

Identification Smart Coins: An encrypted coin associated with a wallet ensuring the identity of the wallet's owner. After verifying a user's identity externally, such as with a credit card, bank account, government-issued ID such as a driver's license or passport, biometric signal, electronic identification, or other types of identifiers, one or more Smart Coins can be associated with a wallet/account by the INN to validate the user's ID in transactions. Identification Smart Coins can include a variety of fields, and the transfer of an Identification Smart Coin can represent an action such as a vote or an application for membership, as examples.

Status Smart Coins: Smart Coins for prestige in the community, such as coins given to early adopters or community members who achieve important milestones or perform specified actions.

DevvProtect Smart Coins: Smart Coins associated with a wallet indicating the wallet is a DevvProtect Wallet. DevvProtect-Availability Smart Coins can indicate that a Devv wallet can send DevvProtect even though the wallet itself is a standard Devv wallet.

Voting Smart Coins: Smart Coins can be used for voting. All accounts, identified accounts, or any other subset of accounts can receive a Smart Coin for a vote from the INN. Smart Coins can be sent to one of multiple different addresses, for example, each representing a different desired vote. Voting Smart Coins can have a limited lifetime for a vote, and a limited lifetime in terms of storage on the blockchain.

Asset Smart Coins: Smart Coins can be sent by the INN to an account representing ownership of an asset, such as a digital asset or a representation of a physical asset. These Smart Coins can be encrypted so that the owner of a store, for example, where the assets are sold can validate ownership. Devvio, for example, can integrate ownership of software modules with encrypted Smart Coins that represent the modules' ownership. Asset Smart Coins can wrap other types of ownership representations, including physical assets such as cash, gold, contracts, other cryptocurrency tokens, etc. Asset Smart Coins can also wrap a simple ID or even a JSON representation of data, which can then be processed off-chain.

Record Smart Coins: Smart Coins can include records such as medical records, payment records, legal records, or nationality records as examples. They can include encrypted data or simply an identifier for referencing an off-chain record. The encryption can be controlled by a third party for off-chain processing, by the INN, or directly by the user, as examples.

Task Smart Coins: Task Smart Coins include a representation of off-chain human tasks and efforts. For example, Task Smart Coins can represent a bounty request for creating a new software asset in a developer marketplace, a need to repair a leaking roof, or a car ride

from one location to another. Task Smart Coins can retrieve updated state information from off-chain inputs.

Credit Smart Coins and Loan Smart Coins: Credit Smart Coins and Loan Smart Coins can represent a loan from Devvio or lending account. They represent the mechanisms to keep track of the loan/credit balance.

Logic Smart Coins: Logic Smart Coins can represent state information for logical calculations on the blockchain. Logic Smart Coins can be used for more generic processing. In situations where Logic Smart Coins create significant loads for network processing, they can be issued through the INN with a payment. Logic Smart Coins include the following examples.

- Initiation Smart Coins start a process or verification check. They can also be used as a request sent to an asset holder. Initiation Smart Coins can wrap JSON data that describes a request. For example, an Initiation Smart Coin can be used to start checks with Logic Smart Coins that subsequently perform an action. An Initiation Smart Coin can also be used to request that a digital asset be made available to a purchaser. The Initiation Smart Coin can be sent to the wallet of an asset holder. The asset holder can determine whether the asset should be made available based on Asset Smart Coins in the sender's wallet, and can make the asset available or not, in a methodology included in the Initiation Smart Coin.

- State Smart Coins define a state for processing. State can include data in the Smart Coin itself, a wallet balance, the existence of other Smart Coins, or other on-chain states as examples

- Logical Building Block Smart Coins can be referenced to other Smart Coins and can include simple logic functionalities like AND, OR, XOR, or NOT, as examples.

- Locking Smart Coins can lock/unlock the ability to make transfers using other Smart Coin types.

- Send Smart Coins can transfer Devv or Smart Coins automatically when specified criteria are met.

- Rights Smart Coins provide logic-based permissions for moving digital assets in another's wallet. This can be used to track a representation of supply-chain movements and can be used to implement off-chain state as an input into the blockchain.

- Functional Smart Coins: Functional Smart Coins can implement any type of programming functionality allowed by the Devv protocol. Conceivably a Functional Smart Coin could even have Turing complete functionality. However, Devv's philosophy is to implement functionalities as they are needed over time, for common use cases, and to avoid complex processing on-chain. The emphasis is on processing in off-chain environments.

