



Token Taxonomy Initiative (TTI) Summit

TTI Workshop Reference Guide

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Token Base Descriptions

Token Base	Alias	Description
Whole Fungible	Loyalty Point	Whole Fungible tokens have interchangeable value with each other, where any owned sum of them from a class has the same value as another owned sum from the same class. A whole token cannot be sub-divided so it doesn't support the notion of 'making change'.
Fractional Fungible	Virtual Money	Fractional Fungible tokens have interchangeable value with each other, where any owned sum of them from a class has the same value as another owned sum from the same class. Similar to physical cash money, a crypto currency is an example of a fungible token that is divisible.
Unique Whole Fungible	SKU	Unique, Whole Fungible tokens have interchangeable value with each other, where any owned sum of them from a class has the same value as another owned sum from the same class. A whole token cannot be sub-divided, so it doesn't support the notion of 'making change'. Because this token is unique, it will have its own identity and can have unique properties like a serial number. Implementations should support a GetBalance or List for owners to see their balances or tokens they own.
Unique Fractional Non-Fungible	Physical Money	Unique, fractional fungible tokens have interchangeable value with each other, where any owned sum of them from a class has the same value as another owned sum from the same class. Similar to physical cash money, a crypto-currency is an example of a fungible token that is divisible. Because this token is unique, it will have its own identity and can have unique properties like a serial number. Implementations should support a GetBalance or List for owners to see their balances or tokens they own.
Whole Non-Fungible	Title	Every non-fungible token is unique. A non-fungible token is not interchangeable with other tokens of the same class but have some shared properties while also having unique property values between instances. These tokens are whole tokens and can have quantities greater than 1 and also could support variable supply.



Fractional Non-Fungible	Time Share	Every non-fungible token is unique and some will need to allow for fractional ownership. A non-fungible token is not interchangeable with other tokens of the same class as they typically have different values. A property title is a good example of a non-fungible token where the value of different real estate titles is not equal and freely exchanging them is a bad idea. Some Non-fungible tokens will need to be represented with their own class, meaning it will share no common properties with other tokens from the same template. Other non-fungible tokens can exist within the same class and have some shared property values while also having unique property values between instances.
Singleton	Document	A restriction on the token in that there can only be 1 whole token in the class and is not dividable. This behavior is only available to non-fungible base types. By definition, a Singleton cannot be mintable.

Token Base Examples

Token Base	Example
Whole Fungible	An inventory item or SKU, where an item is treated as a whole because it makes no sense to own a fraction of a SKU or loyalty point.
Fractional Fungible	Fiat currency is the most widely understood example of a fractional fungible item. A fractional fungible is divisible, so you can 'make change'.
Unique Whole Fungible	An inventory item or SKU, where an item is treated as a whole, because it makes no sense to own a fraction of a SKU or loyalty point.
Unique Fractional Non-Fungible	Fiat currency is the most widely understood example of a fractional fungible item. A fractional fungible is divisible, so you can 'make change'.
Whole Non-Fungible	CryptoKitties, Art, Reserved Seat for an event.
Fractional Non-Fungible	Membership, Time Share vacation property.
Singleton	CryptoKitties, Art, Reserved Seat for an event.



Token Base Analogies

Token Base	Analogy
Whole Fungible	
Fractional Fungible	Physical Money
Unique Whole Fungible	Loyalty Point
Unique Fractional Non-Fungible	Physical Money
Whole Non-Fungible	Property Title
Fractional Non-Fungible	Time Share
Singleton	Natural Gemstone

Behavior Definitions

Behavior	Symbol	Definition
Attestable	a	A token class that implements this behavior will support a basic attestation request returning a true or false and if true it will return a cryptographic proof the requester may store for future validations. Attestable will accept a simple ownership query to validate that an account is the owner of the token or a attestation proof and validate it.
Burnable	b	A token class that implements this behavior will support the burning or decommissioning of token instances of the class. This does not delete a token, but rather places it in a permanent non-use state. Burning is a one way operation and cannot be reversed. This behavior is Delegable. If the token definition is Delegable, BurnFrom will be available.
Compliant	c	A regulated token needs to comply with several legal requirements, especially KYC and AML. If the necessary checks have to be made off-chain the token transfer becomes centralized. Further the transfer in this case takes longer to complete as it can not be done in one transaction, but requires a second confirmation step. A compliant token fulfills all legal requirements on-chain without interaction from an off-chain entity



