Algorithm 1 The challenger for the burn protocol game-based security.

1: function spend-attrack, $\pi(\kappa)$ 2: $(t, m, \sigma, pk) \leftarrow A(1^n)$ 2: return (sum/verify(1^n, t, pk) \land Spend/verify(m, σ, pk))

4: end function

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be produced using the respective secret key. new transaction m, together with a signature σ , which signs m and should the public key pk, which is the address spending money incoming to the received from the network, the blockchain node calls SpendVerify, passing corresponds to transaction data. When a new candidate transaction is we intentionally leave it undefined. In both Bitcoin and Ethereum, mthe inability to spend. As the format of m is cryptocurrency-specific, signing algorithm is irrelevant for our burn purposes, as burning entails signature scheme and accompanied by a respective signing algorithm. The These two functionalities are typically implemented using a public key Resident Ing ?

game SPEND-ATTACK is illustrated in Algorithm 1. from, we introduce a game-based security definition. The unspendability To state that the protocol generates addresses which cannot be spent

with respect to a blockchain address protocol Π_{α} if for all probabilistic polynomial-time adversaries A there exists a negligible function $neg(\kappa)$ Definition 4 (Unspendability). A burn protocol II is unspendable $such that \Pr[SPEND-ATTACK_{A,\Pi}(\kappa) = true] \le negl(\kappa).$

rithm 2 captures this property. only evaluate to true for a single tag t. The game BIND-ATTACK in Algocretely, given a burn address burnAddr, BurnVerify $(1^{\kappa}, t, burnAddr)$ should It is desired that a burn address encodes one and only one tag. Con-

Definition 5 (Binding). A burn protocol II is binding if for all probabilistic polynomial-time adversaries A there is a negligible function negl(s) such that $\Pr[BIND-ATTACK_{\mathcal{A},\Pi}(\kappa)] \leq negl(\kappa)$.

> Retrie to Prove We note here that the correctness and binding properties of a burn protocol are irrespective of the blockchain address protocol it was designed for.

We are now ready to define what constitutes a secure proof-of-burn

and binding with respect to Π_{α} . **Definition 6 (Security).** Let Π be a correct burn protocol. We say Π is secure with respect to a blockchain address protocol Π_{α} if it is unspendable

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tag is revealed, correctness mandates that the burn transaction becomes a burn transaction prior to revealing the tag. Naturally, as soon as the network, only the user who performed the burn knows that it constitutes which satisfy this property, when the burn transaction appears on the regular address if its tag is not known. During the execution of protocols a property which mandates that a burn address is indistinguishable from a to censor burn transactions. To mitigate this, we propose uncensorability address. While this is desirable in certain circumstances, it allows miners We observe that it may be possible to detect whether an address is a burn The aforementioned properties form a good basis for a burn protocol

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Definition 7 (Uncensorability). Let \mathcal{T} be a distribution of tags. A burn protocol Π is uncensorable if the distribution ensembles $\{(pk, sk) \leftarrow \text{GenAddr}(1^\kappa); pk\}_\kappa$ and $\{t \leftarrow \mathcal{T}; pk \leftarrow \text{GenBurnAddr}(1^\kappa, t); pk\}_\kappa$ are computationally indistinguishable.

Construction

We now present our construction for an uncensorable proof-of-burn protocol. To generate a burn address, the tag t is hashed and a perturbation is performed on the hash by toggling the last bit. Verifying a burn address burnAddr encodes a certain tag t is achieved by invoking GenBurnin Algorithm 3. matches, the burnAddr correctly encodes t. Our construction is illustrated Addr with tag t and checking whether the result matches burnAddr. If it

learn low 2 Key Hash (P2PKH) [2], with respect to which we prove our construction secure and uncensorable in Section 5. It is parametrized by a secure construction which includes the concrete hash functions and checksums signature scheme S and a hash function H (for completeness, we give a We outline the blockchain address protocol for Bitcoin Pay to Public

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