

The state of cross-chain crime

Countering the new age of
crypto crime and money laundering in
a cross-chain world

Executive Summary	03
Introduction	04
The Cross-chain Problem	05
Cross-chain Sanctions Risks	06
About this Report	08
01. Decentralized Exchanges (DEXs)	09
What is a DEX?	10
Dex Aggregators	11
Criminal use of DEXs	11
Swapping Tokens to Non-freezable Assets	12
Swapping Tokens For Mixing	14
Swapping Tokens to Bridge Them to Other Blockchains	14
Analyzing Illicit Token Flows	15
Summary of DEXs	18
02. Cross-chain Bridges	19
What is a Cross-chain Bridge?	20
Criminal Use of Cross-chain Bridges	21
Bitcoin-based Crime	22
Illicit Bridge Use on Other Chains	25
Summary of Cross-chain Bridges	27

03. Coin Swap Services	28
What is a Coin Swap Service?	29
Licit versus Illicit Coin Swap Services	30
Sanctions risks	32
Criminal Use of Coin Swap Services	21
Bitcoin-based Crime	22
Illicit Coin Swap usage in Other Cryptoassets	25
Terrorist Financing	25
04. Solving the “Cross-chain Problem” with Holistic Screening	41
VASPs and Legacy Blockchain	42
Multi-asset Screening	45
Cross-asset Tracing	46
Cross-chain Tracing	47
Conclusion	48
Methodology	49
Glossary	50
Notes & Citations	54
About the Authors	56
Other Reports by Elliptic	57

Executive Summary

Blockchains have become increasingly interconnected in recent years. New technologies such as decentralized exchanges (DEXs) and cross-chain bridges have removed many of the barriers to the free flow of capital between cryptoassets. However, these technologies are also being abused for money laundering by the likes of ransomware groups and hackers, who are moving billions of dollars in crypto between assets and blockchains anonymously to obfuscate their illicit financial flows.

To determine the nature and scale of this activity, Elliptic has conducted research into the criminal exploitation of three types of service that can commonly be used anonymously to facilitate cross-chain activity. These are decentralized exchanges (DEXs), cross-chain bridges and coin swap services.

Our main findings include the following:

- Criminals and high risk entities have used DEXs, cross-chain bridges and coin swap services to obfuscate at least \$4 billion-worth of illicit crypto proceeds. Some of the most prolific perpetrators include hackers, dark web markets, online gambling platforms, illicit virtual asset services, ponzi schemes and ransomware.
- Some \$1.2 billion of stolen crypto from DeFi or exchange thefts have been swapped using DEXs, which is over a third of all crypto stolen from the incidents surveyed.
- RenBridge – a cross-chain bridge that allows users to swap assets across different blockchains – has laundered over \$540 million in illicit cryptoassets alone.
- A further \$1.2 billion in illicit assets have been laundered using “coin swap” services, which allow users to swap assets both within and across blockchains without opening an account. Many are advertised on Russian cybercrime forums and cater almost exclusively to a criminal audience.
- There is a growing risk of cross-chain and cross-asset obfuscation from sanctioned, seized and terrorist entities. Wallets connected to groups eventually sanctioned by the United States – including those used by North Korea to perpetrate multi-million-dollar cyberattacks – have laundered more than \$1.8 billion through such techniques.

These findings highlight the rise of the “cross-chain problem” – an issue prevalent across the crypto space that poses key risks for virtual asset services and criminal investigators. Criminals are now increasingly leveraging cross-asset and cross-chain transactions to evade legacy blockchain analytics solutions, which are not designed to trace such activity. The Financial Action Task Force (FATF) also called-out money laundering through cross-chain transactions – or “chain hopping” – in its June 2022 report on virtual asset risks.¹

This report will draw on case studies and original data to address the criminal use of decentralized exchanges, cross-chain bridges and coin swap services. It will then introduce Elliptic's Holistic Screening capabilities – designed for virtual asset services and investigators to effectively trace through and overcome the risks of cross-asset and cross-chain crime.

Introduction

The early history of crypto crime is dominated by mostly Bitcoin-based thefts and dark web markets. Ranging from the \$530 million Mt Gox exchange heist to the notorious Silk Road marketplace, illicit actors of the early 2010s largely targeted the dominant cryptoasset of the time – Bitcoin – to both enrich themselves and launder their criminal proceeds.

Fast forward over a decade, and the way threat actors engage with cryptoassets has changed dramatically. Thousands of new tokens – often powering different decentralized finance (DeFi) protocols, metaverses or blockchain-based games – have been built on blockchains such as Ethereum, Binance Smart Chain, Polygon and Solana. Examples include NFTs, memecoins and stablecoins such as Tether. Concurrently, many projects have developed new blockchains entirely – such as Cardano and Dogecoin – which have amassed huge user bases of their own.

For criminals, this expansion of blockchain technology poses many opportunities for criminality. Crypto thefts from DeFi protocols exceeded \$2 billion in 2021,² with an average of one protocol being exploited every three days.³ Dark web entities now take payments in multiple currencies, while terrorist organizations often advertise donation addresses for numerous cryptoassets.

As opportunities for criminality have risen, so too have the available strategies for criminals to launder their illicit crypto. For example, criminals use decentralized exchanges (DEXs) to convert between illicitly-acquired tokens on the same blockchain for onward laundering. Alternatively, cross-chain bridges are being used to “bridge” illicit assets on one blockchain to a different blockchain entirely – a practice known as “chain hopping”. Both strategies serve to obfuscate transaction trails and make investigations more difficult.

Money laundering across assets has also become attractive for criminals due to the growing anti-money laundering/know-your-customer (AML/KYC) regulations placed on traditional exchanges. As more virtual asset services adopt these checks, criminals have increasingly been drawn to unregulated and anonymous alternatives to process their illicit crypto. These include “coin swap” services, where users are not required to open an account or verify their identity to exchange assets. Much like DEXs and bridges, because these “coin swap” services typically do not require identity verification checks, they pose a third major point of risk.

The potential to obfuscate illicit funds from legacy blockchain analytics – which historically have been limited to tracing transactions in only one asset at a time – is not the only driver of cross-chain or cross-asset crime. Criminals also leverage these abilities to access services on other blockchains, for example to invest in DeFi protocols or NFTs on Ethereum using illicit funds originating in Bitcoin.

All virtual asset services are therefore at risk of what is known as the “cross-chain problem”. With the first generation of legacy blockchain analytics tools, a virtual asset service would lose sight of illicit funds after a criminal has converted them to a different token or bridged them to a different blockchain. Following these funds across tokens or blockchains would require time-consuming manual investigation – and in many cases would prove unsuccessful or unfeasible.

The Cross-chain Problem

The increasingly interconnected nature of crypto is a major boost and an integral part of the industry overall. However, to harness the potential of seamless exchanges across blockchains and assets, the cross-chain problem must be managed and mitigated in the face of growing regulatory scrutiny.

To summarize, cross-chain and cross-asset swaps are made possible by three main types of virtual asset services besides centralized exchanges, which will be discussed throughout this report in more detail. These are:

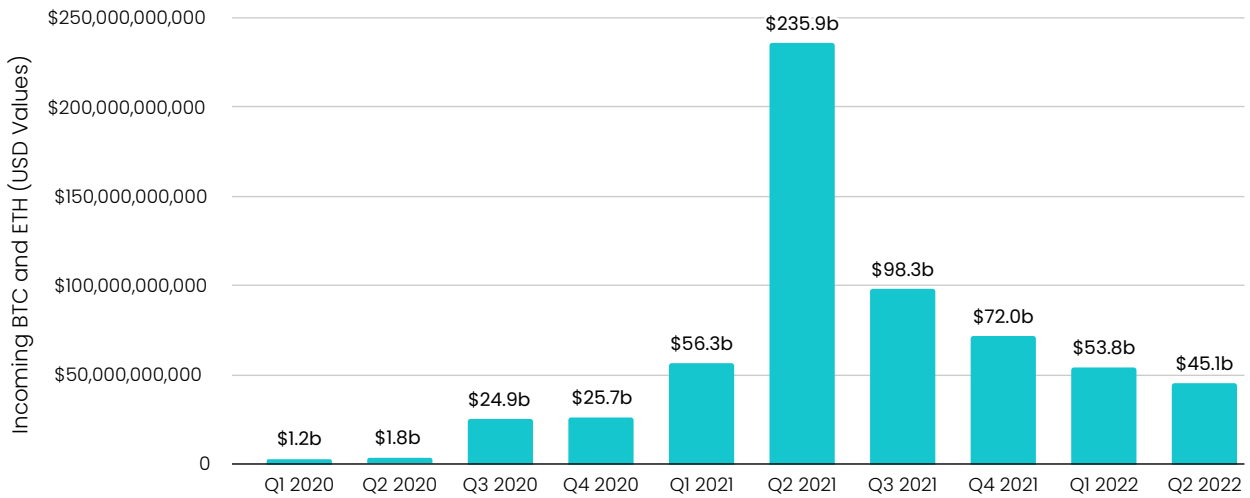
1. **DEXs:** decentralized services – often running on smart contracts – that allow cross-asset swaps on the same blockchain.
2. **Cross-chain bridges:** services that are typically decentralized that allow cross-chain swaps across assets on different blockchain platforms.
3. **Coin swap services:** centralized and typically anonymous services that allow exchanges between different assets without the need to create an account or submit identity verification. Many are based in Russia and cater to a cybercriminal audience.

The use of these services is overwhelmingly legitimate – allowing traders, gamers, investors and others to seamlessly move funds both within and across blockchains efficiently. As the number of available tokens, blockchains and DeFi investment opportunities have increased, the use of DEXs, bridges and coin swap services has grown substantially – processing \$615 billion of Bitcoin and Ether since 2020. The below chart shows the USD values of BTC and ETH swapped across both chains and assets through these services over time (note that these values are affected by fluctuations in crypto prices).

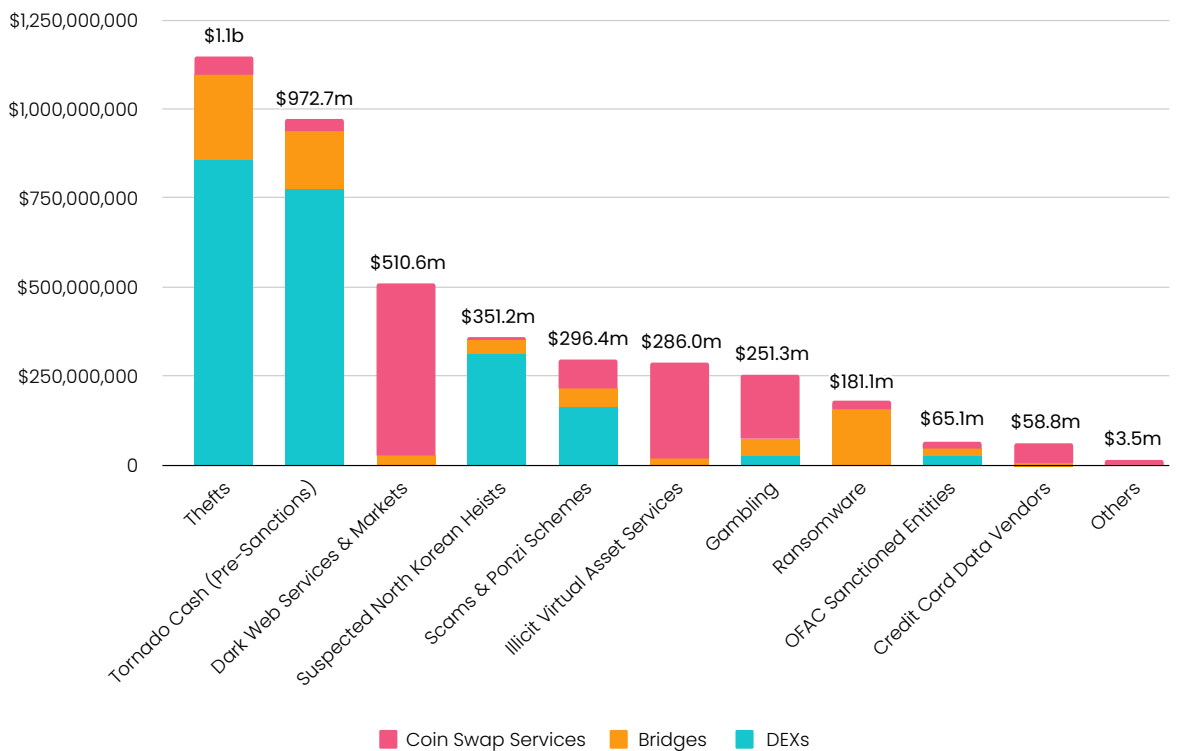
The lack of AML/KYC checks employed by these platforms for the most part means that criminals face little resistance when using them for malicious purposes. Over \$4.1 billion of illicit and high risk cryptoassets have been processed by these services.

It is not just traditional cybercriminals who are leveraging cross-chain or cross-asset opportunities for illicit purposes. Elliptic’s August 2022 report into NFTs and Financial Crime has identified that NFT scammers also use DEXs, coin swap services and cross-chain bridges to obfuscate their proceeds. Of a sample of \$69.5 million in stolen NFT proceeds originating from over 320 scam incidents, 8.3% (\$5.6 million) was laundered through decentralized exchanges.⁴

BTC and ETH Swapped Across Assets and Across Blockchains Since 2020



Illicit and High Risk Crypto Laundered Through DEXs, Cross-chain Bridges and Coin Swap Services by Origin



Cross-chain Sanctions Risks

Entities sanctioned or eventually sanctioned by the United States constitute approximately \$1.5 billion of illicit cryptoassets being processed by DEXs, cross-chain bridges or coin swap services. Nearly two-thirds of this figure (\$972 million) originates from Tornado Cash. Other prominent sources include illicit sanctioned exchanges such as SUEX, Chatex, Garantex, dark web marketplace Hydra and North Korea's Lazarus Group state cyberhackers.

In addition, DEXs, bridges and coin swap services have also processed over \$351 million worth of funds stolen during crypto heists suspected to have been orchestrated by the Lazarus Group. This means that, in total, over \$1.8 billion of cryptoassets being processed by these services are potentially associated with entities sanctioned by the United States. This is just under half of the overall \$4.1 billion originating from illicit or high risk origins that have been processed by these services.

To emphasize the risks associated with DEXs and cross-chain bridges, the below case study presents one of the most notorious crypto heists of all time – the \$540 million theft by the Lazarus Group in March 2022, which led to multiple new sanctions against North Korea and two other cryptoasset services by the United States.



Use of a DEX and Bridge by the \$540 Million Ronin Heist

Ronin is a cross-chain bridge used to access the popular *Axie Infinity* blockchain game, which operates on a sidechain to Ethereum in order to speed up transactions. However, the drive to improve transaction speeds made Ronin an effectively-centralized chain, making it susceptible to hostile social engineering attacks.

North Korea's Lazarus Group – which has previously been linked to several crypto-based heists – managed to take control of a majority of the bridge's transaction validators through phishing their controllers using fake job adverts. On March 23rd 2022, the attackers stole over 138,600 ETH and 25.5 million USDC – worth over \$540 million at the time.

The attackers first swapped the USDC to ETH using two decentralized exchanges. They then began laundering the funds through a popular Ethereum-based Mixer named Tornado Cash. On May 6th 2022, the US Treasury announced that it had identified \$20.5 million of these funds then being bridged via a cross-chain bridge to the Bitcoin blockchain, where they were mixed using Blender.io – a Bitcoin-based mixer.⁵

The US sanctioned Blender.io in May and eventually Tornado Cash in August 2022 for its part in laundering North Korea's stolen crypto.

The Ronin heist case exemplifies that cross-chain and cross-asset movements of illicit funds bring with it notable sanctions risks. The United States Office for Foreign Asset Control (OFAC) – an entity linked to the Treasury – has included more than 400 crypto wallets on its sanctions list associated with sanctioned entities.

However, OFAC has also clarified that this list is not exhaustive.⁶ Virtual asset services have the responsibility to ensure that any crypto wallet they engage with is not linked to sanctioned entities, regardless of whether the wallet itself appears on a sanctions list. If a sanctioned entity holds cryptoassets across multiple blockchains, the ability to confirm such associations becomes difficult – particularly with legacy blockchain analytics solutions that do not support automated and programmatic cross-chain tracing capabilities.

There is an evident need to comprehensively understand, consider and mitigate the risks of cross-chain and cross-asset crime as the crypto ecosystem becomes increasingly interconnected. This report aims to bring to light these trends, risks and next-generation solutions to the cross-chain problem.

About This Report

Much like the case of Ronin above, the report will provide insights into the criminal use of (1) DEXs, (2) cross-chain bridges and (3) coin swap services through proprietary data and case study examples. Case study examples will draw on the most striking and high-risk trends observed – including sanctioned entities, ransomware, DeFi exploits and terrorist financing.

The next sections will also discuss how functionalities offered by cross-chain and cross-asset services are leveraged by different types of criminal and serve different purposes and use cases throughout money laundering schemes. In addition, it will emphasize how enforcement actions – such as the sanctioning of Tornado Cash – will likely result in criminals increasingly using chain hopping and cross-asset swaps as alternative money laundering methods.