Deligable	g	A token class that implements this behavior will support the delegation of certain behaviors to another party or account to invoke them on the behalf of the owner. When applied to a token, behaviors that are Delegable will enable delegated request invocations. This is useful to provide another party to automatically be able to perform the behaviors that can be delegated without seeking permission up to a certain allowance.
Encumberable	e	A token class that implements this behavior will have restrictions preventing certain behaviors like transferable, burnable, etc. from working while it is encumbered. The encumbering party should make a request to encumber, the owner should be notified about the request, and accept the request, which will finalize the encumbrance and send the EncumberResponse message to the requestor.
Fabricate	f	Unique tokens can be fabricated from a base tokenization capability present in the platform being used. Similar to minting or issuing of new token instances, tokens are given a type, which can be a simple string, and a quantity. The result will be a single token of some quantity of the type. You can fabricate multiple tokens in the same issue request to different new owners of the fabricated tokens.",
Holdable	h	Every token instance has an owner. The Transferable behavior provides the owner the ability to transfer the ownership to another party or account. A hold specifies a payer, a payee, a maximum amount, a notary and an expiration time. When the hold is created, the specified token balance from the payer is put on hold. A held balance cannot be transferred until the hold is either executed or released. The hold can only be executed (partially or the full amount) by the notary, which triggers the transfer of the tokens from the payer to the payee. If a hold is released, either by the notary at any time, or by anyone after the expiration, no transfer is carried out and the amount is available again for the payer. This behavior is Delegable. If the token definition is Delegable, HoldFrom will be available.
Issuable	i	This token has a controlling a central party, the issuer, is the only one able to create/transfer/destroy tokens. Other parties can inspect (only their own) holdings, but may not transfer tokens; to do this they need to request the issuer to perform the action using a `RequestTokens` contract.",



Loggable	l	A token class that implements this behavior will record log entries from its owner with a generic payload. These entries can be recorded stand alone and be given a unique identifier, EntryId, upon recording or these entries can be recorded in a series or group that will create a SeriesId and a EntryId, where all the entries will have a unique EntryId but have the same SeriesId. Log entries can be queried by their EntryId or you can request an entire series with the SeriesId. The last recorded entry can also be requested without an Id and you can also request entries from a starting point to a finish point. For example, you could request entries 100 through 125, which will return the entries starting at position 100 through 125 or the last entry recorded up to 125. To add entry query by any other property of the token, that property must be specifically defined and cannot be a property in the base token property list.
Mintable	m	A token class that implements this behavior will support the minting or issuing of new token instances in the class. These new tokens can be minted and belong to the owner or minted to another account. This behavior may be invalidated by a restrictive behavior like Singleton, where only a single instance of the token can exist. Mintable is technically delegable, but it's delegation should be controlled by a behavior like Roles.
Indivisible	~d	An ability or restriction on the token where it cannot be divided from a single whole token into fractions. Sets the base token Decimals property to 0 which will make the token indivisible and a whole token is the smallest ownable unit of the token.
Non-Transferable	~t	Every token instance has an owner. The Non-transferable behavior prevents the owner of a token from changing.
Overdraftable	o	Overdraftable, to grant an overdraft credit limit to a wallet owner, who can then make transfers or create holds without the required (positive) balance. Available balances of these type of tokens can therefore become negative, and they can accrue interest over time that is chargeable by the issuing institution
Pausable	p	Pausable is an influencing behavior that can be applied to other behaviors in the Token. Pausable will have an applies to A token class that implements this behavior will halt trades and free all transfers, handy if there is a bug found in the token implementation.