Appendix D: Devv's Lending System

Devvio provides a mechanism for lending with fixed-supply, protected, fractional reserve lending. Having the ability to borrow Devv can be a very valuable functionality for our community. In order to allow lending and borrowing, the Devv protocol utilizes Lending Coins, Loan Coins, and on-chain contractual mechanisms based on those coins, which together create a lending system that shares some of the same characteristics and benefits of fractional reserve banking. However, in contrast, Devv addresses the weaknesses of fractional reserve banking. Devv's protocol has a specific limit on the amount of Devv that can be issued. A pre-determined portion of lending capability is set aside for Devvio, called the Devv Loan Reserve (DLR), in order to guarantee the majority of any given withdrawal (80%) for any given depositor. Lenders can only make loans in an aggregate total amount equal to the DLR, given loan issuance rules controlled by Lending Coins. Because loans cannot be made in aggregate beyond the DLR, the lending system is non-inflationary (as it relates to monetary supply) beyond the DLR, and the overall fixed supply of Devv cannot be adjusted more than the DLR. All of the algorithms that define lending mechanisms are implemented automatically by Devv nodes.

In order to implement lending, Lending Coins are issued by Devvio. A wallet that contains a Lending Coin can be considered to be a lender. These Lending Coins can be sold by Devvio so that a lender has a basis in its activities, or Devvio can require a deposit. Devvio can also agree to repurchase a Lending Coin, for example, using a fiat currency or Devv, or by returning a deposit. Details are negotiated between Devvio and lenders. In order to create a lender, Devvio sends a Lending Coin to the lender's wallet indicating both the amount it can lend out to others and the lender's obligations. There are two types of Lending Coins - Fractional Reserve Lending Coins and Full Reserve Lending Coins. Lending Coins record lending authorizations, and Fractional Reserve Lending Coins can only be issued up to an aggregate amount equal to the DLR. Full Reserve Lending Coins do not add to that aggregate amount. If Devvio tries to authorize lending in an aggregate amount of Fractional Reserve Lending Coins larger than the DLR, that issuance transmission will be considered invalid by Devv nodes.

Fractional Reserve Lending Coins
After a fractional reserve lender is created with a Fractional Reserve Lending Coin, it can accept deposits. Devvio cannot deposit Devv into lender's accounts. When a lender accepts deposits, a liability is created where the lender has an obligation to return deposits when the depositor requests a withdrawal. After lenders have received deposits, they can make loans to others. Lenders can only loan up to 80% of their deposits, and must maintain 20% of their total outstanding deposits as a Devv reserve. At the end of any given period, if the 20% balance is not maintained, then the lender must borrow money from Devvio at a rate defined by the Lending Coin. This will happen automatically on the blockchain. Lenders have an obligation to immediately return 80% of deposits when a withdrawal is requested, and lenders cannot perform any further lending until they have returned the remaining 20% of a withdrawal request. In order to return the final 20% of a withdrawal request, a lender must maintain additional reserve (beyond the 20% reserve) to account for the 20% risk on that withdrawn deposit to maintain the same 20% risk level for other depositors and Devvio. When a lender makes a loan,

it issues a Loan Coin that defines standard loan terms like interest rate, term, and payment obligations. The lender also issues Devv that the borrower can use. If a depositor wants to make a withdrawal and the lender does not have enough money in its reserve to cover the withdrawal, then the lender must borrow money from Devvio to cover the withdrawal. Because 80% of the fractional reserve for all lenders is guaranteed by Devvio for withdrawals, and depositors can only demand a withdrawal of 80% of their balances, there is no risk of a lender defaulting on its obligations, even if everyone requests all of their money at once (known in the banking industry as a "bank run"). Because depositors have a 20% risk on their deposits, there is an incentive for lender scrutiny when making deposits. Additionally, Lending Coins can allow voting rights to depositors to approve loans.

Full Reserve Lending Coins
A Full Reserve Lending Coin can be issued by Devvio to a wallet that contains Devv to cover any lending. When the Full Reserve Lending Coin is issued with a lending limit, an equal amount of Devv in the wallet is locked to the loan, and cannot be transferred other than through a loan. If there are no outstanding loans, the lender can remove the Full Reserve Lending Coin, freeing the locked Devv. The Devv that is locked can be loaned to others within requirements set by the Full Reserve Lending Coin. The lender assumes all risk for bad debt on loans with a Full Reserve Lending Coin. Devvio receives a percent of interest profits, defined by the Lending Coin, on full reserve loans.