The report will conclude with an introduction to holistic screening – the next generation of blockchain analytics – that can trace through cross-asset and cross-chain illicit activity. These capabilities empower virtual asset services to identify, understand and mitigate the risks researched and presented throughout this report. Customers of Elliptic will be able to use the insights provided in this report when using our blockchain analytics platform to monitor and mitigate these risks.

Look out for the following information contained within this report – designed to equip investigators with the latest holistic tracing capabilities required in this new age of cross-chain crime:



Red Flags & Warning Signals

Warnings describe significant issues and trends in criminal behavior that are worth highlighting and can indicate suspicious activity, while red flags are indicators of risk that might not clearly pinpoint illicit activity as a standalone.



Diagrams and Flowcharts

Illustrations, diagrams, graphs and charts are included throughout to help you visualize a typology and, where possible, give a relative view.



Case Studies

Wherever possible, real-life examples of how criminals are exploiting the typologies Elliptic has examined are included to evidence how the typology is played out.



Elliptic Blockchain Analytics

A spotlight into the next-generation blockchain analytics Holistic Screening tools we use to detect, study and prevent cross-asset and cross-chain financial crime.

→ 01.

Decentralized Exchanges (DEXs)

What is a DEX?

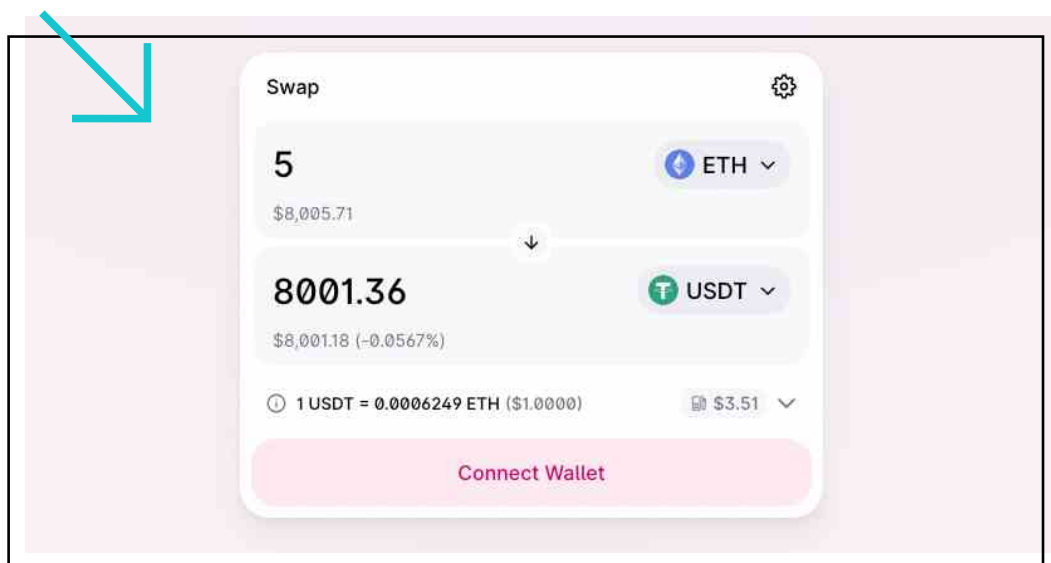
Decentralized exchanges (DEXs) are decentralized applications (dApps) running as smart contracts on blockchains like Ethereum. These smart contracts provide a peer-to-peer exchange mechanism that allows users to trade tokens without relying on an intermediary. The terms of the trade are defined and automatically executed by code, as well as being recorded on the blockchain. Unlike bridges, their exchange capabilities only extend to assets on the same blockchain.

DEXs are also referenced as automated market makers (AMMs), referring to their ability to automatically execute buy and sell orders on their platform using smart contracts.

This is in stark contrast to centralized exchanges (CEXs), which control the security, pricing and execution of trades as well as taking custody of assets being traded during the transaction. DEXs are therefore considered to be safer, as users always retain custody of assets being traded, however they cannot offer trading with fiat, which CEXs do.

The biggest DEX currently operating on the Ethereum blockchain is Uniswap, which was established in November 2018. In May 2022, it released a paper stating that for popular ETH/USD and ETH/BTC trading pairs, it had between 2 to 4.5 times the liquidity of the largest CEXs in the sample period spanning June 2021 to March 2022.⁷ As of August 2022, Uniswap offered 586 trading pairs and daily trading volumes exceeding \$1 billion.

The decentralized nature of the protocol means that anyone can create a trading pair by providing liquidity to a pool. Uniswap is completely open source and has spawned a number of clones on Ethereum – as well as on Ethereum Virtual Machine (EVM) compatible sidechains and layer-two solutions.



The Uniswap DEX user interface.

DEX Aggregators

DEX aggregators are smart contracts that use algorithms to search every DEX for the best price – thereby optimizing trading for users. When using an aggregator, a trade is often split across multiple DEXs, offering the best available rate to the user. The individual will interact with the aggregator contract, which will then optimize the trading using liquidity across different DEXs, execute any trades and return the swapped tokens to the original user.

Criminal Use of DEXs

Elliptic's internal analysis attributes the criminal use of DEXs to predominantly the following blockchain activities:

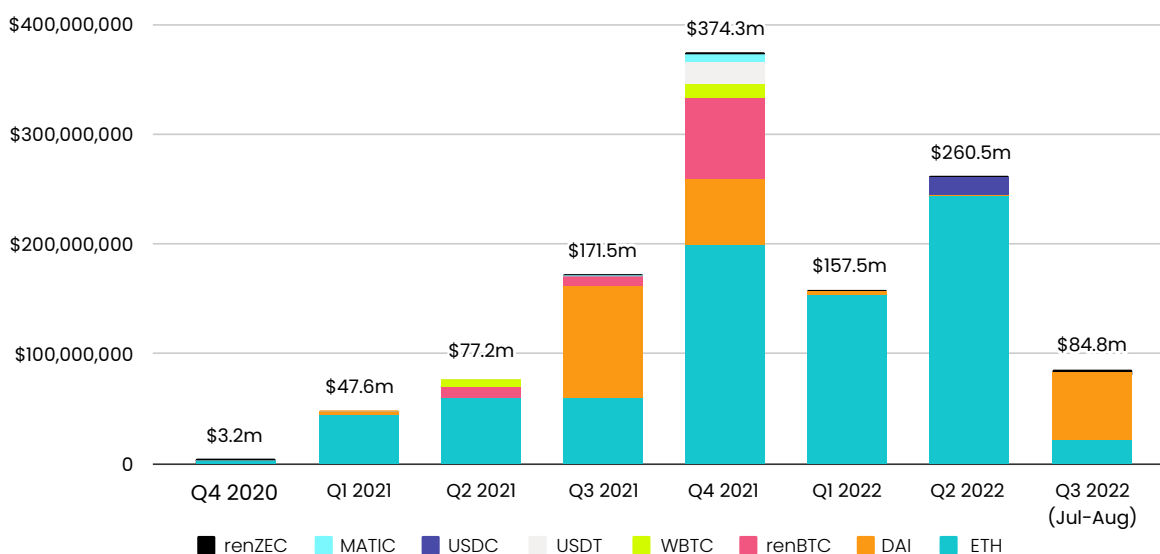
1. Swapping tokens to avoid asset freezes: certain cryptoassets can be frozen by their issuers if found to be held by illicit wallets. Criminals therefore use DEXs to swap freezable assets to unfreezable ones such as ETH or DAI – an unfreezable stablecoin.
2. Swapping tokens for ETH: typically in preparation for sending through Tornado Cash. This was a particularly prominent use case before Tornado Cash was sanctioned by the United States.
3. Swapping tokens in preparation to bridge to other blockchains: for example, assets can be swapped to renBTC – a wrapped version of BTC on Ethereum which can then be bridged across to the Bitcoin blockchain using RenBridge. The Bitcoin blockchain has a multitude of mixers and other obfuscation services available that may become increasingly attractive alternatives to criminals after the sanctioning of Tornado Cash.

The use of DEXs by criminals is closely associated with exploits in the DeFi space and hacks of centralized exchanges. Across approximately \$3.3 billion of funds stolen through such crimes across over 80 incidents since late 2020, more than a third (\$1.18 billion) were swapped to other tokens through DEXs.

There is often a sense of urgency for criminals when using DEXs, especially if they are in possession of freezable assets that can be frozen at any moment. DeFi exploits often also result in the theft of protocol-specific tokens, such as the governance token of the victimized DeFi service. Such tokens can rapidly fall in price after an exploit becomes known, as users of the DeFi protocol typically bulk-sell their tokens as they lose confidence. Exploiters may also find themselves holding a large chunk of all tokens available following a theft – affecting liquidity, supply and demand and therefore the token price. As a result, they typically aim to swap these tokens for assets with higher trading volumes – such as ETH – as quickly as possible to avoid losing funds in the impending token price slump.

Analysis of DEX use by DeFi or exchange exploiters over time emphasizes that ETH, renBTC and DAI are the three most popular assets that DEXs are used to obtain. The next three sections elaborate on the three main criminal use cases of DEXs.

Stolen Asset Value Swapped through DEXs After Crypto Thefts by Quarter-year



Assets shown are assets post-conversion through a DEX. Figures include Ethereum-based thefts or proceeds of thefts initially bridged to Ethereum.

Swapping Tokens to Non-freezable Assets

Issuers of stablecoins such as Tether (USDT) and USD Coin (USDC) have capabilities encoded into their smart contracts to freeze funds held in their assets. This capability is typically deployed to freeze sanctioned addresses or known criminals.

This is exactly what happened with the \$33.4 million USDT stolen by the PolyNetwork exploiter, with Tether ultimately refunding the PolyNetwork from its own treasury.⁸ Prior to this, Tether had hit the news when it froze 20 million USDT stolen from the KuCoin exchange in September 2020.⁹

Elliptic’s internal analysis indicates that criminals stealing USDT or USDC typically swap these assets to decentralized stablecoins such as DAI to evade the risk of their proceeds being frozen. Unsurprisingly, the majority of exploiters swap any stolen USDT in minutes, rather than hours, for example:

- AscendEX Exploit (December 2021): the exploiter took 50 minutes to swap \$4.5 million USDT and nine minutes to swap a further \$1 million – all through Curve.fi.
- Qubit Finance Exploit (January 2022): it took the Qubit exploiter less than three minutes from bridging \$20 million USDT to swapping them for ETH using Curve.fi and Uniswap.
- Fortress Protocol Exploit (May 2022): the exploiter took less than four minutes from bridging \$3 million USDT to swapping them into DAI and ETH on Uniswap.

Of the exploiters stealing freezable assets in the DeFi incidents surveyed, only two did not conduct near-immediate swaps into unfreezable assets:

- **EasyFi Exploit** (April 2021): the exploiter bridged \$1.85 million in USDT from Polygon, which were swapped ten hours later using the linch DEX aggregator
- **Spartan Protocol Exploit** (May 2021): the criminal stole \$0.42 million in USDT, \$93,000 of which were immediately sent to the coin swap service FixedFloat. However, the remainder was swapped using SushiSwap a full 76 days later.

Two illicit use cases of DAI are provided in the case study below.



Swapping Tokens into Decentralized Stablecoin DAI

In August 2022, the Nomad Bridge smart contract was drained after several criminals duplicated illicit transactions that exploited a vulnerability – taking a total of over \$156 million. One of the attackers stole approximately 38.7 million USDC, which was converted into a near-equivalent amount of DAI using a DEX.

More rarely, hackers may convert assets into DAI to be sent through Tornado Cash. For example, an exploiter of the DeFi lending platform Fortress Protocol in May 2022 converted approximately 400,000 USDT into an equivalent amount of DAI using a DEX. The funds were then sent through Tornado Cash.

The DAI contract of Tornado Cash showed comparatively low levels of usage prior to being sanctioned on August 8th 2022. This lack of widespread use lowered the anonymity of DAI-based mixing – making it a less attractive use case for money laundering schemes.



The Nomad Bridge began minting “white hat NFTs” as prizes for exploiters returning funds.¹⁰

Swapping Tokens For Mixing

This use case was particularly prominent prior to the sanctioning of Tornado Cash on August 8th 2022. As the most popular decentralized mixer on Ethereum prior to US sanctions, Tornado Cash laundered \$1.54 billion in confirmed illicit proceeds – \$1.04 billion originating from thefts.¹¹

As the ETH contract of Tornado Cash had the largest volume during the mixer’s operation, ETH was the preferred asset for launderers seeing maximum obfuscation through the use of Tornado Cash. Many therefore used DEXs to swap their stolen assets to ETH for mixing.



The RARI Capital Exploiter – Preparing Stolen Funds For Tornado Cash

On April 30th 2022, an exploiter managed to steal over \$80 million from RARI Capital – a DeFi investment protocol. Several investment pools were attacked through a “re-entrancy attack”, draining funds including LUSD, FEI, DAI, UST, USDC, FRAX, USDT and RAI. A re-entrancy attack occurs when a malicious smart contract makes repeated withdrawals from a protocol’s contract before the contract can update its balance. This allows the attacker to withdraw the same funds multiple times.

These assets were exchanged for approximately 22,035 ETH – totalling \$60 million at the time – using two DEX aggregators (Paraswap & CoW Protocol). The ETH was then sent to Tornado Cash.

 Rari Capital Retweeted



Fei Protocol @feiprotocol · Apr 30

We are aware of an exploit on various Rari Fuse pools. We have identified the root cause and paused all borrowing to mitigate further damage.

To the exploiter, please accept a \$10m bounty and no questions asked if you return the remaining user funds.

 162

 567

 1,225



Fei Protocol – which merged with RARI in December 2021 – tweets about the exploit.¹²

Swapping Tokens to Bridge Them to Other Blockchains

A cross-chain bridge is an often-decentralized virtual asset service that allows users to convert their assets on one blockchain to one on another. More information on bridges – including how they operate and their criminal use cases – is available in the next chapter.

The use of bridges often coincides with DEXs, as criminals frequently need to swap tokens within blockchains first before they become convertible on bridges. This can be due to the absence or costly nature of a certain trading pair, making direct chain-hopping less feasible or impossible due to the lack of an available liquidity pool.



Swapping Tokens into renBTC to Bridge into Bitcoin

In September 2021, an exploiter identified flaws on the smart contracts of VEE Finance – a DeFi lending protocol on the Avalanche blockchain. The attacker was able to exploit these vulnerabilities to steal \$34 million worth of assets.

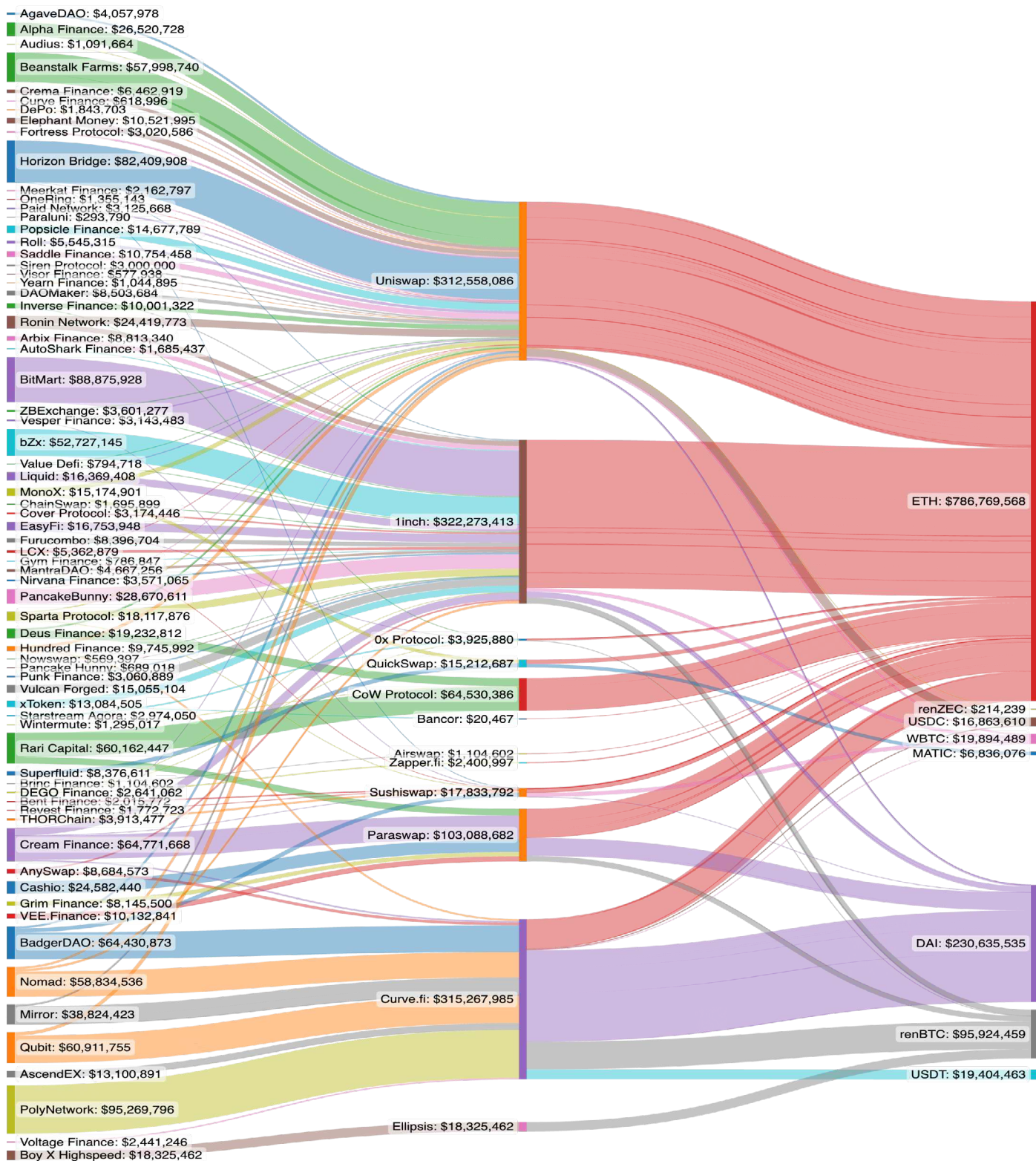
The attacker first bridged funds to Ethereum, obtaining approximately 8,803 ETH and 214 Wrapped BTC. While the ETH was sent to Tornado Cash, the exploiter decided to bridge the 214 wBTC to Bitcoin. Although this is technically possible, it is often difficult due to the lack of liquidity pairs on cross-chain bridges and instead requires the use of a centralized exchange – an undesirable option for exploiters. The attacker instead swapped the wBTC to renBTC so they could use the Ren bridge.