Redeemable	q	This behavior only applies to unique tokens. Redeemed tokens can no longer be spent. Redeeming a token removes an asset from the business network and guarantees that it can no longer be transferred or changed. You redeem a quantity represented in a token or tokens you own. If the redemption amount is less than the quantity represented in your token submitted, the remaining quantity after redemption is deposited into a new token and returned to you as the owner. For example, if you have a token representing 100 dollars, and want to redeem 50, the redeem transaction will create a new token worth 50 dollars, and transfer another 50 to a restricted account without an owner.
Roles	r	A token can have behaviors that the class will restrict invocations to a select set of parties or accounts that are members of a role or group. This is a generic behavior that can apply to a token many times to represent many role definitions within the template. This behavior will allow you to define what role(s) to create and what behavior(s) to apply the role to in the TemplateDefinition.
Singleton	s	A restriction on the token in that there can only be 1 whole token in the class and is not subdividable. This behavior is only available to non-fungible base types. By definition, a Singleton cannot be mintable.
Divisible	d	An ability for the token to be divided from a single whole token into fractions, which are represented as decimal places. Any value greater than 0 will indicate how many fractions are possible where the smallest fraction is also the smallest ownable unit of the token.
Transferable	t	Every token instance has an owner. The Transferable behavior provides the owner the ability to transfer the ownership to another party or account. This behavior is often inferred by other behaviors that might exist like Redeem, Sell, etc. This behavior is Delegable. If the token definition is Delegable, TransferFrom will be available.
Unique Transferable	u	The unique transferable behavior provides the owner the ability to transfer the ownership to another party or account of one or more unique tokens owned. This behavior and does not transfer the tokens themselves. Rather, new tokens are created by the transfer transaction. Because this behavior works with unique tokens, the invocation request can take multiple tokens as inputs to be transferred. The quantity of the assets being transferred to the recipients of the transaction needs to be the same quantity as the



		<p>input tokens. If you do not want to transfer the entire quantity of the asset represented by the token, you can transfer a portion of the asset and the transaction will automatically make you the owner of the remaining balance. Using the example above, if only you spend 50 dollars of the 100 dollar token, the transfer transaction will automatically create a new token worth 50 dollars with you as the owner. All input tokens of the transaction need to be of the same type and the tokens being transferred need to belong to the transaction initiator and are unspent.</p>
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Behavior Examples

Symbol	Example
a	Certain tokens will want to prove something like ownership or validation of an issued proof from the token for applications wanting to check attestations.
b	When a token is used in a certain way, you may want to remove it from circulation or from being used again. Since the ledger doesn't allow for deletions, burning a token essentially 'deletes' the token from being used, but not from history.
c	When doing a bank transfer the transaction is checked by the involved banks according to legal requirements. A compliant token can
g	-
e	For example, a property title's owner may have obtained a loan from a bank to purchase the property. The loan represents a contract between the owner of the property and the bank, this loan encumbers the property title preventing the owner from being able to sell the property, transferable, to another party until the loan is paid off. Paying off the loan will remove the encumber, which will allow transferable to be invoked.
f	Fabricated tokens have a type and quantity, like a check or IOU, a single token can represent a distinct quantity of a value identified by its type.
h	When checking in a hotel, the hotel will put a hold on the guest's account to ensure that enough balance is available to pay for the room before handing over the keys.
i	A private issued stock which is not listed on any exchange may require the owner's permission to sell shares issued to the seller.
l	You may want to record certain actions like validations or external uses of a token or asset into a token log.



m	A consortium of oil producers needs to create tokens for each barrel of oil they are putting on the market to trade. There are separate classes of tokens for each grade of oil. Producers of barrels will need to have the ability to mint new tokens in order to facilitate the trading of them in the supply chain.
~d	Indivisible is common for items where division does not make sense, like a property title, inventory item or invoice.
~t	A vote token, for a citizen in a public election would be non-transferable.
o	-
p	There may be a run or a crash in the market that may require the halting of trades for this token. This is like the big red button.
q	If an item in a supply chain reaches its final destination, or a financial asset reaches its term, the token representing the asset can be redeemed since the asset no longer needs to be used.
r	
s	
d	Divisible is common for crypto-currencies or tokens of fiat currency. For example, the US Dollar is divisible to 2 decimal places, where a value like .42 is possible. Bitcoin, is divisible up to 8 decimal places
t	
u	For example, if you own a token that is worth 100 dollars, you can spend 50 dollars using that token. The transfer transaction will create two new tokens as output. One token worth 50 dollars will belong to you, and another token worth 50 dollars will belong to the recipient.