Lending
Borrowers receive Devv and Loan Coins representing their debt. Loans are automatically repaid in defined installments described by the Loan Coin in the wallet. Devv amounts in the wallet are automatically applied to loan payments. If a wallet does not contain enough Devv when a loan payment is due, the loan is immediately considered in default, and penalties can be applied to the loan's balance, as defined by the Loan Coin. If the loan is in default for too long a time period or in too high an amount, as defined by the Loan Coin, then the lender has the option to foreclose on the loan. Loan Coin terms must fit within interest rate and other obligations defined by the issuing lender's Lending Coin. Lending Coins must fit within overall lending requirements defined by Devvio's bylaws. Devvio negotiates the requirements on lending when issuing a Lending Coin, within bylaw limitations.

When a loan is repaid, the principal credits any loans from Devvio first and then adds to the lender's reserve second. Interest on the loan is shared between participants as profit. Interest goes 40% to the lender's depositors (pro-rated over all deposit lifetimes during the relevant term of the payment), 50% to the lender, and 10% to Devvio. If a loan is not repaid, then the lender must satisfy the outstanding debt by foreclosing on collateral (on or off chain) or by using profits on other loans. Ultimately if the lender itself defaults and goes bankrupt, Devvio will guarantee 80% of the deposits out of the DLR, and the Lending Coin in question becomes frozen. Because depositors are in a position to lose 20% of their deposit in the case of loan default, they are incentivized to choose a trustworthy lender. When a Lending Coin is frozen, it still counts towards the aggregate amount that can be loaned with respect to the DLR, but no further lending can occur with that Lending Coin until Devvio repays the bad debt associated with it.

Therefore, frozen Lending Coins lower the total amount of Devv available to be loaned, until Devvio pays off bad debt associated with frozen Lending Coins.

Credit

Devvio can issue credit in the form of Credit Coins from available amounts in the DLR or from Devv ownership, directly to users. Credit Coins act in a similar fashion as credit cards. Where a Loan Coin disappears when a loan is paid off, a Credit Coin can be used for credit on an ongoing basis, subject to the terms associated with its use.

DLR Availability

The DLR will unlock, and be available for lending purposes, over time. 20% will unlock three year after Devv's launch, and an additional 20% will unlock each year thereafter until the full DLR is available for lending.

Summary

Devv's lending system provides for the valuable utilities of lending and borrowing, while avoiding many of the pitfalls associated with a traditional fractional reserve banking system. Where a traditional fractional reserve banking system is inherently unstable, given the potential for bank runs, the Devv lending system uses the DLR mechanism to prevent that instability. The trade-off is the possibility that the DLR may become frozen over time; however, this is unlikely given the built-in incentives for all participants. Even without the DLR, a full reserve lending system will be in place. Also, with a traditional fractional reserve banking system, there are often negative incentives, as Central Banks fully guarantee the full amount of many depositor's balances, which means that there is no scrutiny on the depositor's part in choosing a bank. By including a degree of risk for depositors, our lenders will be encouraged to justify their lending practices. Finally, lenders in a traditional fractional reserve banking system exert a large influence on money supply. The only influence on money supply that Devv's lending system allows is limited to the fixed-amount DLR.

In Devv's lending system, protections exist for most eventualities, including limits on risk and influence of the lending system with respect to money supply. Within those limits, our protocol unlocks the enormous value that lending and borrowing provide, enabling a straightforward, common-sense framework for a robust lending system.

Appendix E: Identity

Identity is a powerful solution within the Devv protocol. Smart Coins can be issued by the INN in order for users to prove their identity in a variety of use cases. Identity Smart Coins are issued to DevvProtect wallets only, as Devvio knows the identity of DevvProtect wallet holders by definition.

Identity Smart Coins can be used in any situation where an identity is required for a transaction, such as a seller that wants to validate an identity for a sale. In this case, the INN can issue an Identity Smart Coin to a DevvProtect Wallet with Devv for the transaction. It is important to note that the identity of the individual does not need to be associated with his/her entire Devv ownership. A Devv owner can create a new DevvProtect Wallet on a case-by-case basis, send Devv to that wallet or receive Devv from someone else, and then request that the INN issue an Identity Smart Coin for the new account. The transfer of Devv to a new DevvProtect Wallet can additionally be handled via a private transaction, described below, so that an Identity Smart Coin cannot be publicly linked with other accounts.

