

t-TON: the Trustworthy and Open Network (Hackthon Sybil Analysis on Airdrop)

1. Intro

With the TON blockchain's rapid growth—surging from over 10 million to 100 million accounts between April and October 2024—the rise of Sybil attacks has become a pressing issue. This project, **t-TON: the Trustworthy and Open Network**, aims to counteract these bot-driven activities that exploit airdrops through advanced AI and data-driven Sybil detection.

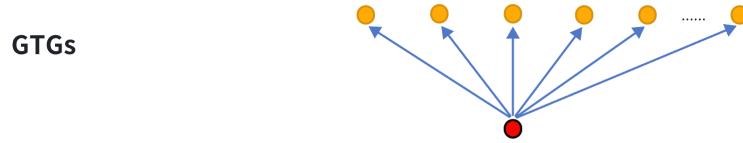
Our approach began with analyzing the NOT airdrop, laying the groundwork for a generalizable Sybil detection framework adaptable to future airdrops. We had identified a cumulative total of 561,883 Sybil accounts out of a base of 3,136,304 airdrop addresses with outgoing transactions, resulting in a Sybil rate of 17.92%. Unlike EVM, TON's unique challenges, such as data sparsity, asynchronous architecture, and the absence of Sybil assessment standards, require innovative solutions. To address these challenges, we developed a multi-faceted detection framework that leverages TON's distinct features while adapting proven methodologies from the EVM ecosystem.

The project will deliver an adaptive Sybil detection methodology and valuable insights into Sybil activities on TON, supporting the transformation of TON into a more Trustworthy and Open Network.

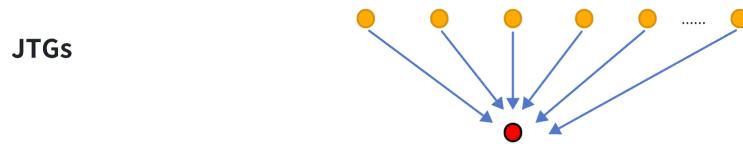
2. Methodology

Sybil attackers exploit bots and automated scripts to manage multiple accounts, enabling them to interact extensively with the TON chain. These bulk-operated accounts exhibit interconnected and similar behaviors, allowing them to be grouped into a single cluster for identification. We have developed three approaches targeting each phase of Sybil cluster formation—**generation, transfer, and consolidation** to identify TON Sybil accounts. By leveraging Gas Transfer Graphs (GTGs), Jetton Transfer Graphs (JTGs), and centralized exchange deposit patterns, this framework enables comprehensive detection of Sybil behaviors.

Approach 1 (Two-Phase Approach): In EVM, Trusta Labs has developed a two-stage framework that uses AI and machine learning clustering algorithms to identify Sybil clusters. Please refer to <https://medium.com/@trustalabs.ai/trustas-ai-and-machine-learning-framework-for-robust-sybil-resistance-in-airdrops-ba17059ec5b7> for a comprehensive overview of our approach.



Star-Like Pattern

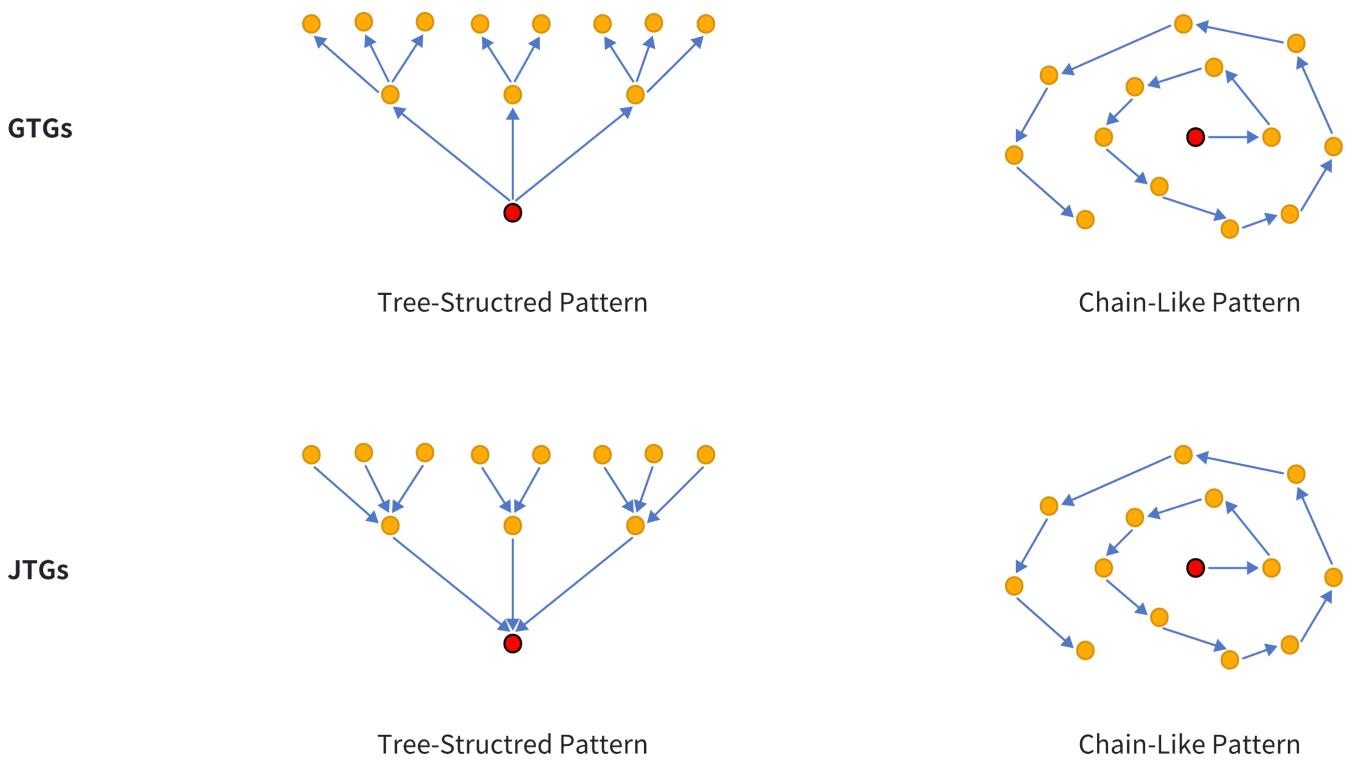


Star-Like Pattern

- **Stage One** employs community detection algorithms such as Louvain and K-CORE to analyze **Gas Transfer Graphs (GTGs)** and **Jetton Transfer Graphs (JTGs)**. The **GTGs** track the initial transfer of native gas token (in the case the TONCOIN) from the same core wallet to many other wallets (forming a Star-Like pattern). Likewise, JTGs are assessed to identify any star-like formations where multiple addresses consolidate funds into a single suspicious address. Notably, most jetton cluster transfers tend to complete within a single day. Therefore, we specifically focus on the jetton transfer information based on the first transfer-out date for these addresses, as this provides a closer connection to their behavior with the jetton transfers, compared to analyzing all jetton transfers indiscriminately. This stage aims to detect tightly connected and suspicious Sybil groups.
- **Stage Two** focuses on analyzing account profiles and on-chain behaviors, with the snapshot taken on 2024-09-28. The K-means algorithm is applied to further refine the results of Stage One by clustering similar accounts, reducing false positives in the process.

In summary, we first use graph mining algorithms to identify Sybil clusters and then apply account behavior analysis to filter out false positives, enhancing the overall accuracy.

