



BSTX Protocol

BSTX-listed securities (“Security” or “Securities”) are equity securities that are able to use the functionality of distributed ledger or “blockchain” technology to maintain ancillary records of ownership on the Ethereum blockchain.¹ An existing state of Securities ownership on the books and records of market participants is replicated using tokens on the Ethereum blockchain through the automatic operation of a “smart contract.”² The BSTX Protocol (the “Protocol”) is the set of rules and permissible operations of the smart contract that facilitate changes to the ancillary recordkeeping mechanism on the Ethereum blockchain regarding Security ownership. Each Security would have its own smart contract operating pursuant to the Protocol to facilitate this ancillary recordkeeping process.

The discussion below first provides a general background on smart contracts, tokens, and protocols followed by a specific discussion of the Protocol as it will govern the tokens representing each Security (*i.e.*, the smart contract governing the equity security of a BSTX-listed issuer for purposes of facilitating the ancillary recordkeeping mechanism using the Ethereum blockchain).

Smart Contracts

The term “smart contract” is commonly used to describe computer-coded functions in connection with the Ethereum blockchain. An Ethereum smart contract is neither “smart” nor a legal contract in the traditional sense. Smart contracts in this context refer to immutable³ computer programs that run deterministically⁴ in the context of the Ethereum Virtual Machine.⁵ Smart contracts operate within a very limited execution context. They can access their own state, the context of the transaction that called them, and some information about the most recent blocks (*i.e.*, the most recent recording of transactions and other events recorded to the Ethereum blockchain).

¹ The Ethereum blockchain is an open-source, public distributed ledger (*i.e.*, a blockchain) that records certain information relating to the operation of various smart contracts built on Ethereum.

² The Ethereum blockchain is used only as an ancillary recordkeeping mechanism to reflect the number of securities owned by a market participants at a fixed point in time. It will not be used to effect the trading, clearance or settlement of transactions in Securities. Pursuant to the rules of BSTX, Securities are uncertificated equity securities that have been made eligible for services by The Depository Trust Company (“DTC”). DTC would serve as the securities depository for Securities, and confirmed trades on BSTX will be transmitted to National Securities Clearing Corporation (“NSCC”) for clearing such that NSCC would clear the trades through its systems to produce settlement obligations that would be due for settlement between participants at DTC.

³ Smart contracts are immutable in that, once deployed, the code of a smart contract cannot change. Unlike with traditional software, the only way to modify a smart contract is to deploy a new instance.

⁴ Deterministic in this context means that the outcome of the execution of a smart contract is the same for everyone who runs it, given the context of the transaction that initiated its execution.

⁵ The Ethereum Virtual Machine can be understood as a global computer on which smart contracts run.

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In the context of tokens representing Securities, smart contracts generally may have three components: (i) functions, (ii) configurations; (iii) and events.⁶ Functions describe the basic operations of a smart contract, such as the ability to query a particular address to determine how many Securities belong to that address.⁷ Configurations are attributes of a smart contract that are typically set at the launch of a smart contract, such as designating the name of the smart contract. Events describe the functions of a smart contract that, when executed, result in a log or record being recorded to the Ethereum blockchain, such as the transfer of an asset from one address to another. Not all functions of a smart contract result in a log or record being recorded to the Ethereum blockchain. Smart contracts only run if they are called by a transaction.⁸

Smart contracts can call another smart contract, which can call another contract, and so on. Smart contracts never run “on their own” or “in the background,” but rather lie dormant until a transaction triggers them to carry out a specified operation pursuant to the protocol on which they operate. All transactions execute in their entirety or not at all, regardless of how many smart contracts they call or what those smart contracts do. Only if a transaction successfully executes in its entirety is there an “event” representing a change to the state of the blockchain with respect that transaction. If an execution of a smart contract’s operation fails due to an error, all of its effects (*e.g.*, events) are rolled back as if the transaction never ran.⁹

Tokens

Tokens historically referred to privately issued, special-purpose coin-like items (*e.g.*, laundry tokens or arcade game tokens). In the context of blockchain technology, tokens mean blockchain-based abstractions that can be owned and that represent assets, currency, or access rights. A token on the blockchain used for ancillary recordkeeping of ownership of Securities can be thought of as a digital representation of shareholder equity in a legal entity organized under the authority of state or federal law and that meet BSTX’s listing standards. Having a token attributed to a particular address, however, does not convey ownership of shareholder equity in the issuer because the official records of a Security’s ownership are maintained by participants at DTC.¹⁰

⁶ However, a smart contract need not necessarily have each of these components. Some smart contracts may simply be used to support the functioning of other smart contracts and may not itself result in events being recorded to the Ethereum blockchain.