Identity Smart Coins can be encrypted, so that the intended recipient is the only entity that can validate and use the identity. For example, a third-party partner can put a relationship in place with Devvio to utilize its identity-validation techniques. The INN can encrypt identities to be decrypted later by the third-party using a provided decryption key. Alternatively, the owner can request an Identity Smart Coin encrypted with a key that the owner holds. The INN can send Identity Smart Coins to wallets upon their owners' requests. Then, transactions originating from an identified DevvProtect Wallet, whether these transactions involve Devv or not, can be verified as originating from a specified identity, using the Identity Smart Coin that the INN sent. Identities can also be verified by Devvio with the owner's prior approval. Identity Smart Coin encryptions include numerical aspects of the wallet, such as its public key, so that Identity Smart Coins sent by the INN cannot be associated with unrelated accounts using public records.

As another example of Identity Smart Coin use, Devvio can verify the citizenship status of a DevvProtect Wallet owner. This can be initially done by Devvio through standard means, such as by obtaining a copy of a passport. The owner can then request that an encrypted Identity Smart Coin be sent to their wallet, including their name and citizenship information, to be used with a service that is only available to citizens of a particular country. The owner could then send a Devv payment to the service provider. The service provider can either decrypt the identity (if that was arranged ahead of time with Devvio), or the service provider can request a validation of the ID from Devvio, which can provide it with the owner's permission (either as an account setting or as part of the original Devv transmission), or the owner can provide the key to be used to decrypt the identity with an off-chain message.

Identity validation can have many useful purposes. It can be used to enable voting by a third party. It can be used in transactions that require some level of identification such as joining an organization, securing a credit card or mortgage, making a purchase, taking an action restricted to certain groups, participating in a raffle, or interacting with an online group.

Identity Smart Coins can include personal details, such as name, address, email, phone number, gender, nationality, or any other information needed in an identity request. Devvio can also aid in identity validation by overseeing other types of identity inputs such as a bank account validation (sending small amounts that are reported back), mobile phone texting validation, validation of government issued IDs or reference numbers, physical facial or fingerprint scans, or any other type of identification information that can lend itself to a digital identity. Identity Smart Coins can be used with third-party systems, such as for submitting a request. An Identity Smart Coin can be used to apply for a membership, where all of the details needed for the application can be included in the Identity Smart Coin, and the transmission of an Identity Smart Coin is the act of applying for the membership.

Below is a list of example use cases. These can be implemented with third parties that establish a relationship with Devvio, or they can be implemented via an encryption key that the owner provides separately. Devvio can accommodate various implementations based on the user's instructions.

- **Voting** – The INN can issue encrypted Identity Smart Coins to accounts that are eligible for a vote, and those Smart Coins can be sent to the third party's addresses representing voting choices (either through a private or public transmission). In this way, a single vote per identity can be assured.
- **Memberships** – The INN can issue encrypted Identity Smart Coins to eligible members with all of the information required to apply for a membership. The user can send the Identity Smart Coin to the third party's address to apply for the membership. If there are membership fees, those fees can be paid in Devv from the account holding the Identity Smart Coin. A membership can be associated with a physical location like a gym or club, or it can be for online activities like a video game or social site. Identity Smart Coins could be used to verify gender in an online dating site, or age for COPA (Child Online Protection Act) purposes in gaming or other websites.
- **Raffles** – The INN can issue encrypted Identity Smart Coins to eligible participants in a marketing event such as a raffle. Users can self-identify whether they are willing to accept marketing Smart Coins (marketing Smart Coins can also include Devv to incentivize participation, for example). The Identity Smart Coins can assure fair participation.
- **Obtaining a Credit Card** – The INN can issue an encrypted Identity Smart Coin not only including identity information for obtaining the account, but information needed in order to verify a credit score. Alternatively, a pre-paid credit card can be applied for using Devv funds in the user's account. The transmission transferring the Identity Smart Coin to the issuer account represents the application. Applications can of course be submitted for other similar instruments implemented on-chain, like loans (implemented with a Loan Smart Coin) or off-chain like mortgages (implemented through external contracts once the submission is approved).
- **Restricted Purchases** – The INN can issue an Identity Smart Coin to a user upon the user's request so that a restricted purchase can be implemented. The purchase can itself be made in Devv, and the ID Smart Coin can validate requirements for the

purchase, such as an age requirement for buying alcohol or securing a senior citizen discount, a gender requirement for buying a ticket to a dating event, a group requirement like a military or educational discount, a location requirement like citizenship, or any other kind of identity validation.