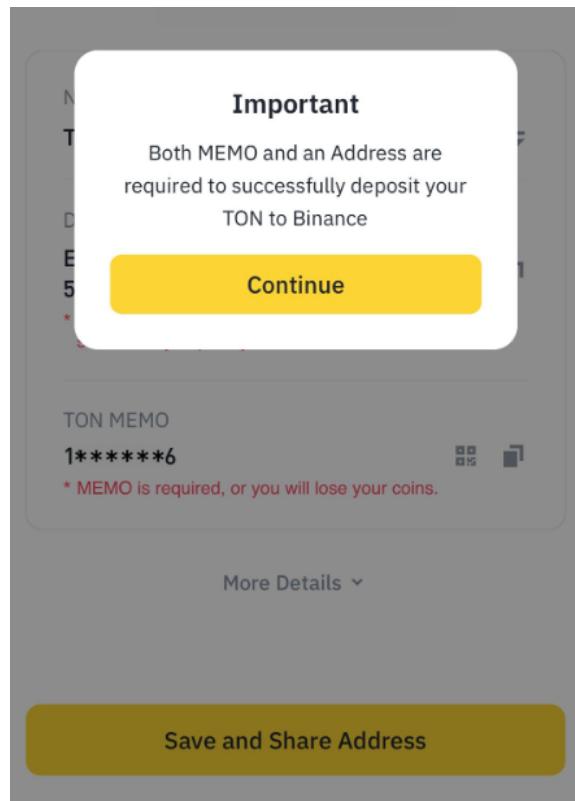
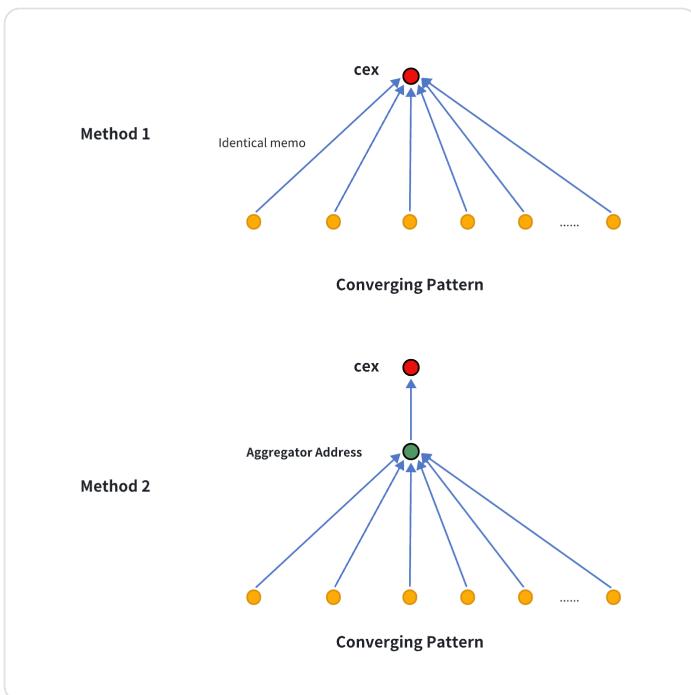
Approach 2 (Highly Suspicious GTGs and JTGs): Only based on graph mining algorithms on Gas Transfer graphs (GTGs) and Jetton Transfer Graphs (JTGs), we can find highly suspicious pattern such as **Tree-Structured** and **Chain-like**, illustrated in the following diagrams.



These two token transfer patterns, while having a size of five or more, will be classified as suspicious Sybil clusters.

Please note the subtle difference in the patterns between GTGs and JTGs. In GTGs, a single address tends to distribute TON to multiple addresses as an initial gas fee, resulting in a diffusion-like structure. Conversely, in JTGs, multiple addresses often consolidate jetton tokens to a single address to save on gas fees, forming a convergence-like structure.

Approach 3 (Airdrop Collection into CEX): Sybil accounts often deposit airdropped token into the same centralized exchange (CEX) account during the token collection phase. Due to KYC requirements, only a limited number of CEX accounts are available for such deposits. Trusta has developed an approach to identify convergent token flows into the same CEX account. As illustrated in the left diagram, these convergent flows signal suspicious behavior. Additionally, it's important to note that a MEMO number is necessary when depositing tokens from TON to a CEX like Binance (as illustrated in the right diagram). We have extracted the MEMO number from Jetton transfers. Consequently, we identify a group of Sybil wallets if they have sent airdropped Jettons to the same address under CEX using the identical MEMO number.



We consider two related convergence methods:

- **Method 1:** Directly consolidating tokens from the TON chain to a specific CEX address. These addresses deposit Jettons into the CEX using the same MEMO information. Additionally, we require these clusters to consist of five or more unique addresses.
- **Method 2:** Consolidating tokens on the TON chain to a specific *Aggregator Address*, which then deposits the Jettons into the CEX. Similarly, we require these clusters to consist of five or more unique addresses.

It's worth noting that although the convergence methods described in Approach 3 bear a resemblance to the star-like patterns in Jetton Transfer Graphs (JTGs), there is a key distinction. Approach 3 includes the consolidation process of funds being deposited into a CEX, while JTGs emphasize the transfer process. Additionally, Approach 3 considers all Jetton transfers, whereas JTGs focus specifically on transfers from the first transfer-out date. Consequently, for JTGs, we incorporate additional on-chain behavior analysis to ensure sufficient evidence that the identified clusters are indeed Sybil accounts.

3. Challenges and Innovative Adaptations

Currently, aside from KYC, there are no specialized Sybil prevention methods tailored for the TON chain. The unique structure of the TON blockchain presented substantial challenges in data parsing and understanding, particularly in tracking the flow of funds. Unlike EVM, where Sybil clusters can be identified by analyzing initial funding sources and straightforward address-to-address transfers, TON's tree-like structure complicates tracking direct fund flows and lacks the well-defined feature variables necessary for capturing comprehensive on-chain behaviors.

This hindered the direct application of conventional Sybil detection methods and pushed us to explore innovative solutions.

However, these challenges also revealed valuable opportunities. TON's unique MEMO feature—a distinct aspect of its transactions—enabled us to link addresses under the same KYC identity within centralized exchanges, providing a crucial tool for analyzing Jetton consolidation patterns. Leveraging this discovery, we developed new methods, including Jetton Transfer Graphs (JTGs) and Airdrop Collection into CEX analysis, to effectively trace fund aggregation and Sybil activity across related accounts.

The limitations of EVM-based methods compelled us to delve deeper into TON's jetton transfer processes, ultimately leading to these innovative approaches. This adapted framework, specifically tailored to TON's unique structure, not only overcame initial data tracking challenges but also proved highly effective in establishing a robust and comprehensive Sybil detection system within the TON ecosystem.

4. Case Analysis

4.1 Sybil Cluster 1: Star-shaped GTGs Sybil Pattern Detected from Approach 1

This sybil cluster consists of 463 Sybil accounts on the TON chain. The algorithm has found several evidences in support of the judgement:

1. All of these accounts received their first Native 0.3 TON on 2024-03-25, from the same address EQAxCUPMC1ppR-V21bJb9SCEbhTML4TEnVQogEmwizY1DN6 (Non-bounceable: UQBkelqdhcz_rcaCF3iLh-g_fYdXr3zF6YKWSn0YQGTzLoyF) (Figures 1 and 2). This forms a star-shaped Gas Transfer Graph (GTG).