Behavior Analogies

Symbol	Alias	Analogy	Analogy Description
a	Provable	Diploma	Check to see if an account is the owner or holder of a diploma token. This can be done by the Account Id or a stored attestation issued by the Diploma Token.
b	Retire	Oil Barrels	If you mint a new token for each barrel of oil created, you may transfer ownership several times until the barrel is refined. The refining process should burn the barrel of oil to remove it from circulation.
	Redeem	Redeem	A token that is a coupon or single use ticket, should be burned when it is redeemed.
c			



g	Allow	Broker	You may allow a broker to transfer your tokens as a part of an investment strategy. Setting an allowance can cap the total number of tokens the broker is allowed to perform delegated behaviors, when exceeded a new allowance request will need to be granted.
e	Restricted or Supervised	Loan	A token can represent an asset that the owner took out a loan to obtain. If so, the token will need to be encumbered by the loan contract preventing the owner from selling the asset until the loan is repaid.
f	Issue or Mint	Writing a Check	Like writing a check, the amount of the check is like the quantity on a token and the denomination is like the type of token.
h		Escrow	Holds are similar to escrows in that they are firm and lead to final settlement.
i	Central Party Control	Shares	A private issue stock share...
l	Event Recorder	Media Use	You may create a token for a video or song and want to log each time it is played or viewed.
	Audit	Audit Log	You may want to create a token for auditing external events, like a access control log that record what user access some resource. Access to the resource can be blocked if the log token is unable to record the access.
m	Create	SKU	A token class can represent a particular item SKU, where the manufacturer of the item has the ability to mint or issue new inventory of the SKU into the supply chain.
~d	Whole	Non-Fractional	It is not possible to own a fraction of this token.
		Barrel of Oil	Barrels of Oil don't make sense to divide.
~t		Diploma	A diploma from an educational institution is not transferable to another party that can claim to have earned the diploma.
		Airline Ticket	Due to security restrictions at airports and airlines, tickets can only be used by the person they were issued to.
o	Not Bounce		Example1
p	Halt Trading	Bug in Code	You may discover a bug in your token implementation that requires you to halt the trading until you can fix the code.
	Freeze		



q	Burn	Oil Barrels	If you receive a token for each barrel of oil as a refiner , you will redeem the barrel when it is refined to remove it from circulation.
	Retire	Admission Ticket	A token that is a coupon or single use ticket, should be marked or torn when it is redeemed so it cannot be used again.
r	Groups	Minters	A role called 'Minters' for a token can have accounts in the role. The MintTo behavior invocation will be bound to the role check to ensure only account in the 'Minters' role are allowed to mint new instances in the class.
s	Unique or One & Only	Analogy 1	singleton analogy 1 description
d	Alias 1	Analogy 1	Divisible analogy 1 description
	Alias 2	-	-
t		Analogy 1	transferable analogy 1 description

Token Classifications

Class	Variation	Definition
Token Unit	Fractional	Fractional – you can make change like a \$1 dollar bill can be broken into 4 .25¢ coins, but you cannot subdivide past 2 decimal places or have a .249999¢.
	Whole	Whole – no subdivision allowed just whole numbers
	Singleton	Singleton – no subdivision and a quantity of 1
Value Type	Intrinsic Value	Where the digital token itself is valuable.
	Reference Value	Where the token represents a physical item like a car or house, or ‘stored elsewhere’ digital item like a photo, scanned document or bank balance.
Representation Type	Common Token	Common tokens are balances on a single distributed ledger, tokens do not have individual identities. Like the balance in a checking account.
	Unique Token	Unique tokens have their own identities, usually called an unspent transaction output or UTXO, that can have individual properties like a serial number. Like physical money in your pocket, each bill has a unique serial number.
Template Type	Hybrid	A hybrid token has a single parent token of a classification and can have many child tokens, that ‘belong’ or are ‘controlled’ by the parent. But like real children, hybrids can have unique abilities to model almost any business use case.
	Single	A single token does not have any children.



TTF Formulas & Templates

Token Formulas	Token Name
tF{~d,t,g,SC}	Loyalty
	EEA-Reward
tF{~d,t,g,SC}+phSKU	Bond
tF{~d,f,u,r,e}	EEA-Penalty
	FabToken
tF{~d,~t,SC}	EEA-Reputation
tF{d,t,g,h,c,SC}	Emoney
tF{~d,t,g,SC}+phSKU]	Inventory
tF{~d,t,i}	Issuance
tN{s,~t,a}	License-Diploma
tN{s,t}	Natural-Gemstone
	Original Art
tN{~d,t,g,SC}	Reserved Ticket
tN{~d,t,s,e,b}+phFile	Document