Appendix F: DevvFiat Examples

The following examples show uses of DevvFiat, a one to one backed version of Devv which are maintained in DevvProtect Allocation Amounts (Dallocation) in the Devv blockchain. These examples show conceptually how DevvFiat can be utilized, but specific implementations will vary in the future as it is fully developed. There are many other types of uses for DevvFiat, beyond the examples given here, as well:

- **Devv owner who wants DevvDollars**: Mike has Devv that he wants to convert into DevvDollars to be able to spend at locations that accept Devv. His Devv is worth $500 at current exchange rates. Joe wants to buy some Devv. Joe purchases the Devv from Devvio for $500 (to keep it simple it's just Joe in this example, but these trades could occur with multiple buyers and sellers of course). Devvio puts the $500 in escrow, and issues to Mike 500 DevvDollars. Devvio now has $500 in escrow, Joe has the Devv, and Mike has 500 DevvDollars. Mike can spend his 500 DevvDollars through Devvio's payment channels, such as a Devv app.

- **Business that wants to accept DevvDollars**: A restaurant chain wants to accept DevvDollars at its restaurants. Devvio puts an agreement in place with the chain, and charges a small fee on transactions, though it is a smaller fee than they typically are charged for credit card transactions, for example. Devvio provides easy to implement access to its Dallocation payment system. When purchases are made, Devvio can immediately verify and approve them, and then all DevvDollar transactions need to be sent by Devvio to the Devv blockchain. End users (customers at the restaurant) do not see any additional cost, similar to credit card payments. Once the chain has DevvDollar revenue, the DevvDollars can later be exchanged for USD out of Devvio's escrow. At the end of the month the restaurant chain will owe Devvio payments on fees. Those fees can be paid in Devv, adding to its liquidity.

- **Customer who wants DevvDollars**: Sally wants to spend DevvDollars at the restaurant chain given the convenience and safety of DevvDollars. Sally creates a wallet, creates an account with Devvio, and then purchases 100 DevvDollars with $100 USD. Devvio then adds 100 DevvDollars into Sally's wallet, allocated in the Dallocation, and puts the $100 USD into an escrow account. She can now spend her DevvDollars using Devvio's app, or a debit card as examples. She walks up to the counter, orders her food, and then makes a payment for $10.22, paid with DevvDollars. Devvio immediately validates the transaction, and then initiates the transfer on the blockchain to the restaurant chain's Dallocation account. A short while later (after the DevvProtect waiting period) the restaurant chain can exchange the 10.22 DevvDollars into $10.22 with Devvio.

- **DevvDollar owner who wants to convert to Devv to buy something on Craig's list**: Sally then decides she wants to have direct access to transfer her DevvDollars as she chooses, and wants to convert her remaining 90 DevvDollars to Devv so that she can transfer a larger sum with even smaller fees (potentially no fees) for a purchase on Craig's List. She indicates to Devvio's exchange that she wants to convert her DevvDollars to Devv. Ron indicates on the exchange that he wants to sell his Devv. Devvio transfers Ron's Devv to Sally (with the amount determined by the current exchange rate), removes her DevvDollars, and pays Ron $90 out of escrow. Sally then

makes the Craig's list purchase by sending her Devv directly to the Craig's list seller's Devv wallet.

- **Person sending money to relative in another country**: Bob wants to send money to Alice, his sister, who now lives in the Netherlands. Bob buys $500 DevvDollars from Devvio, converts them to DevvEuros on the exchange, and sends them to Alice.
- **A group of friends chipping in for dinner**: 5 friends go out to dinner at a restaurant for a birthday celebration for a 6th friend, who they want to take out. The restaurant accepts Devv/DevvFiat. At the end of the night the 5 friends open their Devv apps, scan a QR code the waiter brings them, and each easily puts their share into the total payment.
- **Roommates splitting rent**: Three roommates want to pay their shared rent. Two of them transfer Devv to the third with no fees. The third converts the Devv to US dollars, and pays the rent for them. The next month the apartment complex begins to accept DevvDollars as a payment. All three then pay their share of the rent directly with DevvDollars.
- **An efficient bank**: Banks can implement banking transactions using DevvFiat in a regulated fractional reserve implementation, or credit can be implemented with DevvFiat. DevvFiat can be combined with credit or Lending Smart Coins. This is particularly compelling with the 60% of the world that doesn't have access to banking.
- **Person with money in a volatile country**: Jose lives in a country that is starting to have hyperinflation. Jose and the people around him simply use Devv for their transactions.
- **Person worried about inflation, economic decline, etc**: Nicole lives in a stable country, but it is going into a recession. She buys DevvDollars and converts them into either Devv (depending on its stability over time), or DevvWorldcoin (through Devv as an intermediary), which is a basket of monetary instruments that includes fiat from a variety of countries, and other relatively stable assets like gold.
- **A bank wanting an inexpensive way to transfer fiat**: A bank can use our system to inexpensively transfer inter-bank payments.
- **Users sending other cryptocurrencies**: Devvio can accept other cryptocurrencies and put them into one-to-one backed escrow account in the same way that DevvFiat is implemented. For example, users wanting to transact in Bitcoin but without large delays and fees can send Bitcoin to the INN, receive DevvBitcoin in exchange, and then transact the DevvBitcoin on the Devv network. At any point DevvBitcoin owners can exchange their DevvBitcoin for Bitcoin out of escrow.