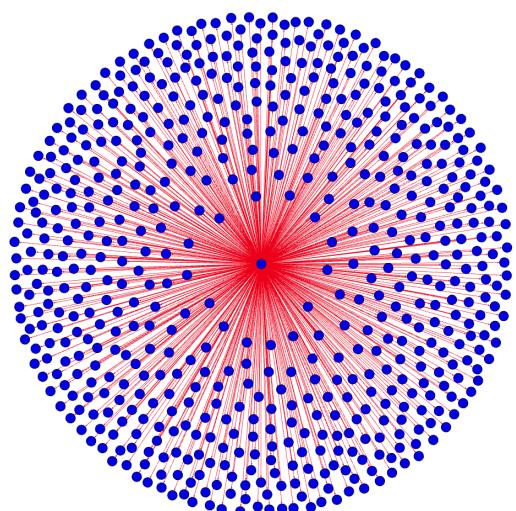


Figure 1: Star-shaped initial fund transfer diagram

Address	UQAxCUPMC1ppR-V21bJb9SCEbhTML4TEnVQogEmwizY1DN6_	QR
Balance	0 TON = \$0	
Contract type	wallet_v4r2 ⓘ	
• Active	0:310..6350c ton.cx - toncoin.org	
History	Transactions	Code
		24 Mar 2024 - 26 Mar 2024 ⓘ
25 Mar 15:44	↑ Sent TON	UQBVu8Rd_-RS1W1br
25 Mar 13:58	↑ Sent TON	UQA19V59_Y_Dfnqe6
25 Mar 12:37	↑ Sent TON	UQAMLqIe_DIXje_DA
25 Mar 12:37	↑ Sent TON	UQAzk9es_YxzDFz_g
25 Mar 12:36	↑ Sent TON	UQA19V59_Y_Dfnqe6
25 Mar 12:36	↑ Sent TON	UQBnuAy0_QRJxFV_t
25 Mar 12:35	↑ Sent TON	UQD0Au92_tPpaRpw9
25 Mar 12:35	↑ Sent TON	UQD11CY_aINH7AZZ
25 Mar 12:35	↑ Sent TON	UQBmWspY_t1FxVxQH
25 Mar 12:34	↑ Sent TON	UQBHY_O_1UTdi2TVH
25 Mar 12:34	↑ Sent TON	UQDHhszb_INwSX9uI
25 Mar 05:55	↑ Sent TON	UQA_09rs...rEKQqsJB
25 Mar 05:55	↑ Sent TON	UQBH1y01_0GDkQDF

Figure 2: First fund transfers on tonviewer (partial display)
https://tonviewer.com/UQAxCUPMC1ppR-V21bJb9SCEbhTML4TEnVQogEmwizY1DN6_

2. They all possess nearly identical on-chain profiles, including the number of total transactions, the frequency of calling different operation methods, the number of unique interaction addresses, and the number of active days, weeks and months. (As shown in Figure 3)

	address	group_size	ext_in_all_hash_cnt	ext_in_all_date_cnt	all_method_cnt	all_to_addr_cnt	ext_in_all_week_cnt	ext_in_all_month_cnt	date_range	days_from_start
	EQDXdFei8BiAJvNpPn8rn4z_LinDbadNMM5SwScLHnEkz49-	463	4.0	4.0	3	4	4.0	3.0	194	211
	EQCO6c_SqRkWoWyjX0joReIRlhxZqNd8XJnHPsgo2atzpC	463	4.0	4.0	3	4	4.0	3.0	194	211
	EQBzVEYEaUwR1wCGEZgCKHecw_QNIm7Fm0wbIEosWHr9Ct45	463	4.0	4.0	3	4	4.0	3.0	194	211
	EQBCjkjoy1-F_enlYPN6qVKN5X4WuT4XQIYYv_SZeOLQIHq	463	4.0	4.0	3	4	4.0	3.0	194	211
	EQCu0XlmLjk3Y6EiyU3bxjdJ2K-pM6Kwf1T02DrwJzHctYBV	463	4.0	4.0	3	4	4.0	3.0	194	211

	EQBkelqdhcz_rcaCF3iLh-g_fYdXr3zF6YKWSn0YQGTzLtFA	463	4.0	4.0	3	4	4.0	3.0	194	211
	EQBpkkrkEa3UTD_59Jcv44ZrKBNzMxsAl3RTN8Wot7QV64Ez	463	4.0	4.0	2	3	4.0	3.0	194	211
	EQBOO_ExoFP8UJxW93C0VLQyC8NwB37l3zN3xoF-YELJpZm	463	4.0	4.0	3	4	4.0	3.0	194	211
	EQB_Cm3M0wxV0t5liMMf0Sz47vV2P-FzGJeViNgD3wa5Ajz	463	4.0	4.0	2	3	4.0	3.0	194	211
	EQBfvKmN5ikwgWEUbRm9TJQPd2i4RwiQvXZlHv_uYxRtDzV	463	4.0	4.0	3	4	4.0	3.0	194	211

Figure 3: On-chain statistical characteristics

3. If we examine their individual on-TON actions from Tonscan, their sequences are quite similar in terms of timing and type. (Ref. Figure 4 & 5). Notably, all these accounts received TON on 2024-03-25, and on around 2024-05-20, they all started transferring \$NOT in the same order of magnitude.

Address	UQDXdFei8BiAJvNpPn8rn4z_LinDbadNMM5SwScLHnEkz9K7
Balance	0 TON ≈ \$0
Contract type	wallet_v4r2 <small>i</small>
• Active	0:d77..124cf ton.cx toncoin.org
History Transactions Tokens <small>1</small> Code Methods Token <small>▼</small> Date <small>▼</small> ...	
04 Oct 17:10	↑ Sent TON EQAGSo-i...DWvZ1Ajw - <small>-0.152093674 TON</small>
20 May 08:46	↑ Send token UQCPZDT-...cSx-jSx0 - <small>-15,505 NOT</small>
25 Mar 18:07	↑ Send NFT UQB0IsoK...CwfRFoye - <small>10,000 \$NOT Voucher </small>
25 Mar 05:35	↑ Sent TON Notcoin Royalty 23c18ab3-f13a-4ff7-8336-cc77cc... -0.06 TON
	↔ Contract deploy EQDXdFei...HnEkz49- Interfaces: [wallet_v4r2]
25 Mar 05:34	↓ Received TON UQAxCUPM...izY1DN6_ - <small>+0.3 TON</small>

Figure 4: Interaction history of one address EQBpkkrkEa3UTD_59Jcv44ZrKBNzMxsAl3RTN8Wot7QV64Ez from the group on tonviewer: https://tonviewer.com/EQBpkkrkEa3UTD_59Jcv44ZrKBNzMxsAl3RTN8Wot7QV64Ez

Address	UQBCjkjoy1-F_enlYPN6qVKN5X4WuT4XQlYYvy_SZeOLQNw			
Balance	0 TON ≈ \$0			
Contract type	wallet_v4r2			
• Active	0:428...38b40	ton.cx · toncoin.org		
History	Transactions	Tokens 1		
Code	Methods			
04 Oct 15:46	↑ Sent TON	EQAGSo-i...DWvZ1Ajw	-0.152089398 TON	
20 May 09:54	↑ Send token	UQCPZDT-...cSx-jSx0	-20,244 NOT	
25 Mar 16:13	↑ Send NFT	UQAT7dMd...5DJX2IQP	10,000 \$NOT Voucher 	
25 Mar 01:16	↑ Sent TON	Notcoin Royalty	deef65a1-a95f-445f-bebc-876d90...	-0.06 TON
	⟨/⟩ Contract deploy	EQBCjkjo...ZeOLQIHq	Interfaces: [wallet_v4r2]	-
25 Mar 00:36	↓ Received TON	UQAxCUPM...izY1DN6_	+0.3 TON	

Figure 5: Interaction history of another address from the group on tonviewer:
https://tonviewer.com/EQBCjkjoy1-F_enlYPN6qVKN5X4WuT4XQlYYvy_SZeOLQIHq

4.2 Sybil Cluster 2: Star-shaped JTGs Sybil Pattern Detected from Approach 1

This sybil cluster consists of 19 Sybil accounts on the TON chain.

1. All of these accounts received their first native TONs on 2024-04-13, though not from the same address. However, on 2024-05-27, the NOT wallets associated with these addresses began transferring the \$NOT tokens they received from the airdrop, consolidating them to the address EQBPu8ty_9PBhET5Jj6IBKlgIHQaq51NjNZUwX0AWIA7A6Oq (Non-bounceable: UQBPu8ty_9PBhET5Jj6IBKlgIHQaq51NjNZUwX0AWIA7A_5v), forming a **Star-shaped Jetton Transfer Graph (JTG)**. Subsequently, this address swapped the received \$NOT tokens for TON and transferred them to mostasharam.ton and Nobitex.