In order to do so, the exploiter used a DEX aggregator, which identified a specific DEX with the most competitive rates to swap 213.94 wBTC to 213.88 renBTC. The renBTC was then bridged to the Bitcoin blockchain.

Analyzing Illicit Token Flows

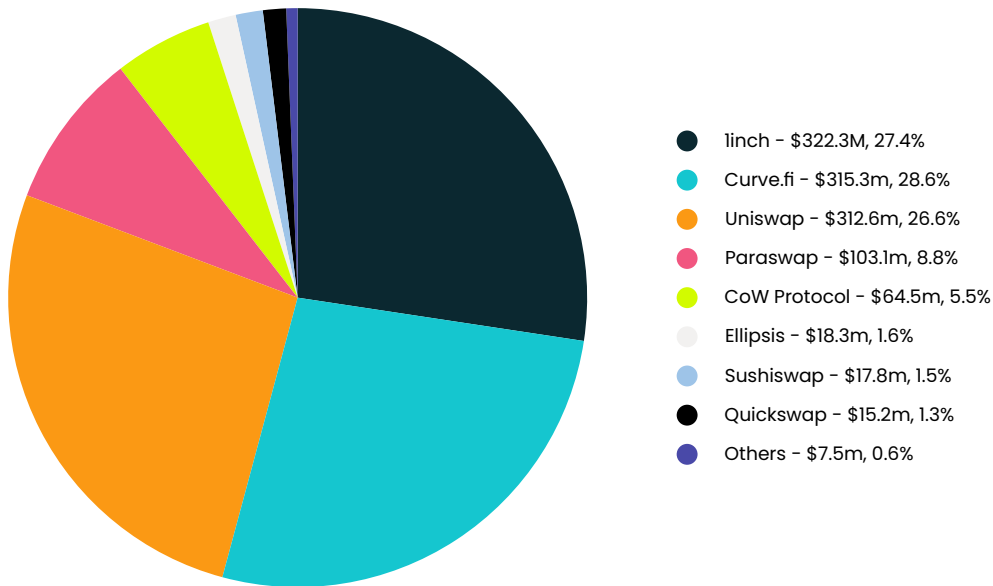
Criminals have stolen assets in 136 different tokens across the almost 80 exploits analyzed since late 2020. However, following DEX token hops – which occurred multiple times in some cases – ETH, renBTC and DAI remained the most common destination tokens.

Cross-Asset Swaps of Tokens Stolen Through Crypto Thefts



Over 53% of the illicit funds identified were swapped directly through two DEXs – namely Curve (\$315 million) and Uniswap (\$313 million). Approximately \$322 million (27.5%) was swapped using the linch aggregator protocol. The preferred DEXs of criminals appear to roughly correspond to the most popular DEXs for general use – implying that there is no particular one that caters to or is exclusively used by a criminal audience.

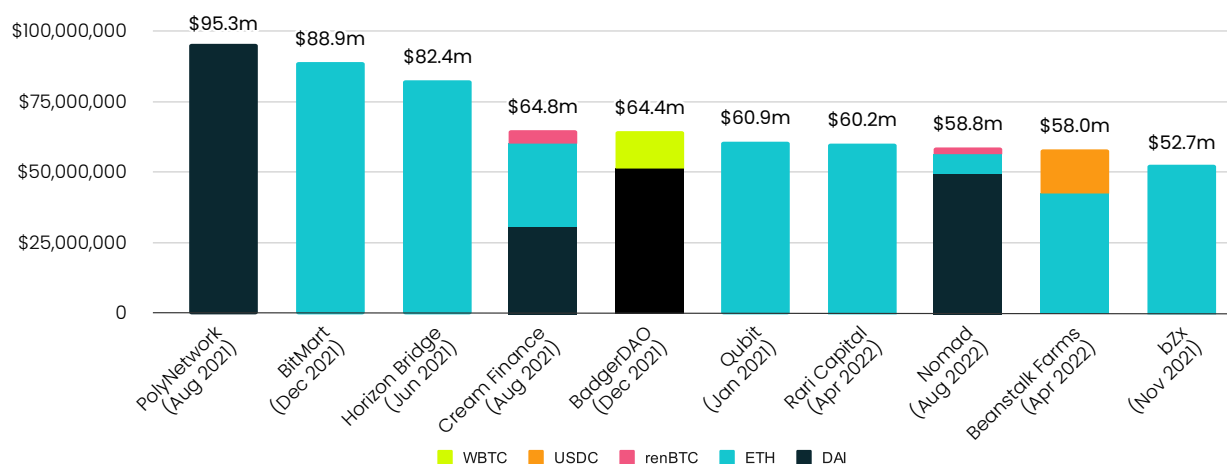
Illicit Crypto Swapped by DEX or Aggregator



Analyzing the most prolific illicit users of DEXs emphasizes that criminals do not necessarily swap to a single asset or even utilize only one DEX to facilitate their laundering. Spreading illicit activity across multiple such platforms allows them to obtain the best conversion rates for different tokens, while also splitting their funds to be laundered onwards through a variety of methods. This is one motivation for criminals to use DEX aggregators if they are processing many different types of stolen assets.

One of the largest DEX swaps perpetrated by a DeFi exploiter was the conversion of almost \$95.3 million worth of USDC to DAI by an exploiter of PolyNetwork bridge on August 10th 2021. This exploit – which stole \$611 million and remains the largest ever crypto heist to date – resulted in the perpetrator returning all the funds shortly after the attack.¹³

Top 10 Exploits by Assets Swapped Through DEXs



In many cases, the motivation to use DEXs will be a combination of the three use cases described above. The case study below, for example, shows the desire to (1) evade asset freezes and (2) to use Tornado Cash – and the exploitation of DEXs to achieve both.



The Deus DAO Hack, Swapping USDC into ETH For Tornado Cash

On April 28th 2022, Deus DAO – a DeFi protocol on the Ethereum Virtual Machine (EVM)-compatible Fantom blockchain – suffered a flash loan attack. The exploiter bridged nearly 15.8 million USDC (\$15.8 million) in stolen funds into their Ethereum account using the Multichain bridge. USDC is a stablecoin that, like Tether, can be frozen by its parent company Circle.

In this case, the exploiter elected to swap the USDC for Wrapped ETH (wETH), which they did by using the CoW protocol, an aggregator of aggregators. By further aggregating DEX aggregators, protocols like CoW attempt to reduce fees and optimize trades.

The USDC was swapped in three separate transactions for a total of approximately 4,448 wETH. All transactions involved the CoW protocol contract interacting with the 1inch aggregator contract and multiple executions using Uniswap, 0x Protocol, Sushiswap, Wintermute and Balancer liquidity pools and included intermediary swaps for USDT, wBTC and CAW before executing the swaps into wETH.

The resulting wETH was converted into ETH. Following that, 5,446 ETH was then sent through Tornado Cash across 54 transactions to the 100 ETH contract, 4 to the 10 ETH contract and 6 to the 1 ETH contract.

Summary of DEXs

While the amount of stolen funds processed by DEXs – \$1.2 billion – is substantial, this figure corresponds to the current average daily trading volume of Uniswap alone. The primary uses of DEXs are overwhelmingly legitimate, and they serve a crucial purpose in today's increasingly connected crypto ecosystem. DEXs are therefore here to stay – and so their risks of criminal exploitation need to be managed.

In today's crypto environment, one EVM-compatible wallet may hold in excess of thousands of different tokens, all potentially exchanged and transferred through DEXs. It takes just one of those tokens to originate from a sanctioned entity – such as a DeFi exploit by the Lazarus Group – for a virtual asset service to be potentially breaching sanctions by processing crypto originating from that wallet. The August 2022 action against Tornado Cash emphasizes that decentralized protocols are not immune from sanctions – particularly if they are found to be laundering the funds of high risk criminal entities.

These considerations demonstrate the importance of multi-asset screening and cross-asset tracing capabilities for managing the overall small but serious risks of DEX-based illicit activity. These assets discussed in depth towards the end of this report – are able to holistically analyze wallet activity by encompassing any tokens it has processed since its creation. This gives a crucial advantage to investigators in tracing through DEX-based criminal obfuscation schemes.

→ 02.

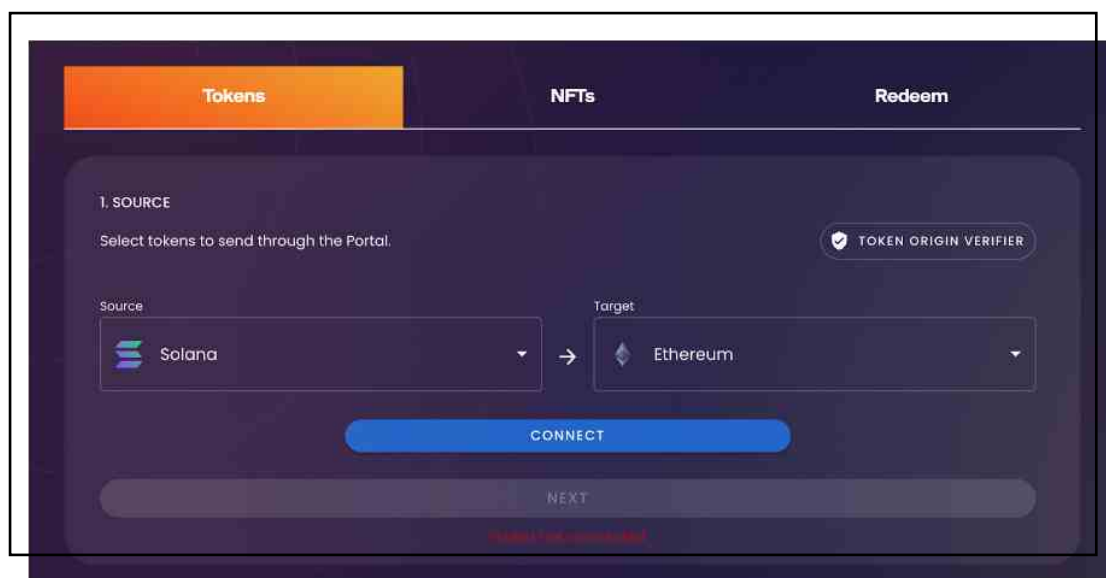
Cross-chain Bridges

What is a Cross-chain Bridge?

A cross-chain bridge – commonly referred to just as a bridge – is a type of virtual service that allows users to exchange tokens on one blockchain to tokens on another. They operate with varying degrees of centrality, with most making use of smart contracts to facilitate exchanges. More recently, bridges have started accommodating other forms of cryptoassets – including NFTs and metaverse-related assets.

When “bridging” an asset A to asset B on another blockchain, the service locks the converted asset A and issues the exchange equivalent of token B to the user. Asset B is itself issued from a reserve of locked assets accumulated from previous conversions in the other direction. This is called “lock-and-mint” – the most common operating mechanism for cross-chain bridges.

Some bridges also allow users to convert an asset A to a tokenized – or “wrapped” form of it on another blockchain. For example, a user can bridge BTC from the Bitcoin blockchain to Wrapped BTC (WBTC) – worth the same amount – on the Ethereum blockchain. Users can then use their WBTC for Ethereum-based services, such as DeFi investments or NFT purchases.



An example user interface of a cross-chain bridge.

Due to the nature of the “lock-and-mint” system, bridges tend to accumulate large amounts of locked assets on numerous blockchains, many of which may not have advanced security or auditing cultures due to their relative obscurity. This has made bridges an attractive target for cybercriminals in the past. From January to July 2022, \$1.2 billion worth of cryptoassets were stolen across eight bridge compromise incidents.¹⁴ Some of these exploits – including PolyNetwork, Ronin, Horizon and Nomad – have been discussed in previous case studies.

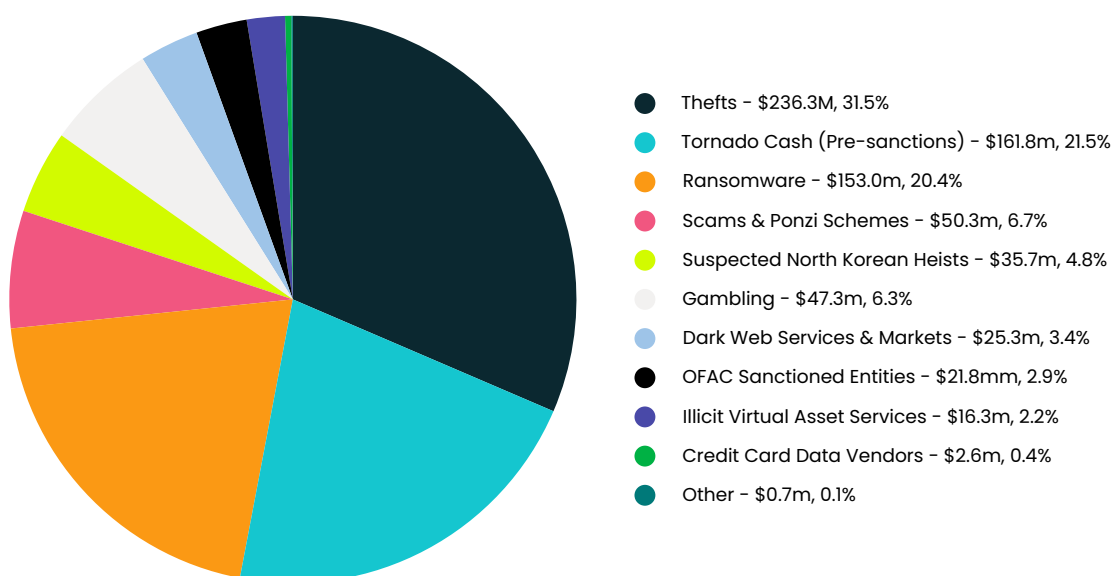
Criminal Use of Cross-chain Bridges

Criminals will most likely feel the need to bridge their illicit assets across blockchains for two main purposes. These are:

1. **Chain hopping as a money laundering “layering” technique:** to accumulate an extra layer of anonymity that makes their activities more difficult to trace using legacy blockchain analytics tools.
2. **To access services not present on the blockchain where the criminal proceeds originated:** examples include DeFi investment platforms and NFT marketplaces on Ethereum, or certain mixers or privacy wallets on Bitcoin.

More than \$750 million of illicit funds have been laundered through chain hopping facilitated by bridges. The vast majority of these illicit assets (over \$540 million) have been processed through RenBridge, a cross-chain bridge used predominantly to exchange assets between Bitcoin and Ethereum. Furthermore, \$47.3 million of online crypto-gambling proceeds have been processed through Ren, which may also represent illegal activity in some jurisdictions.