⁷ An “address” in this context refers to a number that is associated with a particular market participant within the smart contract that can be updated to reflect changes in ownership of tokens.

⁸ The term “transaction” in this context does not refer to an actual securities execution or transaction occurring on BSTX or in the marketplace, but rather to an operation triggering a smart contract to carry out its specified function, which must ultimately originate from a human source.

⁹ A failed transaction (*i.e.*, an attempted operation of a smart contract) is still recorded as having been attempted, but it otherwise has no effect (*e.g.*, as a change in registered ownership on the blockchain as an ancillary record).

¹⁰ Rather, a digital representation of a Security associated with a particular address reflects an ancillary record of Security ownership based on data provided to BSTX by market participants. The records reflected on the Ethereum blockchain regarding Securities may not be current to reflect the most recent transactions in the marketplace and may not reflect ownership by all market participants.

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To create a new token on Ethereum, including for purposes of facilitating ancillary recordkeeping of Security ownership, one must create a new smart contract. The smart contract would be configured to detail, among other things, the name of the issuer and the total supply of the tokens that correspond to the BSTX-listed Security. Smart contracts can be designed to carry out any event that one wants, but using a set standard or protocol allows for participants transacting in those smart contracts to have uniform expectations and functionality with respect to the tokens.

Protocols

A protocol (also sometimes referred to as a “standard” or “protocol standard”) defines the functions, events, configurations, and other features of a given smart contract. The most common protocol used with Ethereum is the ERC-20 protocol, which describes the minimum functions that are necessary to be considered an ERC-20 token. The ERC-20 protocol offers basic functionalities to transfer tokens, obtain account balances, and query the total supply of tokens, among other features. The BSTX Protocol is compliant with the ERC-20 protocol, but adds additional requirements and functionality, as described below.

Ether is the digital currency used to pay fees associated with operating smart contracts (known as “gas”) on the Ethereum network. Payment of gas is required to operate smart contracts because there are costs involved in performing the computations necessary to execute a smart contract and to record any state transitions onto the Ethereum blockchain.

There is an important conceptual distinction between ERC-20 tokens, including tokens used for ancillary recordkeeping purposes of Securities, and ether itself. Where ether is transferred by a transaction that has a recipient address as its destination, token transfers occur within the specific token contract state and have the token smart contract as their destination, not the recipient’s address. The token smart contract tracks balances and issues events to the Ethereum blockchain. In a token transfer,¹¹ no transaction is actually sent to the recipient of the token. Instead, the recipient’s address is added to a map within the token smart contract itself. In contrast, a transaction sending ether to an address changes the state of an address. A transaction transferring a token to an address only changes the state of the token contract, not the state of the recipient address. Thus, an address is not really full of tokens; rather it is the token smart contract that has the addresses and balances associated with each address in it.

BSTX Protocol

BSTX Rule 26138 requires that a BSTX listed company’s Securities must comply with the Protocol to trade on BSTX. The purpose of this requirement is to ensure that all Securities are governed by the same set of specifications and controls that allow for ownership of Securities to be recorded to the Ethereum blockchain using tokens as an ancillary recordkeeping mechanism.

¹¹ A “transfer” in the context of the BSTX Protocol regarding a Security refers to a reallocation of the digital tokens (representing a Security) on the Ethereum blockchain as an ancillary recordkeeping mechanism to reflect corresponding changes in ownership of the Security.

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The Protocol involves three smart contracts. The Asset Smart Contract is the primary smart contract that contains the balances of tokens associated with each address and carries out the functions necessary to reflect changes in ownership for ancillary recordkeeping purposes. There are two accompanying smart contracts that are called by the Asset Smart Contract in executing operations to facilitate updates to the Ethereum blockchain. The first of these is the Registry Smart Contract (“Registry”), which contains the list of permissioned (or “whitelisted”) addresses, and the second is the Compliance Smart Contract, which includes a variable list of additional compliance related rules that the Asset Smart Contract must comply with in executing operations to facilitate updates to the Ethereum blockchain. Each of these three smart contracts are described in greater detail below:

- (1) Asset Smart Contract – The Asset Smart Contract defines and creates the tokens (*e.g.*, the maximum number of tokens available for a particular issuance) for purposes of the Ethereum blockchain ancillary recordkeeping function and records a list of each BSTX Participant or non-BSTX Participant broker-dealer addresses and the tokens held at each address.
- (2) Registry Smart Contract – The Registry Smart Contract (or “Registry”) defines the permissions available to different types of market participants to perform certain functions. Under the Protocol, there are five different types of market participants connected with the Registry, each with different abilities and permissions (as detailed below):¹² (1) Contract Owner, (2) Custodian, (3) Broker Dealer, (4) Custodial-Account, and (5) Investor. The Registry also contains the list of whitelisted addresses to which tokens may be sent and additional information associated with each address (*e.g.*, whether an address has been suspended).
- (3) Compliance Smart Contract – The Compliance Smart Contract is the set of rules held in a separate smart contract that a token can be configured to abide by to ensure compliance with applicable laws and regulations (*e.g.*, by restricting a movement of tokens to an address that has not been added to the Registry for purposes of the Ethereum blockchain ancillary recordkeeping mechanism). The Compliance Smart Contract can be modified to add or remove applicable rules in light of changes to applicable regulatory requirements.

Each of these three smart contracts work together to facilitate the ancillary recordkeeping mechanism for Securities, represented by tokens on the Ethereum blockchain. The discussion below describes the specific functions and configurations of each.

¹² There are additional roles that are not technically part of the Registry and are instead specific to certain smart contracts. For example, an “Issuer” is an Asset Smart Contract-specific role, as discussed in further detail below. Also, an “Administrator” is a Compliance Smart Contract-specific role that allows such a user to, for example, freeze the transfer of tokens for purposes of the ancillary recordkeeping function under certain circumstances and modify or add compliance rules to govern a token.

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The Asset Smart Contract component of the Protocol sets forth 16 functions, 10 configurations, and six events. The 16 functions of the Asset Smart Contract are as follows:

1. “TotalSupply” – a query function that returns the value of the TotalSupplyTokens configuration, which provides the number of tokens created with respect to any issuance of a particular tokens.
2. “BalanceOf” – a query function that provides the number of tokens held by a given address.
3. “Allowance” – provides a limit to the amount of tokens allowed to be transferred from a given address to another given address when using the TransferFrom function.¹³
4. “HolderAT” – a query function that returns the address of the holders of a token at the time of the query. This function enables an individual to generate a list of every address holding a given token at the time of the query.
5. “IsHolder” – a query function that returns a “yes” or “no” answer to whether a given address holds a token.
6. “IsSuperseded” – a query function that returns a “yes” or “no” answer to whether a given address has been frozen (*i.e.*, canceled, subject to the CancelAndReissue function).
7. “GetSuperseded” – a query function that returns the superseding address (if any) when an address is entered. This function is useful in the context of a lost or forgotten address. For example, if an address has been canceled, this function will return the address that took the place of such canceled address. Entry of a currently active address returns a null set.
8. “SetCompliance” – requires the Asset Smart Contract in executing a transaction to call the Compliance Smart Contract and operate in accordance with and specified requirements set forth in the Compliance Smart Contract (*e.g.*, to not transfer tokens to an address in the Registry that has been frozen for ancillary recordkeeping purposes).
9. “SetRegistry” – requires the Asset Smart Contract to call the Registry, which houses whitelisted addresses and the status (*e.g.*, Custodian) associated with certain address to perform certain functions.

¹³ To ensure that tokens remain compatible with the ERC-20 protocol for ancillary recordkeeping purposes, which is the baseline upon which the BSTX Protocol is built, the Protocol will feature “Allowance,” “TransferFrom,” and “Approve” functions. However, during the initial stages of the operation of the ancillary recordkeeping process, these functions will be disabled for the tokens representing Securities through a rule in the Compliance Smart Contract, as use of these functions may enable transfers to non-whitelisted wallet addresses. However, such functions may be enabled in the future, if appropriate. BSTX will provide notice to BSTX Participants via regulatory circular in advance of such functionality becoming operational as part of the BSTX Protocol.

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10. “Transfer” – allows for the transfer of tokens for ancillary recordkeeping purposes to other specified, whitelisted addresses, and requires two parameters: the receiver address and the amount of tokens being sent. One use for this function is to allow an address with Investor status to transfer tokens to a Custodian.
11. “TransferFrom” – allows a Contract Owner (described below) to delegate to a separate address the ability to transfer tokens on its behalf.¹⁴
12. “Approve” – allows the owner of an address to approve execution of the TransferFrom function.¹⁵
13. “SetIssuer” – allows a Contract Owner to designate the address of an Issuer of a token representing a BSTX-listed Security.
14. “IssueTokens” – allows an Issuer to issue new tokens representing a BSTX-listed Security for ancillary recordkeeping purposes.
15. “FinishIssuing” – when this function is executed by an Issuer, there may be no additional issuances of a given token.
16. “CancelAndReissue” – in the context of a lost, forgotten, or inaccessible address, this function allows a Contract Owner, Issuer, or Custodian to transfer tokens to an address that previously did not hold a given token and disallows the inaccessible address from holding any amount of such token for ancillary recordkeeping purposes.