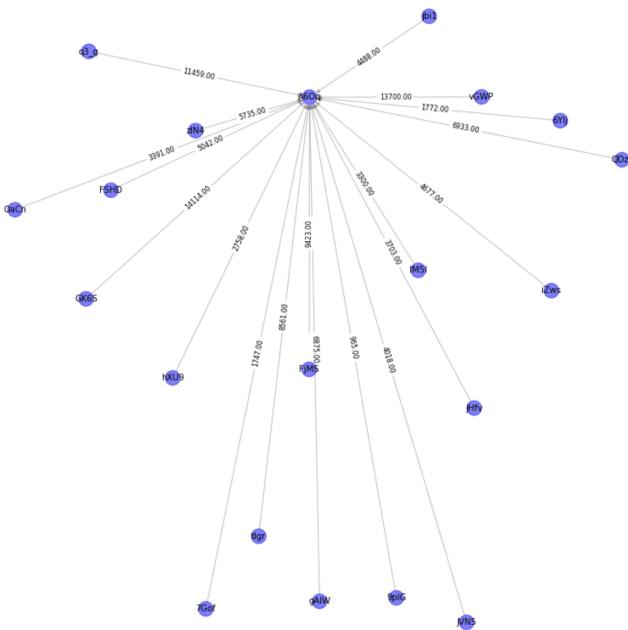


Figure 6: Star-shaped Jetton Transfer Graph

28 May 03:57	↑ Sent TON	mostasharam.ton	-35 TON
28 May 03:27	↓ Received token	UQBgu07m...Ab6jGAA5	+5,529 NOT
28 May 00:13	⇄ Swap tokens	EQCUhn0L...KzucZeER	-31,000 NOT > +34.15 TON
27 May 22:57	↑ Sent TON	Nobitex	1900926486 -33 TON
27 May 21:46	⇄ Swap tokens	EQCUhn0L...KzucZeER	-30,000 NOT > +33.03 TON
27 May 21:41	⇄ Swap tokens	EQCUhn0L...KzucZeER	-30,000 NOT > +30.00 NOT
27 May 21:16	↓ Received token	UQBegLTQ...Ri04iaLU	+3,095 NOT
27 May 20:56	↓ Received token	UQAzeigv...Xor6pIZc	+2 TONNEL
27 May 20:53	↓ Received token	UQCb7el2...-f7IN2Ee	+2,152 NOT
27 May 20:50	↓ Received token	UQAzeigv...Xor6pIZc	+8,253 NOT
27 May 20:48	↑ Sent TON	UQCb7el2...-f7IN2Ee	-0.2 TON
27 May 20:42	↓ Received TON	UQBGVvy..._1KLgnIEK	کارمزد +0.180883445 TON
27 May 20:33	↓ Received token	UQBGVvy..._1KLgnIEK	لایار +5,237 NOT
27 May 20:32	↑ Sent TON	UQBGVvy..._1KLgnIEK	-0.2 TON
27 May 20:26	↓ Received token	UQD-JkeGF...Ge7h5j4	+2,758 NOT
27 May 20:13	↓ Received token	UQCFSo07...goT9MKSH	+21,462 NOT
27 May 19:53	↓ Received token	UQCvtbs...M0BsicHP	+4,677 NOT
27 May 19:31	↓ Received token	UQD9EFFX...k3FA0f11	+3,391 NOT
27 May 19:25	↓ Received token	UQB1chcy...n538GPNK	+14,114 NOT
27 May 19:20	↓ Received token	UQBv1KV...m7ZXFe7X	+9,423 NOT
27 May 19:14	↓ Received token	UQA_93IU...mZzZFvP	+2,771 NOT
27 May 19:06	↓ Received token	UQAESS04...88zwgF_T	+6,865 NOT

Figure 7: Jetton transfers for the aggregator address on tonviewer (partial display)
https://tonviewer.com/UQBPu8ty_9PBhET5Jj6IBKlgIHQaq51NjNZUwX0AWIA7A_5v

2. Similar to the previous case, these addresses also exhibit highly similar on-chain behaviors (as shown in Figure 8).

address	group_size	ext_in_all_hash_cnt	ext_in_all_date_cnt	all_method_cnt	all_to_addr_cnt	ext_in_all_week_cnt	ext_in_all_month_cnt	date_range	days_from_start
EQBnHPtOmKj1JzFzR54xA234SnAxsmah3USzZSpe4V6klJ0l	19	7.0	2.0	4	7	2.0	2.0	44	191
EQD-JkqFzAmrrxCxjDxon5abeBGB_KTwUnGD5OdWGe47hXU9	19	7.0	2.0	4	7	2.0	2.0	44	191
EQALzpYDjvOncLxDrohsJRVNntDQu_FM0DlrdtMq6fUAFSHD	19	8.0	2.0	4	7	2.0	2.0	44	191
EQBVH7FsSw2xVtqCAJ6HZG2TQw8-B8CZ_WiaQjHfPB7Gof	19	7.0	2.0	4	6	2.0	2.0	44	191
EQBz7Y8tQ-TYlukWrQ7do5vvCxpzaf-quRjWExcKhkw3_g	19	8.0	2.0	4	7	2.0	2.0	44	191
EQCdlAf7IPz784D_95vQHG1J33Gw4v5ganM5C95JHfv	19	7.0	2.0	4	7	2.0	2.0	44	191
EQBYStuUIC-Lw8Ezp0azVe1QtDTnQMP0KsVsXvq1KVutigr	19	7.0	2.0	4	7	2.0	2.0	44	191
EQAESD4whv_6TTH4SryaFaqdbeMsfkFxHsPFON88zwgAIW	19	7.0	2.0	4	7	2.0	2.0	44	191
EQBGXyJrcRZk38ntkXLKhmpeUm3ok98IC_hXgaMwPavGWP	19	7.0	2.0	4	6	2.0	2.0	44	191
EQB8F63eB14oXC02JUpDKV-Ub_rx2gYr-2U6W0UUpj6jh1	19	8.0	2.0	4	7	2.0	2.0	44	191
EQCL9pwH2HACowNm6i-L5sJ6TTNYc12pZdeosaKbwTsJVN5	19	7.0	2.0	4	7	2.0	2.0	44	191
EQD9EFX01uJHo56GM3MehiwsfheT1LowLRDVWN8k3FAoAcn	19	7.0	2.0	4	7	2.0	2.0	44	191
EQCLE44SJ5qzY0zDdjmwM2gHOxxmvXve25VA9h1SS7_fzIN4	19	8.0	2.0	4	7	2.0	2.0	44	191
EQBtcHyckdLQqB2IKMaXtpzLoR0BQZnGsBtQAQxn530GK6S	19	7.0	2.0	3	6	2.0	2.0	44	191
EQAQJGMXO61Bw0a0yHu5YLRk44eBGH-BmBwDXePighD6Yj	19	8.0	2.0	4	7	2.0	2.0	44	191
EQDV73eg4QUEkJJTRVlzlz7WfTARSLMfEcBHeKxsjqe09pIG	19	7.0	2.0	3	6	2.0	2.0	44	191
EQCKVbsqnhdnWuNLE7nnbON4cv68MDLMuCmrsmMOBsizws	19	7.0	2.0	4	7	2.0	2.0	44	191
EQBvIK7VvNlgBQ6oaxnXSgywm-Fmpz2QOHTJNX9m7ZXFjMS	19	7.0	2.0	4	6	2.0	2.0	44	191
EQB4URlStV8ptxTpzwE8p4BTuyNQRAVEtbtUdhwJ1QDz-	19	7.0	2.0	3	6	2.0	2.0	44	191

Figure 8: On-chain statistical characteristics

3. Below are the examples of individual address on-chain histories for addresses within this Sybil cluster (Ref. Figure 9 & 10).