Illicit or High Risk Cryptoassets Laundered Through Cross-Chain Bridges by Origin



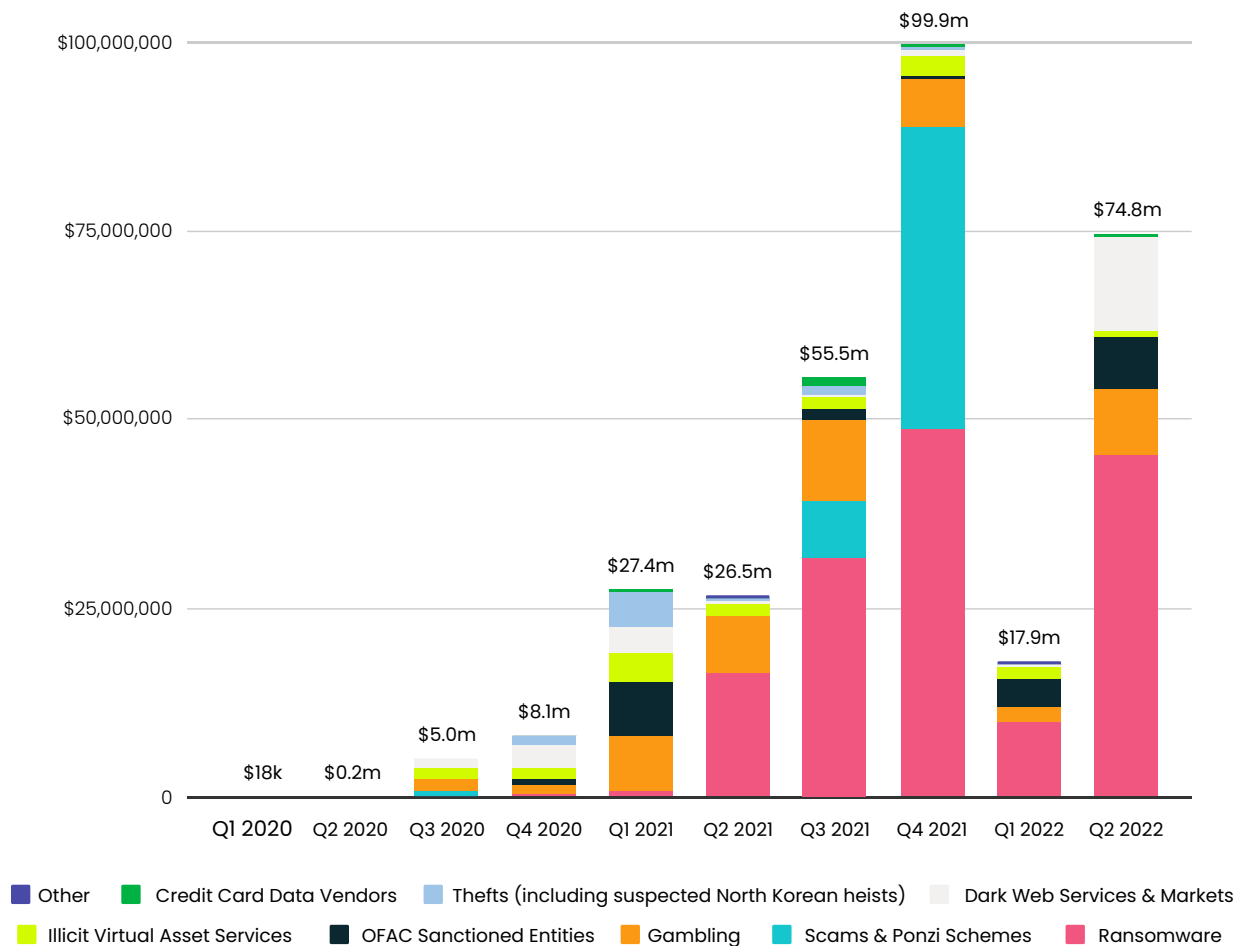
Ren has become particularly popular with those seeking to launder the proceeds of theft. Cryptoassets stolen from exchanges and DeFi services worth at least \$267.2 million have been laundered through Ren over the past two years. This includes \$33.8 million stolen from Japanese crypto exchange Liquid in August 2021. In total, \$97 million was stolen from Liquid, in an attack that has been linked to North Korea.¹⁵

Bitcoin-based Crime

Of illicit funds swapping chains through bridges, over \$317 million has originated on the Bitcoin blockchain – mainly through ransomware (\$153 million) and fraud (\$49 million). Analysis of illicit chain hopping indicates that levels of illicit activity range periodically based on hacks and ransomware attacks.

In the final quarter of 2021, illicit use of cross-chain bridges reached almost a record \$100 million after suspected fugitives behind the collapsed Finiko ponzi scheme began a major laundering operation – coinciding also with a spate of ransomware attacks.

Illicit or High Risk Bitcoins Laundered Through Cross-chain Bridges per Quarter-year



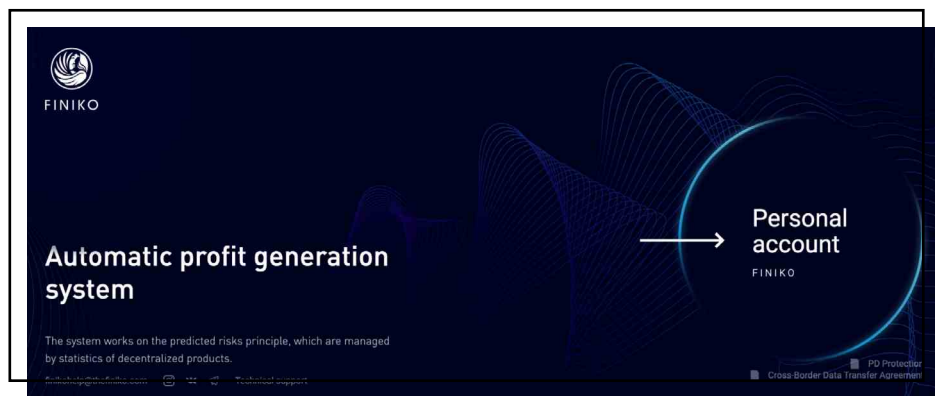


Finiko: the \$1.5 billion Ponzi Scheme

Finiko was a Russia-based scam crypto investment platform that ran as a ponzi scheme, distributing worthless “FNK” tokens in return for victims’ Bitcoins. The scheme offered to pay for mortgages, houses and cars of investors who invested over a certain amount. Originating in the Russian city of Kazan, the BTC wallet of Finiko amassed over \$1.5 billion in investments before its collapse in the summer of 2021.

Despite the arrest of its founder Kiril Doronin and numerous other associates, the scheme began a major laundering operation in November 2021 – bridging over \$32 million of funds through RenBridge.

Other ponzi schemes making use of chain hopping through bridges include Bitconnect and Mining City, which defrauded over \$2.1 billion and \$190 million from investors respectively.



The Finiko “trading platform” as it appeared before collapse in 2021



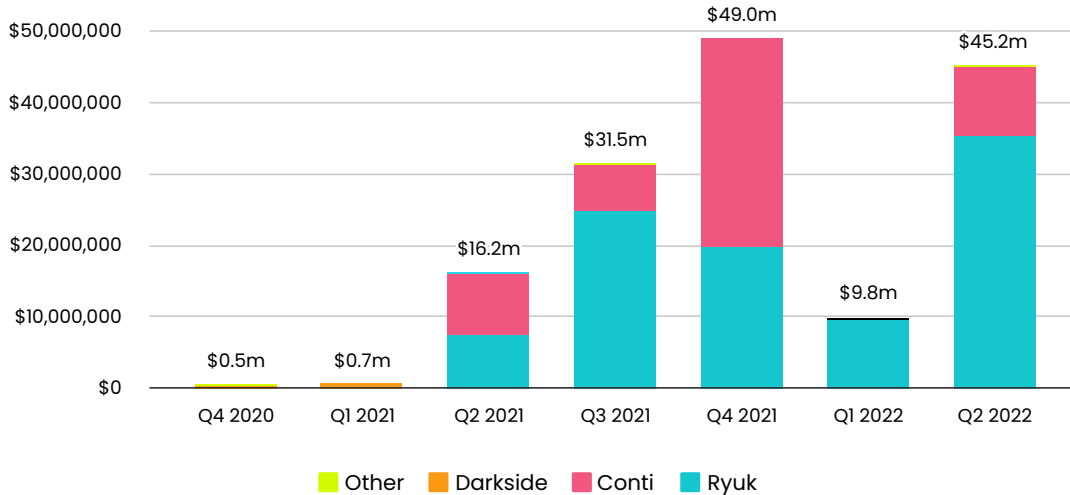
Use of Ren to Launder the Proceeds of Ransomware

RenBridge has been used by numerous ransomware strains to launder their proceeds, including Darkside – the strain behind the notorious Colonial Pipeline attack in May 2021. Overall, close to \$153 million of illicit Bitcoins processed through Ren originate from at least 13 ransomware strains.

The most prolific users include Ryuk and Conti, which have laundered over \$97 million and \$53 million through Ren respectively. The latter has attacked numerous high-

→ Continued

Ransomware Proceeds Laundered Through Ren by Quarter-year



profile victims, including the Japanese electronics supplier JVCKenwood, and London-based high society jeweler Graff. In April 2022, Conti also attacked the Costa Rican government and triggered a national state of emergency. On February 25th, it declared allegiance to Russia’s invasion of Ukraine and threatened western governments opposing Russian President Vladimir Putin’s actions.¹⁶ The Ryuk ransomware strain is also known for attacking government infrastructure – including hospitals and schools.

Blockchain data has identified links between wallets associated with such ransomware strains and other Russia-based cybercriminal activity. Examples include blockchain transactions between Conti, Ryuk operators and Hydra marketplace, a former Russian-speaking major dark web market. These affiliations have also been referenced in US sanctions updates. The case of Hydra – another prolific user of chain hopping techniques – will be discussed in more detail in the “Coin Swaps” chapter.

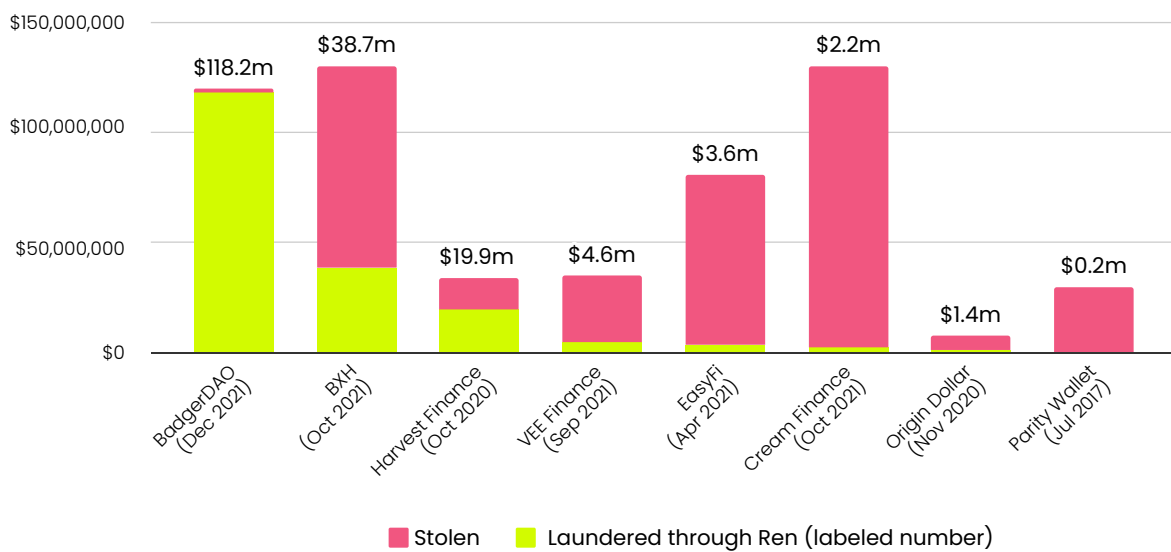


Conti declares support for Russia’s invasion of Ukraine on February 25th 2022.

Illicit Bridge Use on Other Chains

Ren has been used by a multitude of DeFi and exchange exploiters to launder at least part of their funds. Among the most prolific users have been the wallets behind the exploits of BadgerDAO in December 2021 and of BXH in October 2021. Of the approximately \$120.3 million stolen by the BadgerDAO exploiter, \$118.2 million (over 98%) was laundered through Ren.

Proceeds of Major DeFi Thefts Laundered through Ren



Per the previously-discussed use cases for DEXs, one reason for launderers to convert assets to the Bitcoin blockchain is to use the range of mixers and privacy wallets available on that blockchain. This is especially the case in light of the sanctioning of Tornado Cash and associated reduction of obfuscation alternatives on other blockchains such as Ethereum.



The December 2021 BadgerDAO Exploit

BadgerDAO is a DeFi protocol that aims to integrate Bitcoin further into the DeFi space. It also has bridge functionalities, though these were not compromised during the exploit.

On December 2nd, a series of unauthorized transactions stole assets in several tokens from the DAO. A post-mortem by BadgerDAO's developers attributed the transfers to a social engineering attack that facilitated malicious API calls that targeted a segment of the DAO's users. The origin of the eventually-successful social engineering attempt was traced back to September 2021 – two months before the exploit.

Attackers stole approximately 2,148 Wrapped BTC, 212,267 BADGER (the protocol's governance token), 57 DIGG, 77.58 Wrapped ETH and 232,052 USDT. Following the freezing of the USDT, the exploiter managed to accumulate over \$120 million in assets.

\$118.3 million of these assets were bridged through Ren to Bitcoin. The majority of these funds remain in wallets associated with the exploiter(s), although approximately \$4 million of the assets have since been transferred to a privacy-enhancing wallet provider.



The August 2022 Nomad Bridge Heist

On August 1st 2022, the Nomad bridge was attacked by an anonymous hacker using a method so simple that it was quickly copied by others. Many of these individual exploiters chose different methods of laundering their proceeds, as described in a previous case study in the DEX chapter. One opportunistic hacker, however, stole 103 Wrapped BTC from the bridge in 2 transactions.

102.96 WBTC was sent on to a new wallet from which, using the linch aggregator, it was swapped in five transactions for 102.96 renBTC. All of these transactions made exclusive use of the Uniswap liquidity.

Using RenBridge, the renBTC was bridged as 102.69 BTC into the Bitcoin blockchain.

1 BTC was then withdrawn to a centralized cryptoasset exchange account before returning 68.37 BTC to Ethereum via RenBridge to a new account on August 8th, where it was swapped to 816 ETH. This was then sent onto an initial three accounts before being further dispersed.

Summary of Cross-chain Bridges

Like DEXs, bridges are crucial services allowing interoperability between blockchains, investment protocols, metaverses and other legitimate and beneficial blockchain technology use cases. Their usage remains overwhelmingly legitimate and their accessibility is important for the continued development of the cryptoasset ecosystem.

Nevertheless, blockchain bridges such as Ren pose a challenge to regulators, since there is no central service provider that facilitates these cross-chain transactions. Instead, transactions are processed by a network of thousands of pseudonymous validators known as “Darknodes”. These features make bridges highly attractive – if not essential – to the laundering schemes of illicit actors.

The theory of “crime displacement” – namely that criminals facing a prevention measure for one criminal activity will find an alternative activity where the intervention is not present¹⁷ – holds particularly true for cross-chain bridges. As commonly used laundering tools such as Tornado Cash face sanctions, criminals will search for alternatives across blockchains – and inevitably use bridges to access them.

With the laundering potential of “chain hopping” reaching the attention of the Financial Action Task Force (FATF), the associated risks to and compliance responsibilities of virtual asset services are becoming increasingly evident. Elliptic’s Holistic Screening capabilities – discussed in the final chapter of this report – offer a comprehensive solution to address these rapidly growing concerns.

→ 03.

Coin swap Services

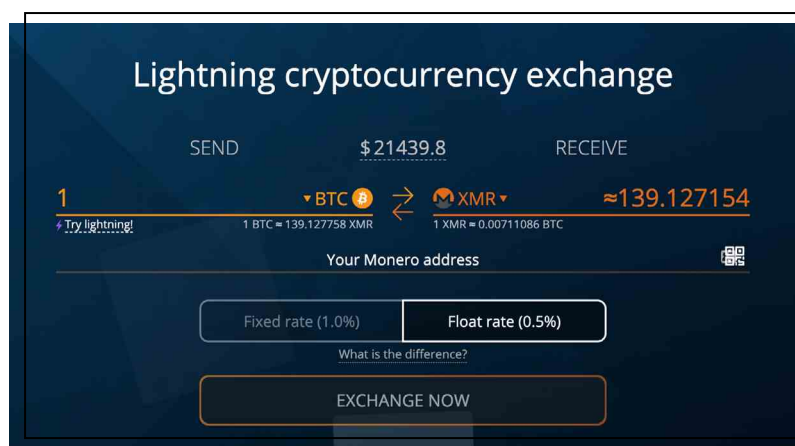
What is a Coin Swap Service?

A coin swap service – sometimes also called an “instant swap exchange” or “non-custodial crypto exchange” – is an entity that allows users to swap cryptoassets for other tokens, either on the same or different blockchain. They are characterized by a number of different features:

- Customers typically do not need to open accounts to begin swapping tokens, and can interact directly with the service’s homepage to do so.
- In almost all cases, customers do not need to verify their identity to swap tokens – allowing them to do so anonymously.
- They typically have opaque ownership structures, with the individuals or groups behind them remaining anonymous.
- Many are advertised on illicit cybercrime forums, which cater mainly to a criminal audience.
- Many are based in Russia or – to a lesser extent – Iran.

Coin swap services may be distinct from “high-risk” or “no-KYC” crypto exchanges, given that users often do not need to open accounts. Where accounts are required, it is usually to record past conversions or make support services easier to access.

For the privilege of remaining anonymous, most coin swaps charge higher commission on average than typical compliant exchanges. These fees are typically around 0.25%, but may increase to over 1% if users are opting for “fixed” fees (fees that do not fluctuate with crypto prices during the conversion). Many will support a wide range of cryptoassets, including Bitcoin, Ether, Tether and in many cases high-risk privacy coins such as Monero.



An example of a coin swap service interface – supporting cryptoassets including BTC, Monero and Layer-two scaling solutions such as the Lightning Network.