Appendix G: Q&A

Doesn't a Validator approach mean that Devv is a central authority overseeing transactions?
No. It is important to distinguish between what central authorities do, and what Devvio does.

A central authority oversees transactions and validates them. A central authority verifies that if someone has already spent their currency, then they cannot spend it with someone else. Users that rely on a central authority are by definition required to <u>trust</u> that it is appropriately keeping track of account balances, and that all of the balance information is privately held. These systems inherently lack transparency and are exempt from an audit by a private citizen.

In contrast, Devvio is tasked with maintaining consensus. The Validators that Devvio chooses only perform a role in <u>publicly</u> agreeing that transactions are valid in order to grow the immutable blockchain. Devvio does not keep track of Devv balances. The blockchain does. Devvio does not prevent double spending. The blockchain does. Devvio does not have any ability to fraudulently create transactions, modify or reverse transactions, or modify balances as a central authority conceivably could. Transactions are cryptographically signed and the blockchain is immutable.

Couldn't Devvio use its power to pick Validators that collude with it to commit fraud?
No. That would not be practical. The openness and transparency of all blockchain operations prevent that, and by doing so, protect all participants. The blockchain is publicly available for everyone to see. The Validator transmissions are publicly available for anyone to see. The source code that Validators run, and the results of the code (on the blockchain), are publicly available for anyone to see. Devv's bylaws for governing the Devv protocol are publicly available for anyone to see. The sole responsibility of Devvio-certified Validators is straightforward – they simply maintain consensus on transactions, which really amounts to cooperatively maintaining an ordered ledger. It is a simple concept at its core. There is no trust required for Devvio as the Validators provide consensus. Anyone can audit the blockchain, and anyone can validate any transactions. A transparent consensus process lies at the heart of any true blockchain protocol, and the Devv protocol upholds this core principle.

There is no incentive for Devvio and Validators to fraudulently adjust the validation mechanism. The risk of being discovered is simply too high to make this form of collusion practical. On any given transaction, involved parties can perform their own absolute verifications. The Proof-of-Validation approach does not allow 51% attacks. Furthermore, once the conspiracy was uncovered (which it certainly would be), the effect would be to destroy users' trust in the system itself, which would by extension destroy the currency's value, making the attempted fraud a worthless effort. The openness of our system works to prevent fraud, and the permissioned operations of Validators prevents the consolidation of consensus-providers that, for example, creates a systemic threat in Proof-of-Work systems like Bitcoin.

Doesn't a permissioned distributed ledger imply that the blockchain does not represent a cryptocurrency?

In many cases, a permissioned ledger has historically meant that the blockchain does not represent a cryptocurrency, and for most historical permissioned distributed ledgers, the blockchain information is not publicly visible. Most historical permissioned distributed ledgers were designed around corporate or enterprise uses. However, in Devv's usage, it is important to understand what the permissions apply to. The permissions <u>only</u> apply to Validators sending validations, or in other words, the consensus mechanism itself. Devv's permissions do not affect access to the blockchain. Devv's permissions still prevent collusion (given the blockchain's visibility). Once this distinction is understood, it becomes clear that our approach opens up a new solution space for cryptocurrencies as a whole.

Why not use an ERC20 token or another cryptocurrency?

Implementing the new protocol used by Devv has a number of benefits over using other cryptocurrencies. First, having a pool of cryptocurrency available as incentives for early adopters is very valuable. Second, our approach has several advantages over protocols that rely on using an ERC20 token or similar mechanism. With Devv, we have:

- The ability to implement governance
- Issuances (mining rewards in the case of Ethereum) go to our community
- No fees on transactions
- The ability to scale, with a superior consensus mechanism that allows a multi-tier blockchain and sharding
- DevvProtect use, which implements optional trust-based transactions (covering concepts like loss, theft, stability, immediacy, identity, and privacy). Other cryptocurrencies do not allow these valuable mechanisms with as tight of an integration with the blockchain itself.