Address	UQBnHPtOmKj1JzFzR54xA234SnAxsmah3USzZSpe4V6klJ0g		Balance		Contract type	wallet_v4r2
• Active	0:671...ea494		ton.cx	toncoin.org		
History	Transactions		Tokens	Code	Methods	
27 May 19:03	↑ Sent TON		UQAESD4...88zwgF_T	-	-	-0.872039959 TON
27 May 18:58	↑ Send token		UQBPu8ty...WlA7A_5v	-	-	-3,300 NOT
27 May 18:54	↓ Received TON		UQAZEhd2...LSYF3MT9	-	-	+0.888824877 TON
13 Apr 18:46	↑ Sent TON		UQAZEhd2...LSYF3MT9	-	-	-0.853385085 TON
13 Apr 18:44	↑ Send NFT		UQBPu8ty...WlA7A_5v	-	Zodiac Postmark #3771	
13 Apr 17:52	</> Called contract		EQD2bE1M...7BwC2kRb	0x013a3ca6	-	-0.075 TON
13 Apr 17:52	↑ Send NFT		UQBPu8ty...WlA7A_5v	-	Young Explorer #37723	
13 Apr 17:50	</> Called contract		EQCPXKOy...itxLLQbr	0x013a3ca6	-	-0.075 TON
	</> Contract deploy		EQBnHPt0...4V6klM5l	Interfaces: [wallet_v4r2]	-	-
13 Apr 17:47	↓ Received TON		UQAESD4...88zwgF_T	-	-	+1.071 TON

Figure 9: Interaction history of one address from the group on tonviewer:
<https://tonviewer.com/UQBnHPtOmKj1JzFzR54xA234SnAxsmah3USzZSpe4V6klJ0g>

Address	UQALzpYDjv0ncLxDRohsJRVVntDQu_FM0DIrdtMq6FUAFXwG	
Balance	0 TON ≈ \$0	
Contract type	wallet_v4r2 <small>i</small>	
• Active	0:0bc...50015 ton.cx · toncoin.org	
History Transactions Tokens 1 Code Methods		Token <small>▼</small> Date <small>▼</small> :
27 May 17:08	↑ Sent TON	UQAwRSoV...1ICIYsNF - - -0.117726681 TON
27 May 17:05	↑ Send token	UQBPU8ty...WlA7A_5v - - -5,042 NOT
27 May 17:02	↓ Received TON	UQAQmynQ...Q54EmL8L +0.134766453 TON
13 Apr 22:27	↑ Sent TON	UQBz7Y8t...PkhwqyIl - - -3.737 TON
13 Apr 22:26	✖ Send NFT Failed	UQBPU8ty...WlA7A_5v - - Zodiac Postmark #3847 
	↓ Received TON	EQDyVGvs..._01M2AaF +0.016394 TON
13 Apr 22:25	↑ Send NFT	UQBPU8ty...WlA7A_5v - - Zodiac Postmark #3847 
13 Apr 22:24	↑ Send NFT	UQBPU8ty...WlA7A_5v - - Young Explorer #49159 
13 Apr 22:23	⟨⟩ Called contract	EQD2bE1M...7BwC2kRb 0x013a3ca6 -0.075 TON
13 Apr 22:23	⟨⟩ Called contract	EQCPXK0y...itxLLQbr 0x013a3ca6 -0.075 TON
	⟨⟩ Contract deploy	EQALzpYD...6FUAFSHD Interfaces: [wallet_v4r2] -
13 Apr 22:20	↓ Received TON	UQBtAmlV...KHGfC9Uv - +3.966 TON

Figure 10: Interaction history of another address from the group on tonviewer:
https://tonviewer.com/UQALzpYDjv0ncLxDRohsJRVVntDQu_FM0DIrdtMq6FUAFXwG

4.3 Sybil Cluster 3: Chain-Like GTG from Approach 2

Sybil Cluster 3 consists of 21 Sybil accounts on the TON chain. The algorithm has found several evidences in support of the judgement.

1. On 2024-05-28, these accounts received their first Native TON, forming a chain-shaped gas transfer graph involving 21 addresses (Figure 11). The transfers were initiated by EQBiQ9hgG7F_iXVOw-y4UDeSuJu5GdulKcdMmdxTXiAx-i8T, with the same funds being passed sequentially along the subsequent addresses to provide the initial gas funding required. The transfer amount started from 1.23 TONs, but the amount decreases by 0.05 to 0.04 TON each time.

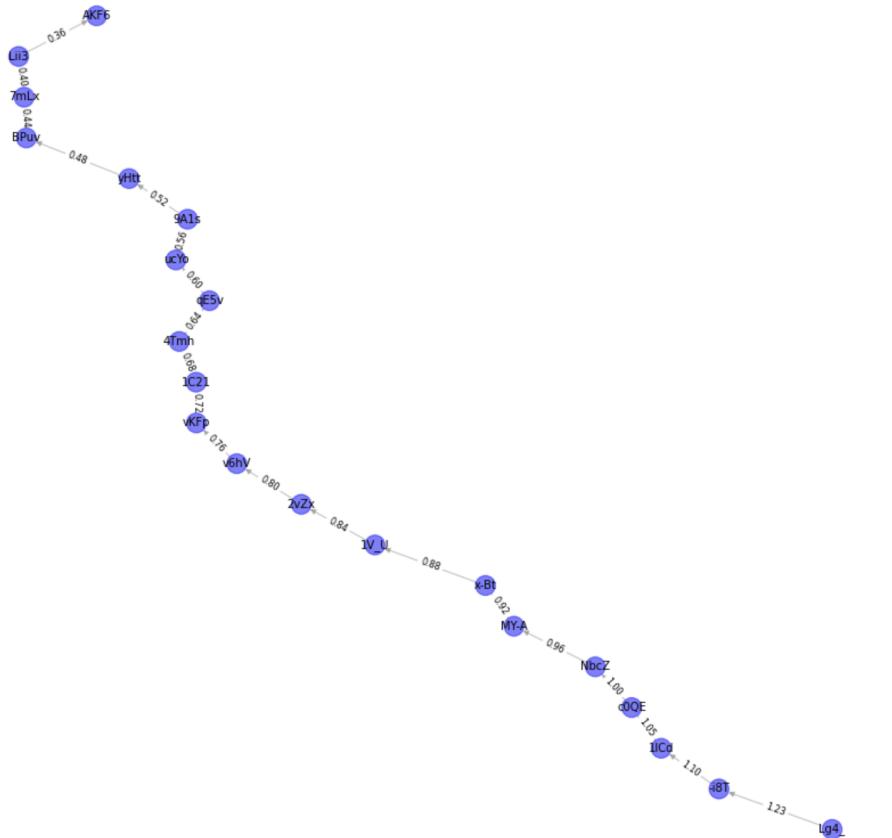


Figure 11: Chain-shaped initial fund transfer diagram.

- Some wallet activities from Tonviewer are shown in Figures 12 and 13. The first address, after receiving its initial gas transfer from OKX, immediately transferred the airdropped \$NOT tokens to Binance using MEMO "102802459", and then sent the remaining gas to the next address. Similarly, the second address performed the same action, transferring the airdropped \$NOT tokens to Binance with the same MEMO, and then continued the gas transfer chain.