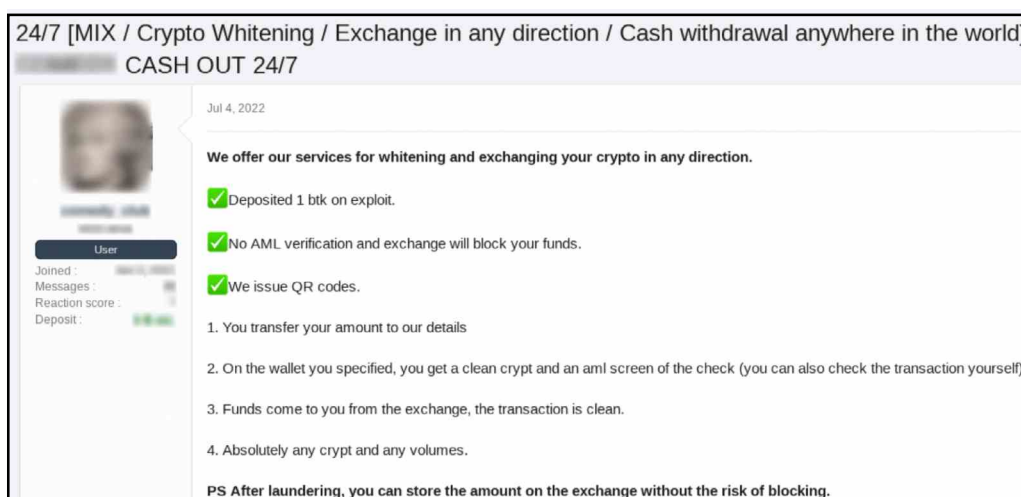
To use a coin swap service, a user will typically select the value and asset they wish to convert. They will then be given a wallet address to deposit their desired amount of crypto and be asked to input the recipient address through which they want to receive the converted funds. The conversion time will be displayed on the service and may typically range from five to 30 minutes.

Licit versus Illicit Coin Swap Services

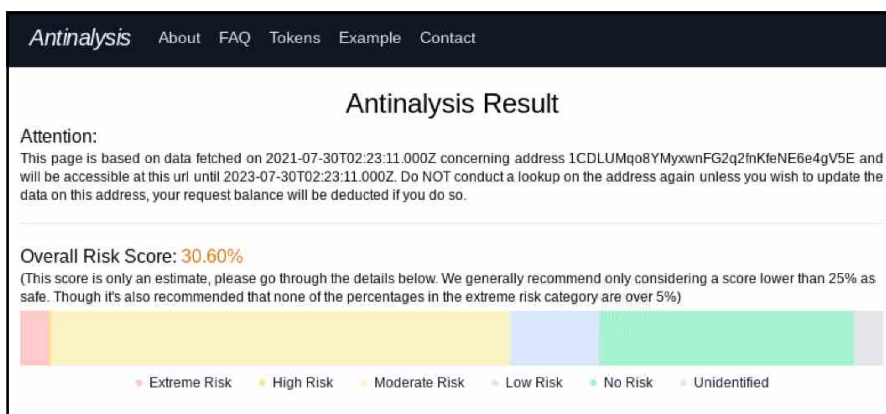
As with all virtual asset services, coin swap services range from entities catering to a largely legitimate audience to outright illicit entities that advertise almost exclusively on cybercrime forums. Compliant coin swap services may deploy blockchain analytics tools and freeze exchanges automatically deemed suspicious – requiring further AML/KYC checks for the conversion to complete.¹⁸

Legitimate-facing coin swap services will often have higher transaction limits, lower costs and shorter wait times due to greater usage. However, illicit coin swap services are still sought after by criminals due to their greater emphasis on “cleaning” illicit cryptoassets during conversions.

These services – often advertised on dedicated criminal forums or Telegram channels – will promote their services based on how “clean” the received funds will be and charge extra to swap crypto from obviously illicit sources. Many therefore also make use of blockchain analytics solutions – likely rudimentary ones pulled together by criminals or through open-source data – ironically for the opposite of their intended purpose. Elliptic has identified rudimentary blockchain analytics solutions advertised on the dark web for criminals to screen their wallets for illicit exposure, such as “Antinanalysis” (see image below).¹⁹



An advertisement for a “crypto whitening” coin swap service on a Russian cybercrime forum, emphasizing the use of some form of anti-money laundering screening.



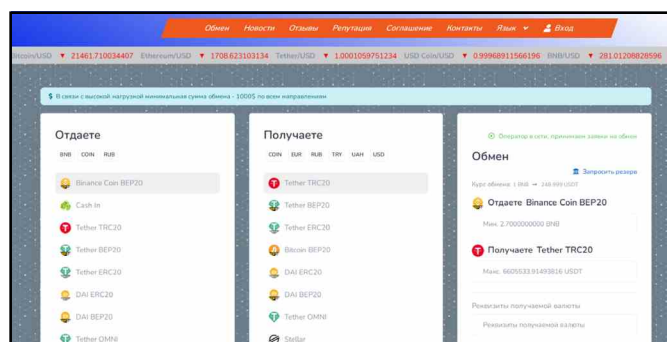
Antinanalysis, a former cybercriminal-operated blockchain analytics service used in conjunction with money laundering through illicit coin swap services.



AudiA6 – an “Exchange + Mixer” That isn’t Actually a Mixer

AudiA6 (no relation to the car of the same brand) is an extensively-advertised cryptoasset mixing and coin swap service, present on many cybercrime forums since Summer 2021. The service self-describes its client base as “not respected users, bandits, tramps, scammers and all”, and offers exchange services via its website and Telegram. The service also allows swaps from crypto to the Russian ruble.

The service boasts that the exchanged cryptoassets are always “clean” with at most 25% exposure to an illicit source. Although only “clean” coin swaps are allowed via the website, the operator allows tainted cryptoassets to be swapped for a 3% additional fee. Illicit cryptoassets being sent through AudiA6 include those originating from two well-known dark web markets ‘OMGOMG!’ and Solaris, according to Elliptic’s internal analysis.



The AudiA6 coin swap service

AudiA6’s “mixer” service, offered alongside its coin swap functionality, is advertised simply as taking the user’s dirty crypto and giving them back clean funds – though not in the typical function of a traditional crypto mixer. In similarly bland language, the operator adds, “What I do with your dirty crypto is my personal concern.”

Sanctions Risks

Much like the AudiA6 example, certain coin swaps catering to Russian audiences will also allow users to convert cryptoassets to and from fiat currency, including the Russian ruble. Since the Russian invasion of Ukraine in February 2022 and the wide-ranging sanctions placed against Russian finances in response, such entities may also reflect a sanctions risk. Sberbank and Alfa-Bank, both subject to sanctions in the United States, represent some of the most common destination or origin banks in the crypto-RUB or RUB-crypto pairs advertised by these services.

Some services also provide opportunities to deposit or receive cash in exchange for crypto. Such services may involve physical handovers of cash or burying it in a predetermined location for the customer to eventually dig up.

The screenshot shows a web interface for a coin swap service. At the top, there are tabs for 'All', 'BTC', 'LTC', 'USDT', 'XMR', 'DASH', and 'fiat'. Below this, there are two main sections: 'give away' and 'You receive'. The 'give away' section lists various options: bitcoin bitcoin, LiteCoinLTC, DASH DASH, Monero XMR, Tether TRC20 USDT, Sber RUB, Tinkoff Bank RUB, Bank card RUB, and QIWI RUB. The 'You receive' section is a table with columns for 'You are getting', 'Well', and 'Reserve'. It lists various options including QIWI RUB, Visa/MC/MIR RUB, Cash Post ATM RUB, Cash RUB, Tinkoff RUB, Sberbank RUB, Tinkoff CashIn RUB, Alfa Bank CashIn RUB, and DASH DASH.

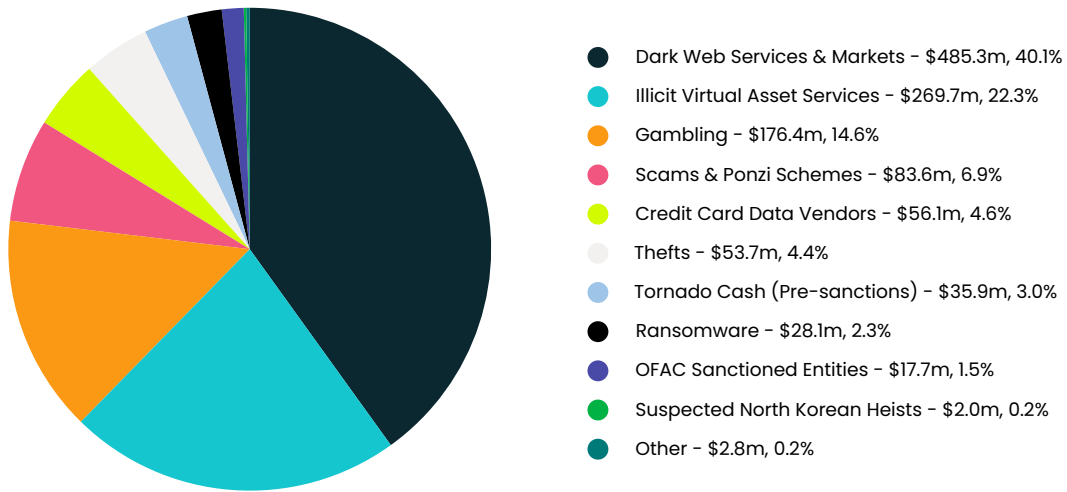
You are getting	Well	Reserve
QIWI RUB	1 → 1266345.3	673074.831
Visa/MC/MIR RUB	1 → 1266345.3	673074.831
Cash Post ATM RUB	1 → 1273117.2	20001500
Cash RUB	1 → 1273117.2	20000000
Tinkoff RUB	1 → 1279889.1	1015842.2319
Sberbank RUB	1 → 1279889.1	1015842.2319
Tinkoff CashIn RUB	1 → 1279889.1	1015842.2319
Alfa Bank CashIn RUB	1 → 1279889.1	1015842.2319
DASH DASH	1 → 449.907236	89.703017

An example of a coin swap service allowing users to swap cryptoassets to and from BTC, cash, Monero and RUB (Russian Ruble), including for banks sanctioned in Europe and America.

Criminal Use of Coin Swap Services

With their strong nexus to Russia and lack of KYC requirements, coin swap services have been used to launder more than \$1.2 billion of illicit cryptoassets – including gambling services that may not be illegal in certain jurisdictions. Several illicit coin swap services are advertised on the same cybercrime forums as the illicit vendors and services laundering proceeds through them. This indicates that many are strongly integrated with the cybercriminal underworld.

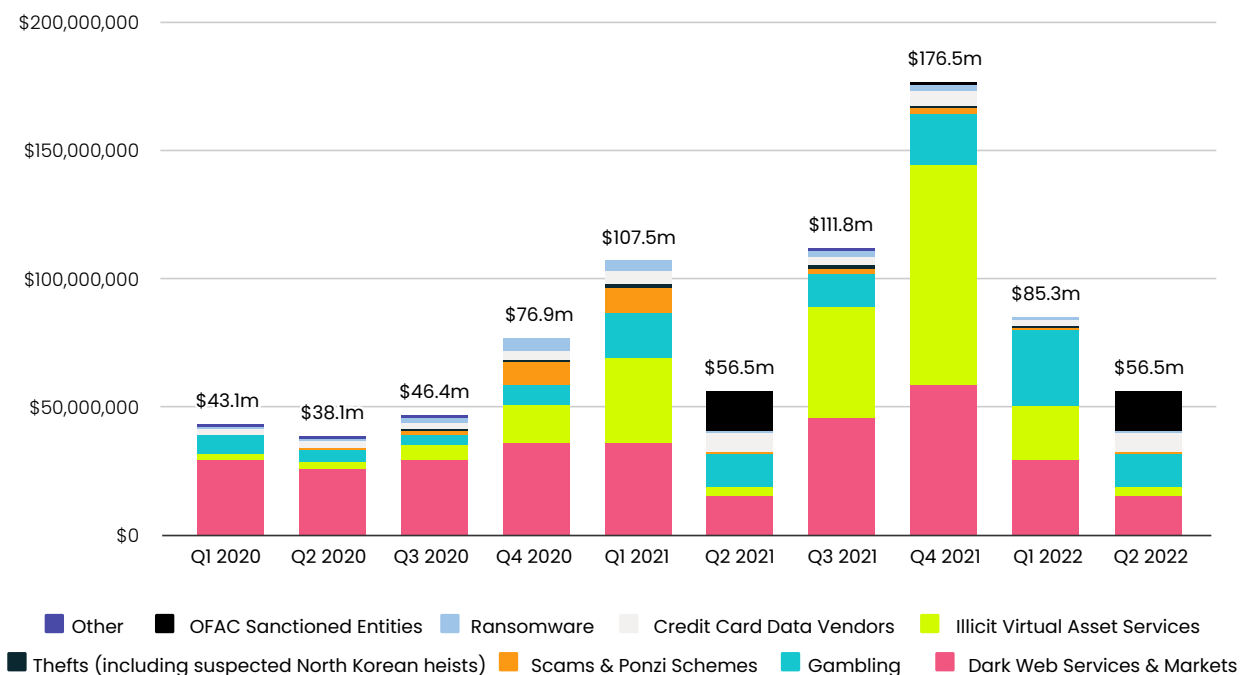
Illicit or High Risk Cryptoassets Laundered Through Coin Swap Services by Origin



Bitcoin-based Crime

Elliptic’s analysis of coin swap services indicates that over 97% of illicit cryptoassets they process – over \$1.1 billion – begin on the Bitcoin blockchain. Illicit BTC laundered through coin swap services mostly originate from dark web markets (more than \$485 million), illicit virtual asset services (over \$269 million) and online crypto-gambling sites (more than \$167 million). Scams and thefts, including suspected Lazarus Group heists, constituted around \$140 million.

Illicit or High Risk Cryptoassets Laundered Through Coin Swap Services by Origin



The preference of illicit actors for coin swap services compared to traditional exchanges is also on the rise. Of all illicit Bitcoins flowing through either coin swaps and exchanges, 7.5% were processed by coin swaps in 2021. This is up substantially from the 0.1% just five years prior.

Coin swap services already represent the most popular known destination of outgoing funds for one relatively new dark web market, Solaris – identified previously in the AudiA6 case study. Over \$6.7 million of illicit funds originating from Solaris have been laundered through at least 18 coin swap services, compared to just \$2.9 million flowing to centralized exchanges. The two case studies below further detail the prolific use of coin swap services by users and vendors of predominantly Russia-based dark web markets and illicit virtual asset services.

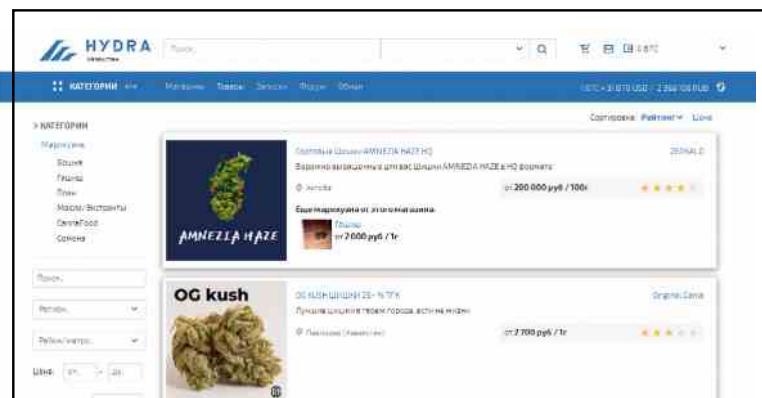


Hydra: the US-Sanctioned \$5.1 Billion Dark Web Giant

One of the most prolific illicit users of coin swap services were the customers and vendors of the Hydra marketplace – a former Russian dark web market. Before being shut down by an international operation in April 2022, Hydra processed over \$5.1 billion of Bitcoin transactions for goods and services – ranging from drugs to stolen identity data. This made Hydra the largest dark web market at the time of its seizure by the German authorities and subsequent sanctioning by the United States.²⁰

Customers and vendors of Hydra account for around \$391.5 million (approximately 33%) of the \$1.2 billion of illicit Bitcoins sent through coin swap services. Over 240 coin swap platforms – ranging from mainstream and legitimate services to illicit ones catering exclusively to Russian cybercriminals – have been used to process Bitcoins originating from Hydra.

Sanctions also do not indicate that blockchain activity from affected illicit entities have ceased – of the \$391.5 million of Hydra Bitcoins flowing into coin swap services, \$6.7 million were processed after the marketplace was seized and sanctioned.



Hydra Marketplace before its seizure



Illicit Crypto Services Use Coin Swaps as an Extra Layer of Laundering

Ranging from dark web markets to vendors of stolen credit card data, the cybercriminal underworld also hosts a range of services that allow criminals to accept payments and cash out their proceeds. Examples include SUEX, Chatex, Garantex and BTC-e – all criminal exchanges that have either been sanctioned or seized by the United States for laundering the proceeds of dark web markets and ransomware.

Due to their heavy exposure to illicit activity, such entities utilize conversions within and across chains to disguise their proceeds. In one case – Chatex – a sanctioned address was even found to possess NFTs.²¹ Coin swap services facilitate a sizable portion of this secondary laundering, processing \$70 million of Bitcoin originating from Garantex and \$67 million from BTC-e. Elliptic’s internal analysis shows that these services were particularly used by the “Ryuk” and “Conti” ransomware strains, Hydra dark web marketplace and ponzi schemes such as Finiko and OneCoin.

Illicit payment processors that provide services to dark web marketplaces or vendors have also sent over \$140 million in Bitcoin through coin swap services. Such payment processors are particularly used by stolen identity and credit card data vendors – a criminal enterprise otherwise known as “carding” that has raked in over \$1 billion in Bitcoin.