Implementing our own protocol also removes platform risk. Ethereum, for example, has many uses and many companies with competing goals using its platform. That is one of the benefits of Ethereum's smart contract approach, but it represents a risk as well. Ethereum also uses a philosophy that ultimately will not be able to compete with Devv. Devv's Validator approach enables a network that is paid fairly for creating consensus, but does not reserve the bulk of its issuances for this function alone. Devv's Smart Coin approach allows a practical and scalable solution that is not overly expensive to implement. Our goal is to control our own destiny, and not be reliant on the ultimate success of another platform.

Doesn't DevvProtect create too much of a dependency on Devvio?

DevvProtect does create a dependency on Devvio, but this is by design and is logically necessary. Fundamentally, if you want to have a dispute resolution system for an online purchase, or the ability to prevent theft and private key loss (all of which are highly sought-after mass-market consumer protections), the most efficient way is to establish a trusted entity that maintains verified identity information. Even in comparison with a distributed trust-based system, the system itself has to be trusted as real-world data is being brought into the blockchain. There is no way around this (Oracles have to utilize off-chain information at some

point), and including a practical solution as a core part of the protocol from inception is critical to a successful strategy.

Keep in mind, though, that DevvProtect is optional. There is no dependence on Devvio that does not justify its value, by definition. If any users wish to avoid dependence on DevvProtect then they can still participate fully in the Devv ecosystem without it. Those who see the value of DevvProtect can utilize Devvio's added protections and functionalities. DevvProtect is available to those that want it and optional for those who don't.

Aren't zero knowledge SNARKS, or something similar, a better solution for Privacy?
We believe that zk-SNARKS have a significant problem. We do not believe that they will be acceptable to governments, and regulation around them will dramatically hinder their mass market use. Although many cryptocurrencies at their core cannot be regulated or controlled, regulation can be brought to bear in the form of significant limitations in conversion to fiat currencies through exchanges, particularly when compared to a solution like Devv.

How does Devv compare with Turing complete smart contract solutions?
Many of Devv's improvements are also improvements over Turing complete smart contract blockchains. One of the most significant is that Devv can scale to significantly more transactions per second than the majority of other blockchains. Devv also includes a green solution for responsible environmental stewardship and offers a better issuance strategy for building a community. Moreover, there are concepts built in to Devv's protocol that cannot be implemented with smart contracts. For example, the ability to return stolen Devv or provide relief for a lost key, using Devv's DevvProtect, are important concepts to be added at a core level in a protocol.

The biggest difference between Devv and DApp based blockchains, however, is in their smart contract strategies. With a Turing complete VM, many calculations are performed on-chain. We do not believe this is an effective, or even viable, long-term strategy, and this puts all efforts using those networks at risk, long-term. We do not believe that efforts built on DApp-based protocols will be competitive against tailored approaches. Turing complete smart contracts are simply too expensive, too complex, and too vulnerable to ultimately serve as a successful alternative when compared against solutions built to solve specific problems.

This is DApp model blockchains' fatal flaw.

For example, as of Q1 2018, to add two numbers together 1 million times, it costs over $20 in gas with Ethereum. On an AWS server, it costs on the order of $0.00000007. That is 9 orders of magnitude more expensive. This makes a strong point that most calculations should happen off-chain in a traditional database where a blockchain is not needed. Implementing a Turing complete smart contract solution runs counter to this idea.

Take Ripple as an example. Could Ethereum's smart contracts be used to implement Ripple's functionality? Yes. Would an Ethereum smart contract approach attempting to recreate Ripple's

strategies be better than Ripple's approach? Certainly not – there is no way that it would be able to compete.

Devv, in contrast to Ethereum, focuses its on-chain processing efforts where they are most effective: for simply transferring representations of ownership, leaving ramifications of that ownership to off-chain calculations. There are times where some limited amounts of smart contract functionality are necessary on-chain, and those can be implemented either directly in the protocol with thorough testing (such as DevvProtect's functionalities, or Devv's lending capabilities), or through a limited set of logical functionalities tailored to specific situations and implemented through a trusted source (Devvio). These assumptions imply that the majority of processing will happen off-chain, where it should be implemented, reserving the precious resources of the blockchain for their intended purpose – solving the problem of digital ownership in a trustless and robust way.

Since Devv doesn't have Turing complete smart contracts, doesn't it have a big disadvantage to a DApp blockchain?
We believe that too much processing occurs on-chain with a Turing complete solution. This places too much emphasis on using blockchains outside of where they are effective and what they were originally intended to do. Blockchains are good at implementing trustless transactions and doing so in a robust and secure way. If trustless transactions and robustness are not critical, traditional databases should be used instead. Centralized databases offer better privacy, significantly better performance, are easier to scale, easier to manage, and easier to program and debug. Also, performing all of the necessary processing on-chain is millions of times more expensive. Actions that cost of tens of millions of dollars to perform on the DApp blockchain can be implemented for pennies on a traditional server.