15 Jun 23:52	<code></> Called contract</code>	EQAML6BV...KQnoISvm	0x61153514	-0.008 TON
	<code>↓ Received TON</code>	EQAML6BV...KQnoISvm	-	+0.004618 TON
15 Jun 23:49	<code></> Called contract</code>	EQAML6BV...KQnoISvm	0x61153514	-0.008 TON
	<code>↓ Received TON</code>	EQAML6BV...KQnoISvm	-	+0.004618 TON
14 Jun 19:45	<code>↓ Received TON</code>	UQBusXJ7...EY54cxnB	-	+1.75 TON
28 May 20:47	<code>↑ Sent TON</code>	UQBUUWYa...IwPb1g1Y	-	-1.1 TON
28 May 20:34	<code>↑ Send token</code>	Binance	102802459	-26,809 NOT
	<code></> Contract deploy</code>	EQBiQ9hg...XiAx-i8T	Interfaces: [wallet_v4r2]	-
28 May 20:24	<code>↓ Received TON</code>	OKX_2	-	+1.235 TON

Figure 12: The root node activities on tonviewer:
https://tonviewer.com/UQBiQ9hgG7F_iXVOw-y4UDeSuJu5GdulKcdMmdxTXiAx-nLW

Time	Action	To/From	Value
29 May 07:04	↑ Sent TON	UQBusXJ7...EY54cxnB	-1.05 TON
29 May 06:59	↑ Send token	Binance	102802459 -20,112 NOT
28 May 20:47	↓ Received TON	UQBiQ9hg...XiAx-nLW	+1.1 TON

Figure 13: The second wallet activities on tonviewer:

<https://tonviewer.com/EQBUUWYafNeUkyNwMQJWX7C-u80QbXyaZE0RnZzjlwPb1lCd>

4.4 Sybil Cluster 4: Tree-shaped JTG from Approach 2

Sybil Cluster 4 consists of 12 Sybil accounts on the TON chain. The algorithm has found several evidences in support of the judgement.

1. On 2024-05-29, these accounts transferred their newly received \$NOT, forming a tree-shaped Jetton Transfer Graph involving 12 addresses (Figure 14). The structure of this graph shows a central node EQCl8wWhpv2g4mEl5lJeU-3mgqXvrNdN3jLUGcQ1eJrBvjm8 acting as the primary aggregation point, with several branches reaching to it.

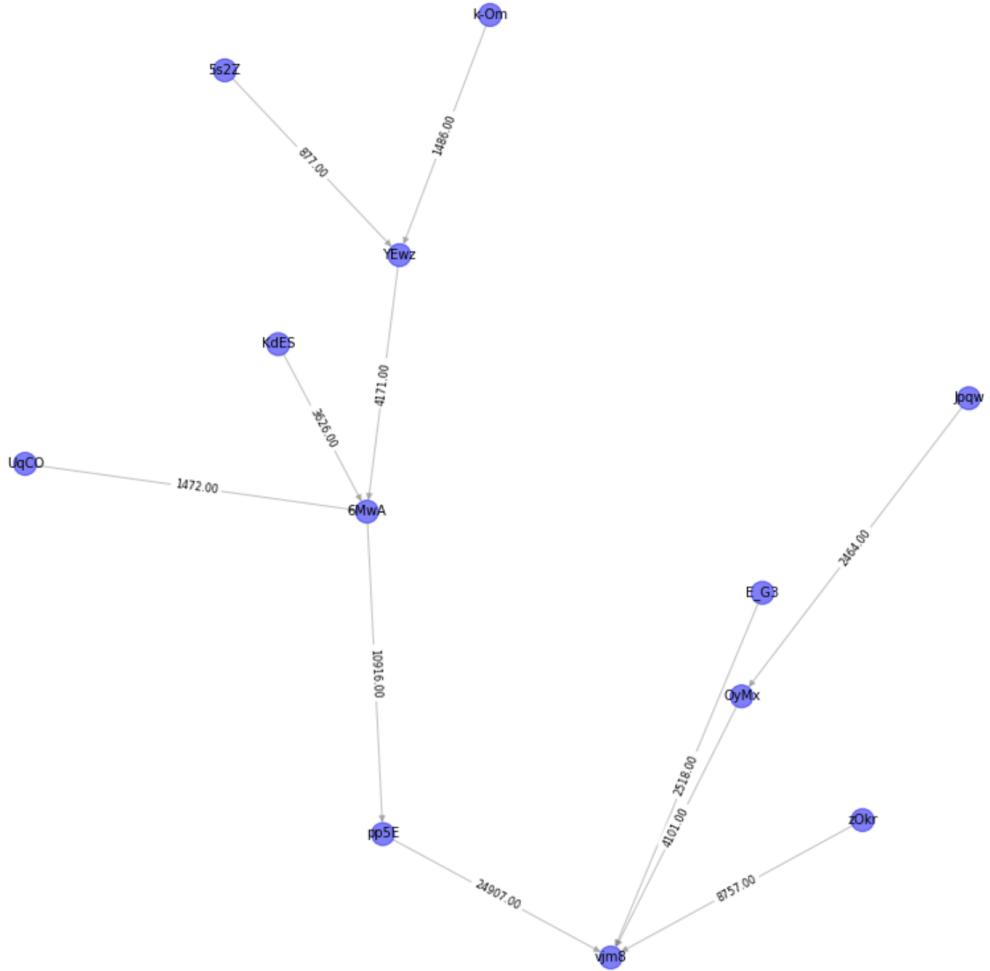


Figure 14: Tree-shaped Jetton Transfer Graph

2. The central node activities from Tonviewer are shown in Figure 15. On 2024-05-29, this address received an aggregation of \$NOT tokens from multiple points. Subsequently, on the same day, it transferred the received \$NOT tokens to Binance in multiple transactions, using the same MEMO: 103526175.



Address	UQC18wWhpv2g4mEl5lJeU-3mgqXvrNdN3jLUGcQ1eJrBvmR5							
Balance	1.24 TON ≈ \$6.02							
Tokens	0.3 ARBUZ ▲ ⚡ View all							
Collectibles	View all							
Contract type	wallet_v4r2 ⓘ							
• Active 0:a5f...ac1be ton.cx · toncoin.org								
History Transactions Tokens 5 Collectibles 28 Code Methods								
Token 29 May 2024 - 30 May 2024 ⋮								
29 May 22:26	↑ Send token	Binance	103526175	-6,626 NOT				
29 May 22:13	↓ Received TON	UQB1vwhU...qGpXE6xy	-	+0.981157734 TON				
29 May 22:03	↓ Received token	UQB1vwhU...qGpXE6xy	-	+2,518 NOT				
29 May 22:02	↑ Sent TON	UQB1vwhU...qGpXE6xy	-	-1 TON				
29 May 16:55	↓ Received TON	UQB_803X...0RM9rvf	-	+0.081043578 TON				
29 May 16:52	↑ Sent TON	UQB_803X...0RM9rvf	-	-0.1 TON				
29 May 16:10	↑ Send token	UQA14zLM...E_KmIzRt	-	-2,000 NOT				
29 May 15:16	↓ Received TON	UQCP6Fhu...jliv0370	-	+0.962317434 TON				
29 May 15:14	↓ Received token	UQCP6Fhu...jliv0370	-	+4,101 NOT				
29 May 15:10	↑ Sent TON	UQDSxU9K...YxtEJsd1	-	-1 TON				
29 May 14:27	↑ Send token	Binance	103526175	-9,000 NOT				
29 May 14:23	↓ Received token	UQDzMI6c...ljw-zLTu	-	+8,757 NOT				
29 May 14:19	↑ Send token	Binance	103526175	-25,000 NOT				
29 May 13:20	↓ Received TON	UQB9BZLX...sjS7qjx6	-	+0.081158627 TON				
29 May 13:18	↓ Received token	UQB9BZLX...sjS7qjx6	-	+2,244 NOT				

Figure 15: The central node activities on tonviewer: <https://tonviewer.com/EQCl8wWhpv2g4mEl5lJeU-3mgqXvrNdN3jLUGcQ1eJrBjm8>

4.5 Sybil Cluster 5: Collection into Binance from Approach 3 - Method 1

Sybil Cluster 5 contains a total of 138 wallets.