Hydra Marketplace before and after its seizure in July 2017

Illicit Coin Swap Usage in Other Cryptoassets

Compared to Bitcoin, illicit funds transferred through coin swap services rarely originate from high risk events on other assets. Approximately \$47.7 million of illicit Ether has been sent through coin swaps, along with \$1.7 million (0.2%) in Tether. The vast majority – \$35.9 million – originates from Tornado Cash, which indicates that illicit actors may use coin swaps and mixers as part of a multi-layering process. Further emphasizing this, over \$18.6 million ETH has been sent from coin swap services into Tornado Cash – showing the interchangeability of these methods within money laundering schemes.

Nevertheless, the vast amount of illicit Bitcoins being sent through coin swap services emphasizes the use of other blockchains such as Ethereum as instrumental in the “layering” stages of many money laundering schemes.

Given the relative prominence of DeFi on Ethereum, more than half of illicit assets sent through coin swap services originate from thefts. Theft proceeds laundered through coin swaps also include stablecoins such as USDT and USDC, along with Wrapped Bitcoin (wBTC).

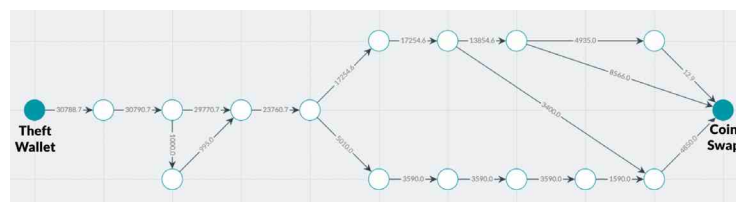
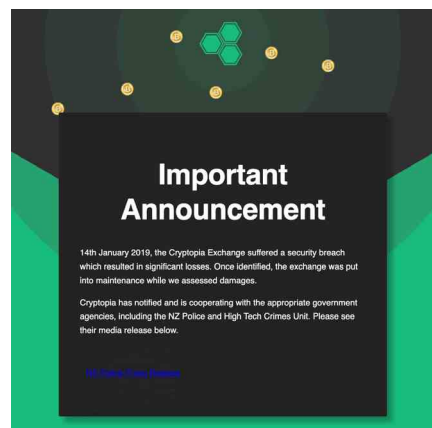


The \$24 million Cryptopia Hack

On January 13th-14th 2019, an estimated \$24 million was stolen from New Zealand-based crypto exchange Cryptopia.²² The series of unauthorized transfers would eventually drive the exchange to liquidation. Funds were stolen in several assets – including \$3.7 million in Ether.

Over the course of the next year, the attacker transferred the stolen ETH across a multitude of intermediary wallets, eventually transferring \$1.2 million into a coin swap service. The service used has also been the laundering method of choice for at least a further \$800,000 of fraud and theft proceeds from other incidents.

The remainder of the funds were transferred through exchanges that were known for their lax AML/KYC policies at the time.



Elliptic Investigator shows the flow of stolen funds into a coin swap service.



Using VASP Screening to Assess Crypto Business Risk

Transacting with crypto businesses such as coin swap services that have inadequate compliance controls can expose virtual asset services to significant risk. Elliptic Discovery – our VASP screening tool will soon provide a holistic view of risk for thousands of VASPs worldwide – helps businesses identify and assess the level of risk. This helps ensure that your business is not handling the proceeds of crime or violating sanctions.²³

VASP screening is also crucial for traditional financial services seeking to engage further with crypto. Elliptic Discovery provides the rapid insights needed to perform due diligence and onboard VASPs with confidence. Besides engagement with illicit cryptoassets, this data includes information on the VASP’s registered jurisdiction, legal name and other identifying information.



Information on monthly (top) and overall (bottom charts) illicit transactions provided by Elliptic Discovery on the coin swap service used by the Cryptopia hackers (see previous case study).

Terrorist Financing

Over \$250,000 in Bitcoin has been sent through coin swap services by various proscribed terrorist organizations. Among the largest users include the Al Qassam Brigades – the military wing of Hamas – which has deposited over \$230,000 through such services, according to Elliptic’s analysis. Other organizations include ISIS, al Qaeda, the Gaza Mujahadeen Campaign and Belarusian pro-democracy movements designated as terrorist groups by the government.

On a smaller scale, coin swap services have also been used to send or receive funds to far right extremist entities – a matter of potential regulatory concern for certain jurisdictions.

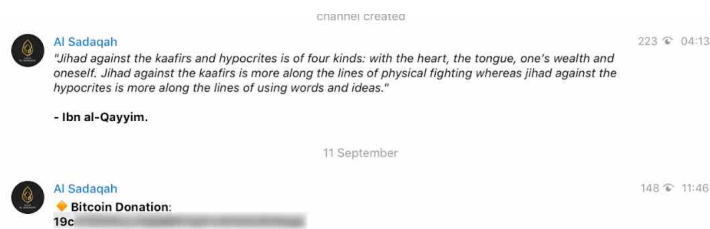


Al Sadaqah

In 2017, a Telegram channel named “Al Sadaqah” – Arabic for “charitable giving” – began advertising a Bitcoin address to raise funds for Syrian fighters. The address received just under \$1,000 in Bitcoin, though the group also encouraged donors to send Bitcoin vouchers and use ATMs as alternative means to donate. The group also accepted Monero, Dash and Verge.

Onward transactions from the Bitcoin donation address saw almost two-thirds of donations being sent through a single coin swap service. The same platform has also been used by numerous dark web entities and carding vendors. The remainder of funds were sent to exchanges that would not have required KYC verification at the time due to the low amounts.

A small amount of donations to Al Sadaqah also originated from Monero-to-Bitcoin coin swap services.



Messages on the Al Sadaqah Telegram channel.

Summary of Coin Swap Services

For legitimate users of cryptoassets, coin swap services, or instant swap exchanges, provide a fast and efficient way of swapping their assets for others both within and across blockchains. However, their typically minimal-to-zero use of AML/KYC – or their use of it for nefarious purposes in the case of illicit-facing coin swaps – make them attractive for criminals seeking to launder their funds. Their support for Monero, the Lightning Network and the Russian ruble in certain cases further increases the risk of illicit activity. Their prolific use by dark web markets, stolen data vendors and ransomware operators emphasize that they are a crucial part of the cybercriminal ecosystem. Coin swaps advertised on cybercrime forums are in no short supply.

Elliptic’s internal research has identified the concerning possibility that millions of dollars worth of Bitcoins – originating from the dark web, sanctioned entities or ransomware – have likely been dispersed across numerous blockchains as a result of coin swaps. Prolific use by some of the most notorious criminal enterprises of their time – such as Hydra Market – demonstrates the crucial need to remain ahead of coin swap-based money laundering and terrorist financing.

→ 04.

Solving the “Cross-chain Problem” with Holistic Screening

In 2014, Elliptic built the first blockchain analytics platform and set the gold standard for Bitcoin transaction screening. But by 2022 – when cross-chain and cross-asset crimes have increasingly become the norm – a new generation of blockchain analytics has become a necessity for those seeking a holistic assessment of their crypto risk.

Holistic Screening is Elliptic’s response to the rapidly changing state of crypto crime and is – once again – an industry first. Elliptic’s next-generation blockchain analytics platform provides multi-asset screening, cross-asset tracing and cross-chain screening capabilities, which are crucial advantages that will be detailed throughout this section.

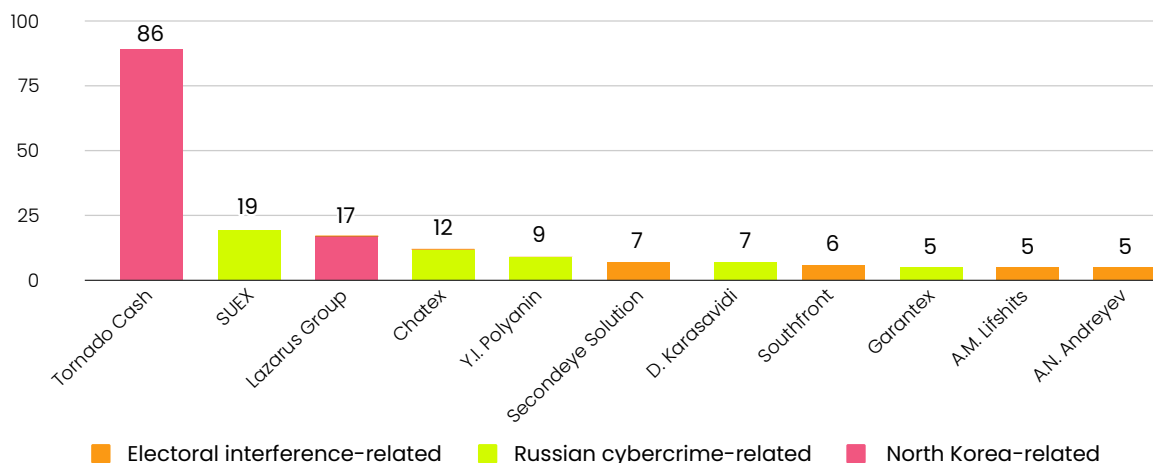
These capabilities mitigate the obfuscation potential of using DEXs, cross-chain bridges and some coin swap services²⁴ by criminals. Elliptic’s Holistic Screening capabilities work programmatically and at-scale – thereby keeping up with the pace of criminal activity in the modern age.

VASPs and Legacy Blockchain Analytics

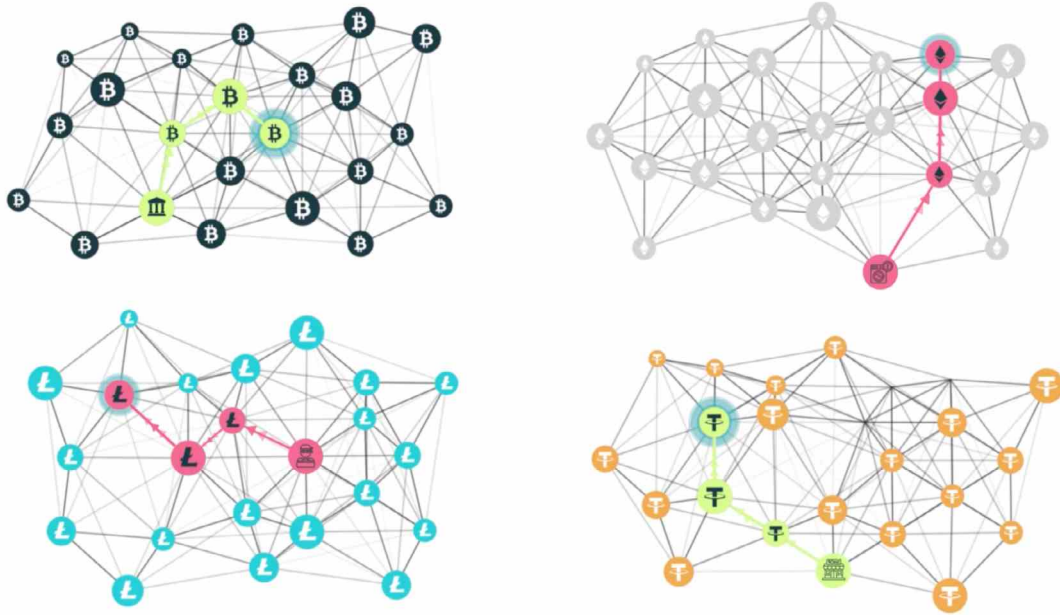
Legacy blockchain analytics solutions do not have the capabilities to trace, screen or forensically investigate transactions across blockchains or tokens. For many compliant virtual asset services that are obliged to protect against AML or sanctions evasion, this poses a major risk – regardless of whether they themselves process multiple assets and/or facilitate transactions involving multiple blockchains.

Consider, for example, the possibility that a certain sanctioned actor has dealt with many cryptoassets at once. This could be an illicit exchange that allows criminal users to hold balances in multiple assets, or a cyberhacker from North Korea’s Lazarus Group who has stolen crypto in many tokens from a multi-asset DeFi service such as a cross-chain bridge. These scenarios are very real, and have come to light in the sanctioning of a series of Russia-based crypto-exchanges and North Korea’s attack on Ronin bridge, respectively.

Number of Cryptoassets Possessed by OFAC Listed Wallets

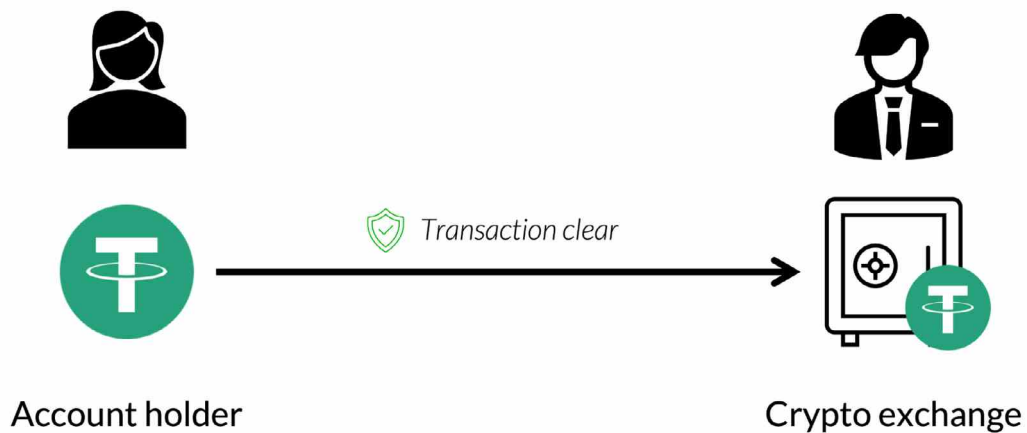


Entities holding five or more cryptoassets shown only. Figures indicate the number of assets held over all time.

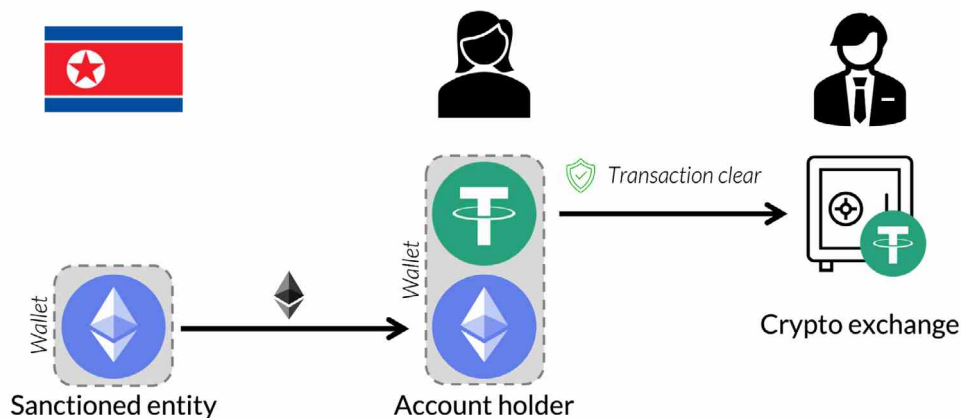


Legacy blockchain solutions are not able to view the activities of the same entity across separate chains holistically. When screening their movements on separate blockchains, some may come up as illicit or sanctioned, while on others they may appear as low/no risk.

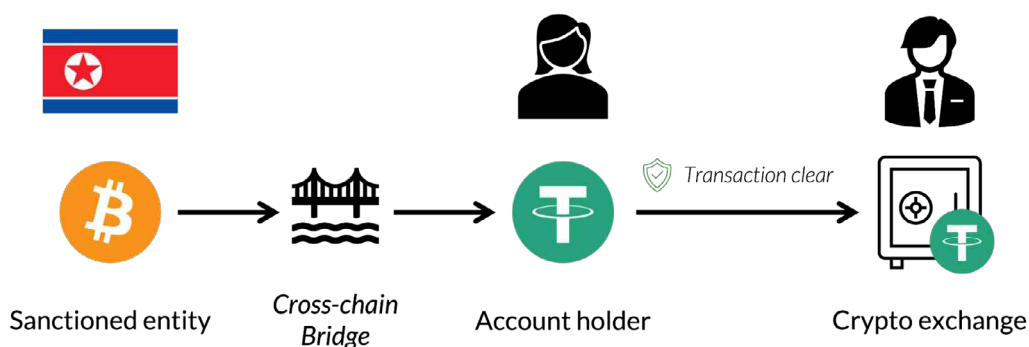
The issue for a VASP using legacy blockchain analytics solutions arises when one such address makes a deposit to an account held by that VASP. For example, consider that individual A has deposited Tether into their VASP account. The legacy analytics tools that said VASP uses will screen it against sanctions lists and check the exposure of its incoming Tether. Not being able to identify any links to sanctioned wallet addresses, it will clear the transaction.



That process has potentially made two critical omissions. Firstly, it has been unable to check whether that same Tether address has received funds originating from sanctioned entities in other cryptoassets, such as ETH. This demonstrates a crucial insight that would have been otherwise gained by holistically screening the wallet address – the ability to check the incoming exposure of any asset that has ever been held by that wallet. In this case, it may be able to spot that this address has indeed processed ETH originating from a sanctioned wallet.