How is Devv used in vertical markets given its Smart Coin strategy?
Our approach starts with different assumptions than a Turing complete system. We focus on maintaining a representation of ownership on the blockchain, and the limited amount of on-chain processing that occurs is handled via Smart Coins. More complex functionalities are implemented by composing Smart Coins into Directed Acyclic Graphs (DAGs). In situations where more complex on-chain processing is desired, Smart Coin implementations can be purchased from Devvio. The on-chain representations can then be used off-chain in real-world situations. Below are some examples:

- **Digital Payments**: Digital payments can be implemented with Devv's core protocol. Rather than implement the functionality with smart contracts, Devv includes instant availability of cryptocurrency through a protocol-level mechanism (i.e. the DevvProtect Allocation Amount or Dallocation). Devvio also provides a stable version of Devv, mechanisms for chargebacks, credit and lending, and protections from theft and loss. These are examples of where core concepts are implemented in the protocol itself rather than smart contracts.
- **Loyalty points, in-game currencies, tickets, gift cards, etc.**: Where smart contracts could conceivably be used to implement not only a record of ownership but also redemption mechanisms, the Devv philosophy would only be used for the ownership

itself. The redemption mechanisms would be implemented with an off-chain trusted source (which really is how most of these systems are used anyhow). Whenever you move from on-chain transactions to off-chain transactions, you innately require interactions based on trust, which includes the majority of real-world situations. Much of the value of a fully trustless solution is ultimately a fallacy because trust is usually required at some point for real-world implementations. In situations where some on-chain processing is needed for timing, transfer mechanisms, etc., Smart Coins can be used with Devv's protocol.

- **ICOs**: ICOs can be implemented with Devv for other types of cryptocurrencies by issuing Smart Coins with a fungible representation of value.
- **Voting**: Voting is handled via Voting Smart Coins. The transfer of these voting representations, represents votes.
- **Identity**: Identity is handled via various types of Identity Smart Coins. The properties of Identity Smart Coins can vary and are expected to improve over time as new use cases evolve.
- **Record Management**: Records can be maintained on the blockchain with Asset Smart Coins that reference an ID for off-chain processing, or which wrap a JSON structure for off-chain processing. As an example, medical records can be encrypted and added to a user's wallet over time. If the user needs to use those medical records when switching doctors, the user can forward the medical records to the new doctor along with an off-chain decryption key.
- **Physical Assets**: Records of physical assets (automobiles, real estate, electronics, etc.) can be recorded with Asset Smart Coins that wrap information referencing the physical assets, which can be utilized with off-chain systems. For example, an Asset Smart Coin can represent an automobile title. When a car is sold, that Smart Coin can be transferred to a new owner.
- **Digital Assets**: Records of digital assets (software, music, movies, etc.) can be established via Asset Smart Coins that wrap information referencing these assets. Smart Coins can be used to issue a request to gain access to a digital asset, which can be granted or denied based on Asset Smart Coins.
- **Stocks**: Stocks offer a strong example of Devv's long-term strategy. Currently, stocks represent a complex and highly regulated environment for implementing transfers. There is no short-term need to be able to implement stock transfers. However, in the future, blockchains would be a highly effective technology for implementing stock ownership and transfers. In the future, as the need begins to arise, Devv can add a Stock Smart Coin to the protocol, which would handle any of the intricacies of stock ownership and transfers.
- **Contracts and Escrow**: Contractual transfers of Devv can be implemented with Smart Coin logical operations. Scheduled payments of Devv can be implemented with Smart Coins that determine timing and automatically make payments. A required payment that is associated with a contractual state (for example, an insurance payment based on the amount of rainfall, a bet based on an outcome, or a payment based on the receipt of goods) can be implemented with logic Smart Coins that interact with Oracle Smart Coins where Devvio gives trusted state information as inputs for calculations.

- **Supply Chain**: Supply chain management can be implemented with logic Smart Coins that give permissions for transferring Asset Smart Coins, which represent goods as they move through the supply chain.

In summary, there is very little that cannot be done with a simple set of Smart Coins when compared to smart contracts, and nothing that can't be done when allowing for additions to Smart Coin functionality over time. Rather than create a Turing complete solution from the beginning, Devv emphasizes moving the majority of processing to off-chain environments, and reserving on-chain processing for tasks critical to owning and transferring value.