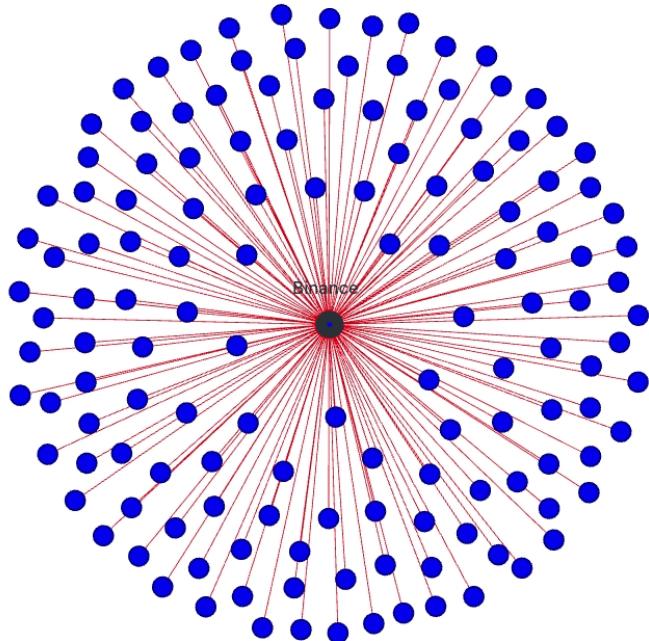


Figure 16: CEX Converging Pattern

All the wallets deposited \$NOT to the same Binance account

EQD5mxRgCuRNLxKxeOjG6r14iSroLF5FtomPnet-sgP5xNJb (Non-bounceable:

UQD5mxRgCuRNLxKxeOjG6r14iSroLF5FtomPnet-sgP5xl-e), using the same memo = 104552008.

SUCCESS
UQA-nahan0SUUORjtCB_ UE-JcpKL sent **2 153 NOT** to Binance

OVERVIEW	DETAILS		
Action	Route	Payload	
↗ Jetton Transfer	UQA-nahan0SU_ UE-JcpKL > Binance	104552008	
		Value 2 153 NOT	

-o- TRANSACTION DETAILS

Account	Binance
Status	Success
Time	28.05.2024, 22:47:01 – 5 months ago
LT	46769396000004
Hash	base64 NN2y/LoSOqHIK23+3UECwaCjNWxSXLIh4IT9oACAvCk= hex 34ddb2fcba123aa1e52b6dfedd4102c1a0a3356c525cb961e084fd00080bc29

Figure 17: Wallet EQA-nahan0SUUORjtCBP1FhWs1QIQC_8pSkUJZaaUE-Jcs90(Non-bounceable: UQA-nahan0SUUORjtCBP1FhWs1QIQC_8pSkUJZaaUE-JcpKL), Payload =104552008,Tonscan:<https://tonscan.org/tx/dfcb59d1edb72abbffff5015d999cf0f536349826d3455bb5be6594a9b34b378>

SUCCESS
Confirmed Transaction

May 29, 11:41 PM

OVERVIEW	DETAILS		
Action	Route	Payload	Value
↗ Jetton Transfer	UQCTU05QpJN.. al7SWqW3 > Binance	104552008	17 585 NOT
➡ Contract Deploy	UQCTU05QpJNvb2fBtR52lhZSoufxziWLTK00euNOal7SWqW3	interfaces: ["wallet_v4r2"]	

-O- TRANSACTION DETAILS

Account	Binance
Status	Success
Time	29.05.2024, 23:42:51 – 5 months ago
LT	46789178000005
Hash	base64 MOABrkwA7WKi9Ma08YJz86ef5+i2EdDzzH0HOe+qCk8= hex 30e001ae4c00ed62a2f4c6b4f18273f3a79fe7e8b611d0f3cc738739efaa0a4f

Figure 18: <https://tonscan.org/tx/c3302c69887cb613200bf0f9ce3a86c5b4bbfa340c50d8e06db1856c4f58b44f>

SUCCESS
Confirmed Transaction

May 18, 05:44 AM

OVERVIEW	DETAILS		
Action	Route	Payload	Value
↗ Jetton Transfer	UQDqZiWiEZbG.. qY2sOT89 > Binance	104552008	8 984 NOT
➡ Contract Deploy	UQDqZiWiEZbGwtJwVr0UrHwfL4KYCI-ud2Ai0JY1qY2sOT89	interfaces: ["wallet_v4r2"]	

-O- TRANSACTION DETAILS

Account	Binance
Status	Success
Time	18.05.2024, 05:44:50 – 5 months ago
LT	46571958000004
Hash	base64 HMryvQPofh+EzMQHvXTWMRsWr0Ka0Hhkm3xHqimgZRO= hex 1ccaf2bd03e87e1f84ccc407bd74d631b16af429ad078649b7c47aa29a0651d

Figure 19: <https://tonscan.org/tx/a9aca0ca26a16276dc8dcdd9c2083b0d7d81a0775c89076f2facbf5641912aa3>

4.6 Sybil Cluster 6: Collection into Bybit from Approach 3 - Method 2

Sybil Cluster 6 contains a total of 21 wallets. On 2024-05-18, these addresses initially transferred the airdropped \$NOT tokens to the aggregator address EQCOOJrA6_I0xyNGlzUfAwY1mc-uopv2n8CJQv3M2U-0Cfw7, which then deposited the funds into the Bybit exchange (Figure 18, where the aggregator is highlighted in green).