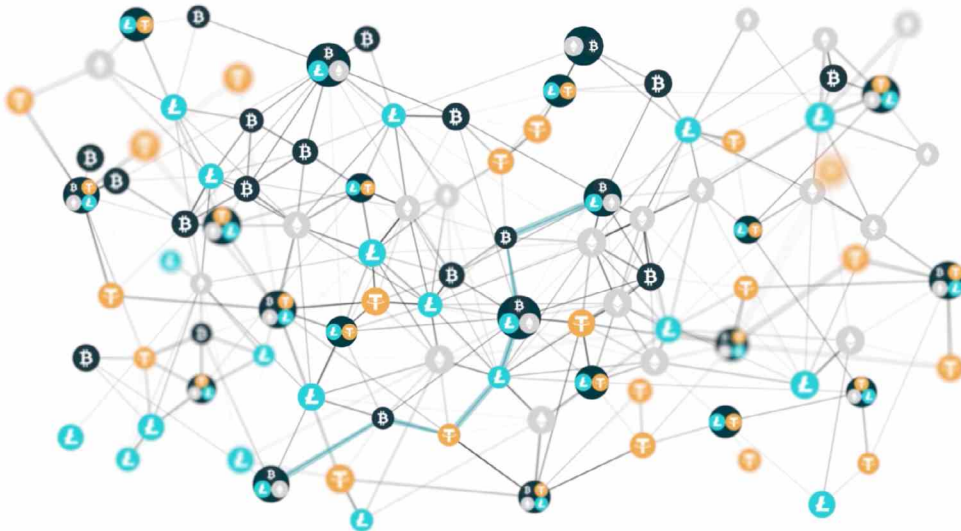
The second potential omission is that the legacy tool would not have checked whether the screened wallet had received funds associated with sanctions or illicit activity through a DEX, cross-chain bridge or coin swap service. By being unable to do so, it would have potentially allowed a transaction that would have breached sanctions or contributed to the laundering of illicit assets.



Ranging from sanctions compliance to AML obligations, these simple yet critical considerations based on real world examples exemplify that holistic screening has become a critical necessity for modern-day cryptoasset businesses.

The next sections discuss the capabilities that Holistic Screening entails, enabled by Nexus – the engine powering Elliptic’s next-generation blockchain analytics platform. These are:

1. Multi-asset screening: the ability to screen wallets across all assets that they have ever contained for incoming and outgoing exposure to risk.
2. Cross-asset tracing: the ability to trace transactions involving the exchange of cryptoassets on the same blockchain.
3. Cross-chain tracing: the ability to trace transactions involving the exchange of cryptoassets across different blockchains.



Visualizing the blockchain holistically is vital for tracing modern-day criminal transactions.

Multi-asset Screening

The process of wallet screening allows entities to check the incoming and outgoing risk exposure of a wallet, based on how much of their incoming/outgoing funds are related to suspicious activity. Legacy screening solutions typically require compliance teams to specify the asset, blockchain and wallet address they wish to analyze.

With Holistic Screening, compliance teams using Elliptic’s solutions no longer need to specify an asset they need to screen. If Holistic Screening is enabled, Elliptic Nexus will identify any asset the address or transaction has interacted with. Compliance teams will get one screening result and one overall score.

Risk	Coverage	Value	Customer	Direction	Transaction time	Screened at
0.3	Single asset Ether (ETH/Ethereum)	\$271.53 Ether (ETH/Ethereum)	Customer123	Deposit	21-Jul-2022 09:38	21-Jul-2022 09:40 by API
8.7	Holistic	\$271.53 Ether (ETH/Ethereum)	Customer123	Deposit	21-Jul-2022 09:38	21-Jul-2022 09:40 by API

An example of the discrepancy between monitoring a transaction for a single asset (top) compared to holistically screening the same transaction across multiple assets (bottom) – the Holistic Screening result identifies criminality that would not have been detected through legacy screening solutions, producing a risk score of 8.7 out of 10 (high) compared to 0.3 (low).

Considering that some wallets on certain blockchains may hold or process hundreds – even thousands – of different tokens at once, legacy screening solutions would have required separate screenings one by one for each of them. Multi-asset screening therefore offers a significant efficiency boost in risk screening for virtual asset services.

Cross-asset Tracing

Cross-asset tracing involves being able to follow funds through decentralized exchanges or other services that swap cryptoassets on the same blockchain. Having been found to process over \$1 billion of DeFi exploit proceeds alone, cross-asset tracing is a formidable and crucial solution to managing risks from DeFi crime and otherwise-complex obfuscation strategies.

Legacy tracing solutions are not capable of demonstrating the cross-asset nature of sophisticated money laundering schemes, requiring investigators to switch investigations separately for each asset and pinpointing the individual transactions where asset swaps occurred. Cross-asset tracing reduces these time consuming processes into simple and automated investigations.

E Cross-asset Tracing Through the Cream Finance Exploit

On October 27th 2022, DeFi protocol Cream Finance was exploited for over \$130 million using both a flash loan exploit and malicious manipulation of the protocol's price oracle. Over 60 tokens were stolen by the attacker – including ETH, DAI and metaverse tokens such as MANA and SAND.

The transaction graph below – procured on Elliptic Navigator – shows a screened transaction between two wallets transacting \$271.53 worth of ETH. As shown by the incorporation of cross-asset swaps in previous transactions, the screened transaction is linked to the use of a DEX, DODO, to swap SAND tokens stolen during the Cream Finance exploit.

This detail – which would be omitted on legacy transaction monitoring solutions – is crucial for identifying wallets used by criminals after they have engaged in post-exploit cross-asset or cross-chain swaps.



Screening a transaction of the Cream Finance attacker that has made use of previous DEX cross-asset swaps.

Cross-chain Tracing

Cross-chain tracing involves following the funds as they are processed through bridges and other mechanisms that move value between separate blockchains. The importance of being able to monitor such chain-hopping activity is exemplified by just how much criminals are making use of this capability – having laundered \$540 million through a single bridge alone.

The trends discussed throughout this report – in particular sanctions against mixers – indicate that chain hopping is likely to be an increasingly popular money laundering technique. Largely constituting this risk will be criminals seeking to access obfuscation and DeFi investment services across different blockchains.

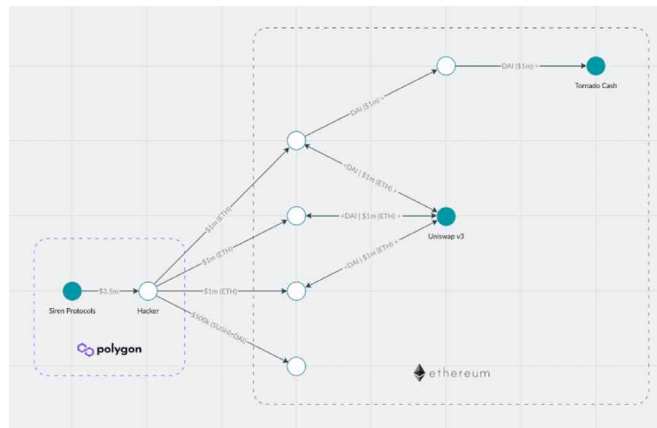
E Cross-chain Tracing Through the Siren Protocol Exploit

On September 3rd 2021, an exploiter took advantage of a re-entrancy vulnerability on the Siren Protocol – a Polygon-based DeFi service. The attacker stole approximately \$3.5 million of UNI, KNC, Wrapped ETH, Wrapped MATIC, USDC and SUSHI tokens.

The exploiter then bridged these assets to the Ethereum blockchain, with \$3 million being withdrawn as ETH and \$500,000 as SUSHI and DAI. The exploiter then swapped the \$3 million ETH through Uniswap to receive \$3 million in DAI. \$1 million of DAI was then transferred to another address, which then began laundering it through Tornado Cash.

The exploiter demonstrates a multitude of cross-chain criminal use cases discussed throughout this report, including the use of bridges and DEXs as layers of obfuscation, the attractiveness of stable-value and un-freezable assets such as DAI and the use of Tornado Cash. Below, Elliptic's Holistic Screening capabilities demonstrate how these processes can be traced through a single investigation – a functionality not available in legacy solutions.

Elliptic Nexus shows the cross-chain and cross-asset swaps of the Siren Protocol exploiter.



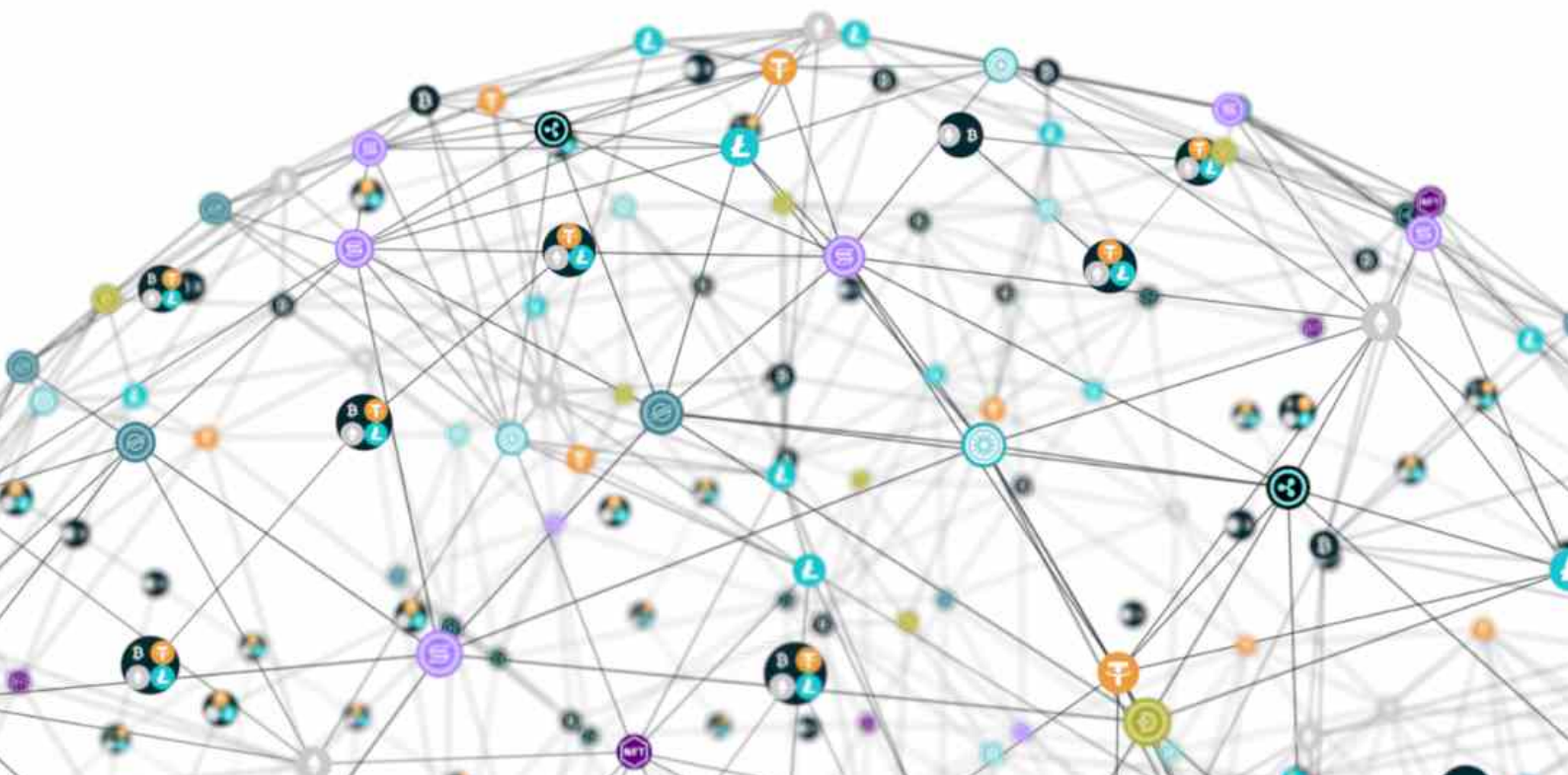
Conclusion

It has long been argued that crime has always managed to stay “one step ahead” of law enforcement – even in the days of cash and traditional forms of money laundering.²⁵ With rapid technological advances both within and around the crypto space, this assertion risks becoming even more true, as the “arms race” between criminals and law enforcement potentially continues to widen.

That chain hopping has reached the awareness of the global standard-setter for anti-money laundering and combatting the financing of terrorism – the Financial Action Task Force (FATF) – sends a clear message to virtual asset services: action is required. This report has demonstrated in no uncertain terms that as crypto crime continues to innovate, compliance teams must also innovate to remain ahead of emerging risks. In particular, the sanctioning of Tornado Cash is likely to bring with it a growing displacement of crypto money laundering to other methods, such as chain hopping.

Already, cross-asset and cross-chain swapping services have been harnessed by criminals to launder over \$4.1 billion of proceeds from illicit or high risk origins. The sources of these funds – which include a range of sanctioned entities, terrorist organizations, crypto heists and other serious crimes – risk harming wider innovation in the crypto space and motivating restrictive responses by more jurisdictions. Addressing the cross-chain problem is therefore a vital step to ensure that crypto continues to innovate positively and remains accessible to everyone.

This report – and the introduction of Holistic Screening as the next generation of blockchain analytics solutions – is Elliptic’s answer to this long-standing problem. As cross-asset and cross-chain transactions become ever more seamless, these capabilities are a major leap forward in closing the criminal arms race.



Methodology

The figures in this report are produced from Elliptic's internal dataset on illicit activity occurring on different blockchains. All customers of Elliptic will be able to replicate and verify the results through access to Elliptic Lens or Elliptic Investigator.

Data collection took place by analyzing the incoming exposure of cryptoassets to all decentralized exchanges (DEXs), cross-chain bridges or coin swap services within Elliptic's data. Incoming exposure refers to the origin of cryptoassets flowing into these services – regardless of the number of intermediary wallets or transactions between them. Data collected for DEXs includes only (1) proceeds of Ethereum-based thefts and (2) proceeds of thefts that originally bridged their stolen funds from another blockchain to Ethereum before using a DEX.

Illicit and high risk origins were then identified and grouped to ensure coherent and accessible data presentation. These groups were: Thefts, Suspected North Korean (Lazarus Group) Heists, Dark Web Services & Markets, Scams & Ponzi Schemes, Illicit Virtual Asset Service Providers (VASPs), Gambling, Ransomware, Data Vendors and OFAC Sanctioned Entities.

"Suspected North Korean Heists" were detached from "Thefts" where appropriate, as the processing of these funds potentially has sanctions implications. Confirmed North Korean heists, such as that of Ronin Bridge, are included in the "OFAC Sanctioned Entities" category. An "other" category encompassed illicit activity that did not have notable values flowing into DEXs, bridges or coin swap services, such as extortion, malware, terrorism & extremism.

OFAC sanctioned entities were only considered as such for cryptoassets originating from them after they were sanctioned. Before their sanction dates, any funds originating from them were recategorized. For example, SUEX – sanctioned by OFAC on 8 September 2021 – was considered an illicit VASP for all funds originating from it before that date. Since Tornado Cash was sanctioned in August 2022, it is considered as its own separate category where relevant.

Cryptoassets considered ranged according to the typical use cases of the services analyzed. For example, illicit activity relating to coin swap services were almost entirely in Bitcoin, while funds flowing into DEXs ranged across several obscure ERC-20 tokens. At the very least, analyses included BTC, ETH and stablecoins USDT, USDC, DAI and Wrapped BTC on the Ethereum blockchain. Additional assets considered are flagged in relevant sections and charts.

Timeframes for data collection begin from whenever data was available (which varied according to entity) – up to and including July 2022. Notable August DeFi exploits are also included for DEXs. Where USD values of cryptoassets are shown, they are calculated through the exchange rate at the time of transaction.

Illicit activity discussed in this report contains services and vendors that may not constitute lawbreaking in certain jurisdictions. These include gambling services, marijuana vendor shops and dark web services that sell anonymity-enhancing browsing solutions.

Glossary

Address: a cryptoasset address is a unique identifier that serves as a virtual location where a cryptoasset can be sent. The address can be freely shared with others to facilitate transactions.

Automated Market Maker (AMM): see “DEX”.

Blockchain: a blockchain is the transaction database shared by all nodes participating in a specific cryptoasset network. A full copy of a network’s blockchain contains every transaction ever executed in the asset. It was first introduced in the Bitcoin whitepaper published in October 2008 as the underlying protocol to allow truly peer-to-peer transactions.

Carding: the process of stealing identity or credit card information through hacking consumer databases or “skimming” payment cards through point-of-sale (PoS) terminals infected with malware.

Centralized exchange: a centrally-managed virtual asset service that allows users to hold, trade and exchange cryptoassets. Also known simply as a “crypto exchange”.

Chain hopping: a money laundering technique where a criminal exchanges cryptoassets on one blockchain to another – possibly multiple times – to obfuscate their transaction trails.

Coin Swap service: a usually non-transparent online service that allows users to swap their cryptoassets without verifying their identity or opening an account. Many of these services are typically based in Russia or Iran.

Cross-asset: the process of exchanging cryptoassets on one blockchain to cryptoassets on another, usually through the use of a centralized exchange, a coin swap service or a decentralized exchange (DEX).

Cross-chain: the process of exchanging cryptoassets on one blockchain to cryptoassets on another, usually through the use of a centralized exchange, a coin swap service or a cross-chain bridge.

Cross-chain bridge: a usually-decentralized protocol that allows users to exchange cryptoassets across blockchains.

Cross-chain problem: the issue that the legacy blockchain solutions that many compliant virtual asset services have in place for AML/sanctions compliance are unable to trace through cross-chain or cross-asset blockchain transactions – a key weakness exploited by crypto criminals.