The BSTX Protocol allows for the ten configurations discussed below.

1. “Cancellations” – stores information about addresses that enables linking of a particular address to a successor address. When a Contract Owner executes the “CancelAndReissue” function, the Cancellations configuration stores the results.
2. “Balances” – stores records of addresses and their associated balances of a given token and is updated upon a transfer of tokens.
3. “Allowed” – stores records of execution of the “Approved” function.¹⁶
4. “Issuer” – when a Contract Owner confers Issuer status upon a given address using the SetIssuer function, this configuration stores information related to execution of such function. For example, Company ABC may be designated as the Issuer of tokens representing a BSTX-listed Security for ancillary recordkeeping purposes and this configuration stores the appropriate address of Company ABC.

¹⁴ See *id.*

¹⁵ See *id.*

¹⁶ Note that the Allowed configuration will be dormant during the initial stages of ancillary recordkeeping functions because the “Allowance” function is disabled. See *supra* note 13.

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5. “IssuingFinished” – when a Contract Owner or Issuer executes a FinishedIssuing function for a given token representing a BSTX-listed Security for ancillary recordkeeping purposes, this configuration is made active and no new issuances of tokens for such Security may occur.
6. “Compliance” – when a Contract Owner employs the SetCompliance function, the Compliance configuration specifies the particular Compliance Smart Contract(s) to which the token (*i.e.*, Asset Smart Contract) must call upon in executing transactions.
7. “Name” – allows a Contract Owner or Issuer to input and store the name of a token. For example, the tokens representing a BSTX-listed Security may be named “Company ABC Preferred Series A1.”
8. “Symbol” – allows a Contract Owner Issuer to input and store the ticker symbol of a token representing a BSTX-listed Security for ancillary recordkeeping purposes.
9. “Decimals” – if enabled, this configuration would allow for fractional interests in tokens. However, the BSTX Exchange does not allow for fractional share interest in tokens.
10. “TotalSupply” – sums the amount of tokens issued through execution of the “IssueTokens” function for a given BSTX-listed Security for ancillary recordkeeping purposes.

The Asset Smart Contract specifies six events. A description of each of these events is below. As noted, the occurrence of an event generates a record on the Ethereum blockchain that is publicly viewable.

1. “Transfer” – this event records the details of the movement of the digital token representation of a BSTX-listed Security from one address to another, as recorded in the ledger of the Asset Smart Contract for purposes of ancillary recordkeeping.
2. “Approval” – this event records successful execution of the Approve function, which is used in conjunction with TransferFrom, which, as noted, will be disabled initially for tokens.
3. “VerifiedAddressSuperseded” – this type of event occurs when a user successfully executes the CancelAndReissue function; a log of the superseded and replacement addresses is created.
4. “IssuerSet” – this type of event occurs upon successful designation of an Issuer of a token corresponding to a BSTX-listed Security; a log of the Issuer’s address is created.¹⁷
5. “Issue” – this type of event occurs whenever an Issuer successfully executes the “IssueTokens” function; a log of the Issuer’s address and amount of tokens issued pursuant to the most recent execution is created.

¹⁷ Note that once an Issuer has been designated such Issuer may perform the tasks discussed herein.

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6. “IssuerFinished” – this event occurs when an Issuer successfully executes the FinishedIssuing function; a log is created noting that new issuance of a given token can no longer occur.

Registry

To facilitate recording an existing state of ownership of Securities on the Ethereum blockchain using tokens as part of the Exchange’s ancillary recordkeeping function, the Protocol requires that the Asset Smart Contract call the Registry Smart Contract that grants certain permissions to different types of market participants, and the Registry stores the list of whitelisted addresses that may transact in tokens. For example, in the event that an address is lost or otherwise compromised, the “CancelAndReissue” functionality would be employed to facilitate the replacement of the lost digital representation of the tokens on the Ethereum blockchain as an ancillary record of ownership, but only certain permissioned market participants may exercise this function.