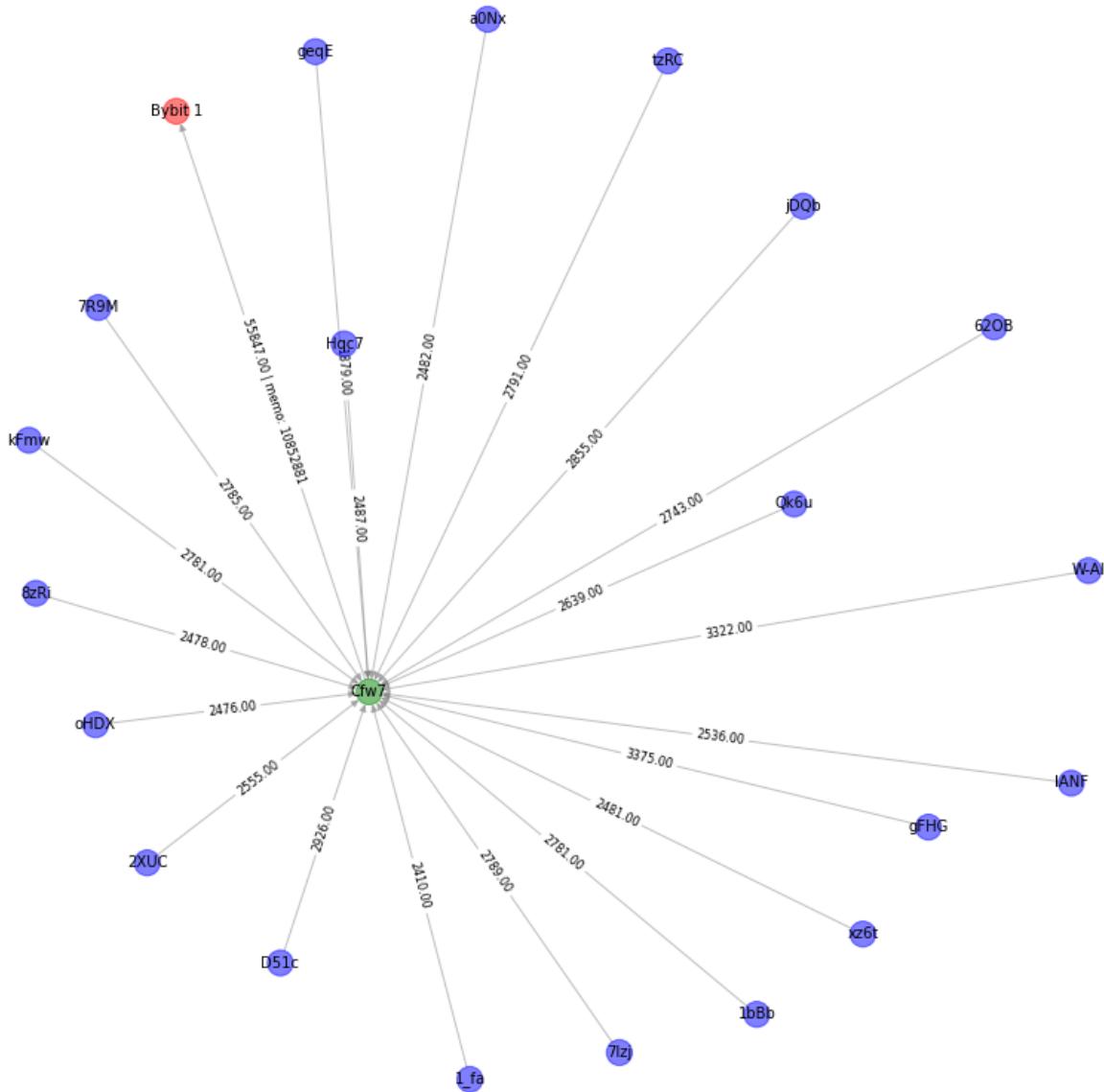


Figure 20: Aggregator collected \$NOT from the other wallets and deposited into Bybit

1. Figure 21 - 23 shows how the addresses sent \$NOT to the aggregator address EQCOOJrA6_I0xyNGlzUfAwY1mc-uopv2n8CJQv3M2U-0Cfw7 (Non-bounceable: UQC00JrA6_I0xyNGlzUfAwY1mc-uopv2n8CJQv3M2U-0CaH-)

Address: UQA-5Ni6p-78sWGYWewQUMv3s8VMAXTulxv8o0hEmcLn82mn
Balance: 0 TON ≈ \$0
Contract type: wallet_v4r2

History Transactions Tokens 1 Code Methods

18 May 10:17	↑ Sent TON	UQDupW1i...nRsmt2mH	-	-0.392202061 TON
18 May 10:16	↑ Send token	UQC00JrA...2U-0CaH-	-	-2,478 NOT
	</> Contract deploy	EQA-5Ni6...mcLn8zRi	Interfaces: [wallet_v4r2]	-
18 May 10:15	↓ Received TON	UQCcHDlm...HlIwgAwD	-	+0.410783277 TON

Figure 21: Wallet EQA-5Ni6p-78sWGYWewQUMv3s8VMAXTulxv8o0hEmcLn8zRi (Non-bounceable: UUQA-5Ni6p-78sWGYWewQUMv3s8VMAXTulxv8o0hEmcLn82mn), tonviewer: <https://tonviewer.com/EQA-5Ni6p-78sWGYWewQUMv3s8VMAXTulxv8o0hEmcLn8zRi>

Address: UQABbayThWcmCs7os4P63bIrQzwdZP98kZ1_hUEhNFQY1e2e
Balance: 0 TON ≈ \$0
Contract type: wallet_v4r2

History Transactions Tokens 1 Code Methods

18 May 10:47	↑ Sent TON	UQBL4KDy...gpLEkAR1	-	-0.206389741 TON
18 May 10:44	↑ Send token	UQC00JrA...2U-0CaH-	-	-2,781 NOT
	</> Contract deploy	EQABbayT_NFQY1bBb	Interfaces: [wallet_v4r2]	-
18 May 10:43	↓ Received TON	UQAN_w6q...D51HHvr-	-	+0.224970996 TON

Figure 22: https://tonviewer.com/EQABbayThWcmCs7os4P63bIrQzwdZP98kZ1_hUEhNFQY1bBb

Address: UQAHjlSohtw05mDnYeyArfKYwOOqdxJqU6-6FIIblpFFQhNr
Balance: 0 TON ≈ \$0
Contract type: wallet_v4r2

History Transactions Tokens 1 Code Methods

18 May 10:10	↑ Sent TON	UQAiD6hY...l5tcoC0S	-	-0.447945727 TON
18 May 10:09	↑ Send token	UQC00JrA...2U-0CaH-	-	-2,639 NOT
	</> Contract deploy	EQAHjlSo...lpFFQk6u	Interfaces: [wallet_v4r2]	-
18 May 10:08	↓ Received TON	UQBmj0AL...-hmNW73N	-	+0.466526953 TON

Figure 23: <https://tonviewer.com/EQAHjlSohtw05mDnYeyArfKYwOOqdxJqU6-6FIIblpFFQk6u>

2. The aggregator address then deposited \$NOT into Bybit using memo "10852881" on the same day (Figure 24).



Address	UQCOOJrA6_I0xyNGIzUfAwY1mc-uopv2n8CJQv3M2U-0CaH-	Token	Date	⋮
Balance	0 TON ≈ \$0			
Contract type	wallet_v4r2 ⓘ			
• Active	0:8e3..fb409	ton.cx · toncoin.org		
History	Transactions	Tokens 1	Code	Methods
20 May 00:50	↑ Sent TON	UQBenzl5q...CgqdFOAo	-	-0.116057083 TON
18 May 11:17	↑ Send token	Bybit 1	10852881	-55,847 NOT
18 May 11:12	↓ Received TON	UQCktzlU...SWwBax60	-	+0.132064636 TON
18 May 11:11	↓ Received token	UQCktzlU...SWwBax60	-	+2,482 NOT
18 May 11:08	↓ Received token	UQBbQF1W...f2cux2No	-	+2,481 NOT
18 May 10:51	↓ Received token	UQDjwRoD...34F1IF6A	-	+2,536 NOT
18 May 10:49	↓ Received token	UQBL4KDy...gpLEkAR1	-	+2,781 NOT
18 May 10:44	↓ Received token	UQABbayT...NFQY1e2e	-	+2,781 NOT
18 May 10:38	↓ Received token	UQAN_w6q...D5iHHvr-	-	+2,487 NOT
18 May 10:35	↓ Received token	UQAcp6CB...TwHF7NEm	-	+2,789 NOT
18 May 10:33	↓ Received token	UQBthugM...o0Yi7UKJ	-	+2,785 NOT
18 May 10:31	↓ Received token	UQBEdxGK...yXAK16of	-	+2,410 NOT
18 May 10:29	↓ Received token	UQBBb0vj...MEUe6z5E	-	+2,743 NOT
18 May 10:27	↓ Received token	UQBUwHzk...wl2AjGne	-	+2,855 NOT

Figure 24: The aggregator address EQCOOJrA6_I0xyNGIzUfAwY1mc-uopv2n8CJQv3M2U-0Cfw7 (Non-bounceable: UQCOOJrA6_I0xyNGIzUfAwY1mc-uopv2n8CJQv3M2U-0CaH-), memo =10852881, tonviewer:https://tonviewer.com/EQCOOJrA6_I0xyNGIzUfAwY1mc-uopv2n8CJQv3M2U-0Cfw7

5. Conclusion

In addition to our initial analysis of the NOT airdrop, we expanded our Sybil detection methods to include other airdrops such as DOGS and CATI. Our findings showed a Sybil rate of 29.19% for DOGS, and 5.48% for CATI, demonstrating the adaptability and effectiveness of our framework across different token distributions. The lower Sybil rate for CATI is attributed to many addresses transferring their tokens directly to centralized exchanges soon after receiving them, leaving minimal on-chain activity for analysis and limiting the identification of potential Sybil behavior. These results confirm that our innovative approach, tailored for TON's unique structure, is crucial for enhancing fairness and security, paving the way for TON to become a more Trustworthy and Open Network.