Cryptoasset: a cryptoasset is a digital asset that is secured with cryptography and where transactions are distributed and validated by a decentralized set of participants, and recorded on a public ledger known as a blockchain.

Cryptocurrency: the term “cryptocurrency” can be used as an umbrella term for virtual forms of money, but is generally used when talking about assets which are supported by a blockchain like Bitcoin (BTC). Cryptocurrencies are not issued or controlled by any government or other central authority. They exist on peer-to-peer networks of computers running free, open-source software. Generally, anyone who wants to participate by owning, sending or spending can do so. The term “crypto” is often used when speaking and writing.

DAI: a stablecoin pegged to the US Dollar that is not freezable by a centralized entity.

Dark Market: dark markets are marketplaces available on the dark web which allow users to sell a range of goods and services. However due to the largely anonymous nature of the dark web, many of the items for sale are illicit.

Decentralized: where no central counterparty has unilateral control of a system and consensus across participants is required to effect changes.

Decentralized Exchange (DEX): a service, typically running on smart contracts, that allows users to swap between cryptoassets on the same blockchain. Examples include Uniswap and SushiSwap.

Decentralized Exchange (DEX) Aggregator: a service that searches through many decentralized exchanges to identify the best conversion rate for a specific cryptoasset swap pair. Examples include 1inch and CoW Protocol.

Decentralized Finance (DeFi): decentralized finance (DeFi) is a peer-to-peer, decentralized, censorship-resistant financial system. Common DeFi applications include crypto wallets, lending, borrowing, spot trading, margin trading, interest-earning, market-making, derivatives, options and more.

Ethereum: the Ethereum blockchain is a network with the ambition of being a decentralized world computer. As such, it offers a more function rich protocol than the Bitcoin blockchain and allows users to transfer the native asset Ether (ETH) as well as creating smart contracts and tokens, or creating more complex decentralized applications (DApps). Ethereum was launched in 2015 and its co-creator Vitalik Buterin is a well known individual in the blockchain world – often speaking at conferences and being active in the space.

ERC20: ERC-20 is a technical standard for the implementation of tokens on the Ethereum blockchain, although it has also been adopted by other compatible blockchains. The rules within the standard include how tokens are transferred between addresses and how data within each token is accessed. Tether (USDT) is a well-known example of an ERC-20 token and many more can be tracked online.

Flash Loan: a flash loan is a means of borrowing funds – typically used for arbitrage – that must be repaid within the same block. However, there have been examples where flash loans have been used nefariously to steal funds and exploit smart contracts.

Holistic Screening: the ability to screen and trace blockchain activity across all cryptoassets.

Know Your Customer: know-your-customer (KYC) standards help protect the financial services industry against fraud, money laundering, corruption and terrorist financing. They involve the checking and verifying of a client's identity both at the onboarding stage and as part of continuing obligations.

Lazarus Group: a North Korean state-affiliated cybercriminal group responsible for a large number of crypto and traditional financial heists, as well as the notorious Sony Entertainment hack in 2014. The group is sanctioned by the United States and is also known as "Appleworm", "APT-C-26", "GROUP 77", "Guardians of Peace", "Hidden Cobra", "Office 91", "Red Dot", "Temp. Hermit", "The New Romantic Cyber Army Team", "Whois Hacking Team" or "Zinc".

Malware: malicious software which bad actors will look to deploy onto a target's computer with the aim of stealing sensitive information.

Multi-asset Screening: the ability to check incoming and outgoing cryptoasset flows of a certain wallet for all cryptoassets it has ever held at once, without the need to screen the wallet for each asset separately.

Non-Fungible Tokens (ERC721/ERC1155): a non-fungible token (NFT) is a kind of cryptoasset that records ownership of a digital item and unlike cryptoassets such as Ether (ETH) and Bitcoin (BTC), is not mutually interchangeable. Each NFT is a unique asset in the digital world and can be bought and sold like any other item.

NFT collection: a set of NFTs minted using the same smart contracts. Over time, the smart contract of reference of an NFT collection may change due to improvements or changes in the protocol.

NFT Marketplace: a marketplace where users can buy, sell and browse non-fungible tokens.

Office of Foreign Assets Control (OFAC): the Office of Foreign Assets Control (OFAC) of the US Department of the Treasury administers and enforces economic and trade sanctions based on US foreign policy and national security goals against targeted foreign countries and regimes, terrorists, international narcotics traffickers, those engaged in activities related to the proliferation of weapons of mass destruction, and other threats to the national security, foreign policy or economy of the United States.

Phishing: where illicit actors will send emails pretending to be from recognized companies or senders in the hope of tracking the recipient to share personal or sensitive information.

Ponzi scheme: a type of financial scam where victims are encouraged to invest in a non-existent product or service and recruit others to do the same, after which initial investors will be compensated with the investments of later victims. The scheme collapses when new investments dry up and the scheme is no longer able to pay earlier investors.

Ransomware: malicious software that encrypts a victim's files and demands a ransom – usually in cryptoassets – in return for the decryption key.

Ren: a cross-chain bridge that has been used to launder over \$540 million of illicit cryptoassets.

Rug Pull: where a project will raise capital and then disappear with the money before delivering any roadmap promises.

Smart Contract: a smart contract is a computer program or a transaction protocol which is intended to automatically execute, control or document legally relevant events and actions according to the terms of a contract or an agreement. It was initially conceived by Nick Szabo in 1998 and later implemented on blockchains such as Ethereum.

Stablecoin: a cryptoasset that is pegged at a fixed exchange rate to another asset or currency, such as the US Dollar.

Tether (USDT): a stablecoin pegged to the US Dollar, operated by Tether Limited Inc.

Token: the term token refers to a programmable unit of value which is recorded and transferred on a blockchain. However, it is distinct from the native asset which is the cryptocurrency created by the protocol and used to pay fees, created as a block subsidy or used in the consensus protocol. The most popular token standard is ERC-20 on the Ethereum blockchain. Tether (USDT) is an example of a token on the Ethereum blockchain. Ether (ETH) is the native asset of Ethereum.

Tornado Cash: a decentralized mixer operating on numerous blockchains before being sanctioned by the United States in August 2022. Tornado Cash mixed over \$7.1 billion of cryptoassets, of which \$1.54 billion was confirmed to have originated from illicit sources.

Uniswap: the largest decentralized exchange (DEX) on the Ethereum blockchain.

USD Coin (USDC): a stablecoin pegged to the US Dollar, operated by Circle.

Virtual Asset Service Provider (VASP): a business that deals with virtual assets. Examples include centralized exchanges and payment service providers.

Wallet: a wallet is a collection of cryptoasset addresses and the corresponding private keys. They allow cryptoassets to be stored, keeping them safe and accessible. They also allow you to send, receive, and spend cryptoassets. Wallets can be self-hosted (where you retain control of the private keys) or hosted (where a custodian stores the private keys on your behalf).

Wrapped ETH / Wrapped BTC: a cryptoasset similar to a stablecoin that is pegged to another cryptoasset (e.g. Wrapped ETH would be pegged to ETH). Wrapped tokens are often used to invest in DeFi protocols and allow representations of cryptoassets on different blockchains to be used as investments.

Notes & Citations

1. "Targeted Update on Implementation of FATF's Standards on VAs and VASPs". Financial Action Task Force (FATF). 2022. [Available at: www.fatf-gafi.org/publications/fatfrecommendations/documents/targeted-update-virtual-assets-vasps.html].
2. Elliptic Internal Analysis.
3. Tom Robinson and Chris DePow. "DeFi: Risk, Regulation, and the Rise of DeCrime". 2021. [Available at: www.elliptic.co/resources/defi-risk-regulation-and-the-rise-of-decrime].
4. Arda Akartuna, Matt Nadini, Chris DePow, Tara Annison. "NFTs & Financial Crime". *Elliptic*. 2022. [Available at: www.elliptic.co/resources/nfts-financial-crime].
5. "U.S. Treasury Issues First-Ever Sanctions on a Virtual Currency Mixer, Targets DPRK Cyber Threats". *U.S. Department of the Treasury*. 2022. [Available at: home.treasury.gov/news/press-releases/jy0768].
6. David Carlisle. "Why Holistic Screening is Crucial for Sanctions Compliance". *Elliptic Connect*. 2022. [Available at: hub.elliptic.co/analysis/why-holistic-screening-is-critical-for-sanctions-compliance/].
7. "The Dominance of Uniswap V3 Liquidity". *Uniswap*. 2022. [Available at: uniswap.org/blog/uniswap-v3-dominance].
8. Tether (@tether_to). Twitter post. 1:41 PM. 25 August 2021. [Available at: twitter.com/Tether_to/status/1430510652582416387?s=20&t=Ash6q7a6gIMQxyqYX7M8SA].
9. Paolo Ardonio (@paoloardonio). Twitter post. 9:28 AM. 26 September 2020. [Available at: twitter.com/paoloardonio/status/1309771801581494272?s=20&t=idGWDo3HuFN9gL7tKfVF9w].
10. Nomad (@nomadxyz_). Twitter post. 4:20 PM. 23 August 2022. [Available at: twitter.com/nomadxyz_/status/1562097376214388736?s=20&t=lZr0hz5gXq7r71dOg5Ntjw].
11. "Tornado Cash Mixer Sanctioned After Laundering \$1.5 Billion". *Elliptic Connect*. 2022. [Available at: hub.elliptic.co/analysis/tornado-cash-mixer-sanctioned-after-laundering-over-1-5-billion/].
12. Fei Protocol (@feiprotocol). Twitter post. 11:08 AM. 30 April 2022. [Available at: twitter.com/feiprotocol/status/1520344430242254849?s=20&t=jgth9exby0O6_RAiCFFq6A].
13. "The Poly Network Hack: \$600 Million in Crypto Stolen and Returned in 24 Hours". *Elliptic Connect*. 2021. [Available at: hub.elliptic.co/analysis/the-poly-network-hack-600-million-in-crypto-stolen-and-returned-in-24-hours/].
14. Elliptic Internal Analysis.
15. "Liquid Exchange Hacked: \$97 Million Stolen". *Elliptic Connect*. 2021. [Available at: hub.elliptic.co/analysis/liquid-exchange-hacked-97-million-stolen/].

16. "Warning". Conti News (Dark Web Blog). 2022. [URL redacted].
17. Shane D. Johnson, Rob T. Guerette and Kate Bowers. "Crime Displacement and Diffusion of Benefits" (Chapter 17) in *The Oxford Handbook of Crime Prevention*. Brandon C. Welsh and David P. Farrington (eds). 2012. Pages 337-353. [doi.org/10.1093/oxfordhb/9780195398823.013.0017].
18. See, for example, the AML/KYC policies of ChangeNOW, a popular Coin Swap Service (2021). [Available at: changenow-io.medium.com/what-is-aml-kyc-and-why-do-i-have-to-pass-it-ab3bb2f59d68].
19. Tom Robinson. "Cybercriminals Have Built Their Own Blockchain Analytics Tool". *Elliptic Connect*. 2021. [Available at: hub.elliptic.co/analysis/cybercriminals-have-built-their-own-blockchain-analytics-tool/].
20. "Treasury Sanctions Russia-Based Hydra, World's Largest Darknet Market, and Ransomware-Enabling Virtual Currency Exchange Garantex". *U.S. Department of the Treasury*. 2022. [Available at: home.treasury.gov/news/press-releases/jy0701].
21. "Crypto Addresses Holding NFTs Worth \$532,000 Among the Latest Sanctioned by OFAC". *Elliptic Connect*. 2021. [Available at: hub.elliptic.co/analysis/crypto-addresses-holding-nfts-worth-532-000-among-the-latest-sanctioned-by-ofac/].
22. "Investigation involving crypto-currency company." New Zealand Police. 2019. [Available at: police.govt.nz/news/release/investigation-involving-crypto-currency-company].
23. Find out more about Elliptic Discovery at: elliptic.co/solutions/vasp-tracking.
24. Since coin swap services are centralized and do not operate through smart contracts like most DEXs and cross-chain bridges, only some can be traced through using blockchain analytics.
25. Charles A. Intriago. "Money Laundering in Florida: Banking Compliance, Federal Enforcement Measures, and the Efficacy of Current Law: Hearing Before the Subcommittee on Consumer and Regulatory Affairs of the Committee on Banking, Housing, and Urban Affairs, United States Senate, One Hundred First Congress, First Session". 1989.

About the Authors



Eray Arda Akartuna

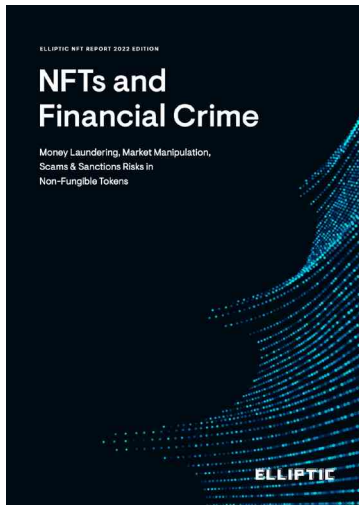
Arda is Elliptic's Senior Crypto Threat Analyst with a focus on crypto-based terrorist financing, dark web vendors, NFTs and DeFi-related crime. He is also a PhD researcher at the Dawes Centre for Future Crime at University College London (UCL), focusing on the money laundering and terrorist financing risks of emerging technologies. He has advised numerous international organizations, public and private sector entities on future crime issues – including the UK Government, US federal agencies and the United Nations International Narcotics Control Board. He has lectured on topics such as Horizon Scanning, Research Design and Crypto Crime.



Thibaud Madelin

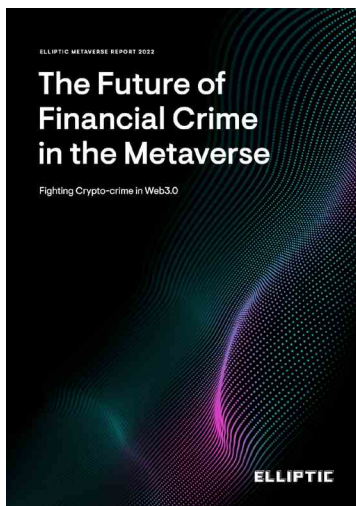
As Elliptic's Research Lead, Thibaud brings considerable law enforcement investigative experience as an Organised Crime, Cybercrime and Cryptoassets specialist for HM Revenue and Customs (HMRC) – the UK tax authority. He was instrumental in penetrating a sophisticated transnational cybercriminal group responsible for a sustained attack on the UK tax system, which led to the UK's first seizure of NFTs. As a Subject Matter Expert he has led cryptoasset training for HMRC officers and the Romanian Border Police. He has also advised HMRC Senior Management and the Joint Money Laundering Intelligence Taskforce on crypto crime matters.

Other Reports by Elliptic



NFTs and Financial Crime

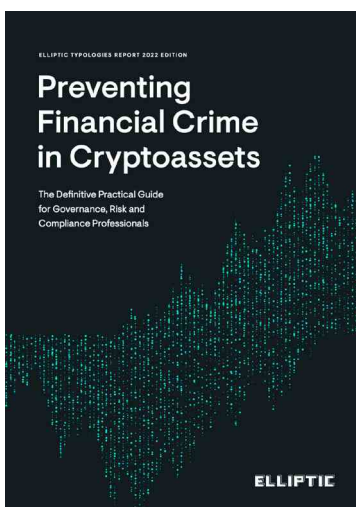
This report provides and explains the latest NFT trends to understand their financial crime risks. Guidance is also provided on regulatory matters concerning NFTs and the utilization of blockchain analytics to detect, investigate and prevent exposure to illicit activity. The report is intended for all stakeholders engaging with NFTs. It provides red flag indicators and recommendations to improve the safety, security and enjoyment of partaking in this rapidly growing industry.



The Future of Financial Crime in the Metaverse

This guide deep dives into financial crime typologies using metaverse-related cryptoassets, in order to arm compliance teams with a comprehensive set of warning signs and case studies on:

- Illicit activity involving cryptoassets in the metaverse.
- Examples of how these indicators fit into broader criminal behaviors.
- Context on how criminals engaged in these activities are working to clean their illicit funds.



Preventing Financial Crime in Cryptoassets: Typologies Report 2022

This report is designed to equip governance, risk and compliance professionals with the knowledge and insights needed to proactively and practically:

- Identify specific money laundering and terrorist financing risks
- Develop anti-money laundering and counter terrorist financing (AML/CTF) governance systems
- Evolve the controls in place to manage risk to business, customers, and society.

About Elliptic

Elliptic is the global leader in cryptoasset risk management for crypto businesses, governments, and financial institutions worldwide. Recognized as a WEF Technology Pioneer and backed by investors including J.P. Morgan, Wells Fargo Strategic Capital, SBI Group, and Santander Innoventures, Elliptic has assessed risk on transactions worth several trillion dollars, uncovering activities related to money laundering, terrorist fundraising, fraud, and other financial crimes. Elliptic is headquartered in London with offices in New York, Singapore, and Tokyo.

Bad actors continue to find new ways to support their criminal activities. Between editions of this report you will find the latest insights and trends around money laundering and terrorist financing using cryptoassets on Elliptic Connect.

elliptic.co/connect

ELLIPTIC



[Connect on LinkedIn](#)



[Follow us on Twitter](#)



[Contact us at hello@elliptic.co](mailto:hello@elliptic.co)