The Registry designates five different types of market participants under the Protocol, each of which is discussed below along with their respective permissions. The permissions associated with each market participant are organized as a hierarchy from the most permissive (*i.e.*, can perform the most functions) to the least permissive (*i.e.*, can perform the fewest number of functions). Each type of market participant described below is able to confer statuses below their permissioned level to additional addresses, but never above their status (*e.g.*, a Custodian may confer Broker Dealer status to additional addresses, but may not confer Contract Owner status to an address). The different classes of market participants specified by the Registry are as follows:¹⁸

1. “Contract Owner” – only one individual address can be designated for this role for a given issuance of tokens representing a BSTX-listed Security. This role is specified at the time of token deployment. Among other functions, a Contract Owner confers “Issuer”¹⁹ status to an address and adds/removes whitelisted addresses with “Custodian” status.
2. “Custodian” – multiple addresses may be designated as Custodians of tokens representing a BSTX-listed Security. Custodians may add/remove whitelisted addresses of “Broker Dealer” parties (*e.g.*, introducing brokers) and “Investors.” A Custodian may also temporarily suspend Broker Dealers (and one or more of their respective customers) and Investors from transferring the digital token representations of Securities for purposes of updates to the Ethereum blockchain as an ancillary recordkeeping mechanism. Custodian status would generally be assigned to BSTX Participants that act as a carrying broker-dealer on behalf of other broker-dealers.

¹⁸ For a given token representing a BSTX-listed Security, multiple wallet addresses may function as Broker Dealer, including wallet addresses carrying out other roles in the status hierarchy (*e.g.*, a Custodian may also be a Broker Dealer).

¹⁹ As discussed above, while Issuer status confers privileges onto the owner of a designated wallet address, Issuer status is technically not part of the Registry and is instead a token-specific designation.

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3. “Broker Dealer” – represents an address of an introducing broker who can add/remove whitelisted addresses of “Investors” and direct Custodians to transfer digital token representations of Securities to certain whitelisted parties for purposes of the ancillary recordkeeping mechanism. A Broker Dealer may suspend Investors from transferring tokens for purposes of the ancillary recordkeeping mechanism.²⁰
4. “Custodial-Account” – this is a wallet address established by a Custodian to maintain custody of the digital token representation of Securities on behalf of the Broker-Dealer for purposes of the ancillary recordkeeping mechanism. Custodial-Accounts may only transfer and receive the digital token representations of Securities for purposes of the ancillary recordkeeping mechanism.²¹
5. “Investor” – this status generally applies to individual retail investors who may want their own address. This status confers the least amount of rights to an address. An Investor may only transfer digital token representations of Securities to his/her address (*e.g.*, by requesting that a Broker Dealer or Custodian perform this function) and must transfer the digital token representation of the Securities back to a Custodian in order to trade the Securities in a manner that would allow for updates to the Ethereum blockchain as an ancillary recordkeeping mechanism. For a given token representing a BSTX-listed Security, multiple addresses may function as an Investor.

Compliance Smart Contract

The Compliance Smart Contract is a set of rules that are called upon by an Asset Smart Contract in executing a transaction for purposes of the ancillary recordkeeping function depending on how a token is configured. For example, when the digital token representation of a Security (*i.e.*, Asset Smart Contract) is executing a transaction (*e.g.*, an instruction to move tokens from one address to another to reflect a change in record ownership as an ancillary record), the SetCompliance function requires the token to look to the Compliance Smart Contract that was configured for the token and comply with any rules or requirements therein. One such rule is to require that the token look to the Registry to determine if the transaction is with another whitelisted address for purposes of updates to the Ethereum blockchain as an ancillary recordkeeping mechanism. The rules configured in the Compliance Smart Contract can be tailored to each particular token.

The Compliance Smart Contract might also specify additional Compliance Smart Contracts with which the token must comply. As a result, to the extent a token needs to comply with a new rule of some kind, that new rule can be programmed into an additional Compliance

²⁰ A Broker Dealer address will generally not have digital representations (*i.e.*, tokens) of Securities associated with such address for purposes of the Ethereum blockchain ancillary recordkeeping mechanism. However, such an address may be linked to a Custodial-Account address and actions taken by a Broker Dealer (including certain transfers to and from its Custodial-Account address) may be audited and traced back to the individual owner of the Broker dealer address.

²¹ Whereas a Broker Dealer represents a wallet address for an introducing broker, a Custodial-Account represents the account carried by a Custodian on a Broker Dealer’s behalf.

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Smart Contract to which the token must comply when executing. The BSTX Protocol uses the Compliance Smart Contract functionality to allow for changes to the rules and requirements applicable to a token when carrying out functions (such as transfers) with respect to the Ethereum blockchain ancillary recordkeeping mechanism without redeployment of the entire issuance of tokens representing a BSTX-listed Security. In the absence of this structure, adding an additional rule could require a recall and reissuance of the tokens to accommodate new rules.