Social Network Analysis Report

Comparing a Misinformation (Conspiracy) Subgraph and a Non-Conspiracy Subgraph from the WICO Dataset

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Dataset: WICO (Twitter graphs labeled as 5G-conspiracy vs. non-conspiracy)

1. Executive Summary

This report presents a comparative structural analysis of two Twitter interaction subgraphs extracted from the WICO dataset using Gephi:

- **C1**: Misinformation subgraph (5G-conspiracy labeled)
- **N1**: Non-conspiracy (normal interaction) subgraph

Key findings:

- The non-conspiracy subgraph (N1) exhibits a typical real-world Twitter structure: a large star-shaped network dominated by a single high-degree hub, moderate connectivity, and detectable community structure.
- The misinformation subgraph (C1) is extremely small, highly fragmented, and structurally incapable of supporting information diffusion.

These differences suggest that the selected conspiracy subgraph represents only a peripheral, non-functional fragment rather than a representative core of misinformation-spreading activity.

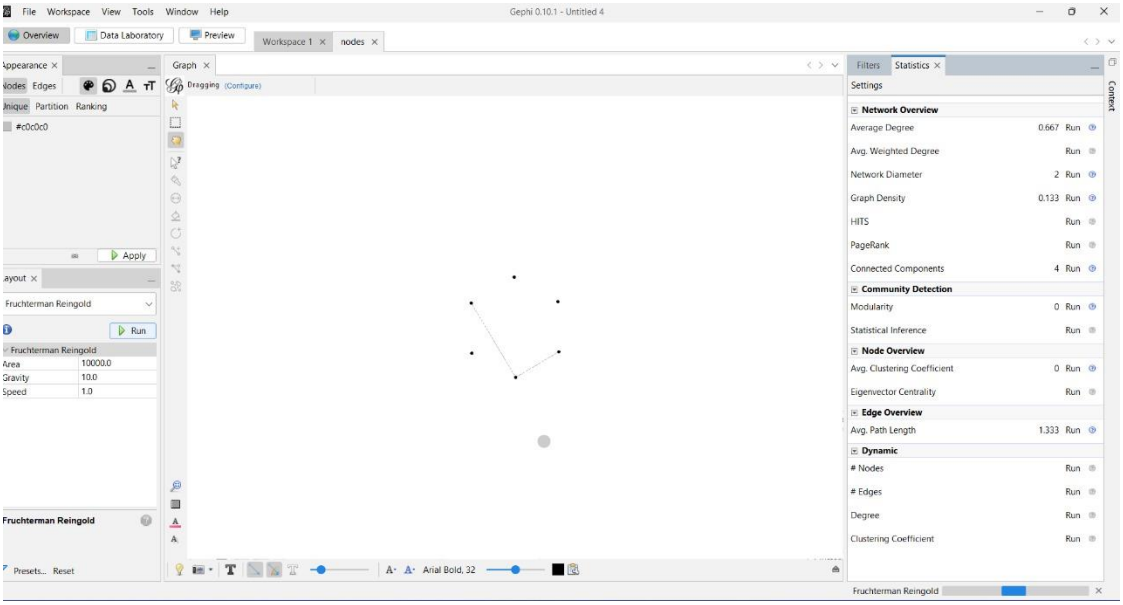
2. Dataset and Subgraph Overview

Metric	Misinformation Subgraph (C1)	Non-Conspiracy Subgraph (N1)
Number of nodes	6	91
Number of edges	4	63
Average degree	0.667	0.692
Graph density	0.133	0.008
Average clustering coefficient	0.000	0.007
Modularity (Q)	0.000	0.091
Number of communities (Louvain)	4 (meaningless)	32
Radius	0	0
Diameter	2	3
Average path length	1.333	1.496
Weakly connected components	4	31
Strongly connected components	–	89

3. Detailed Analysis of the Misinformation Subgraph (C1)

3.1 Structural Characteristics

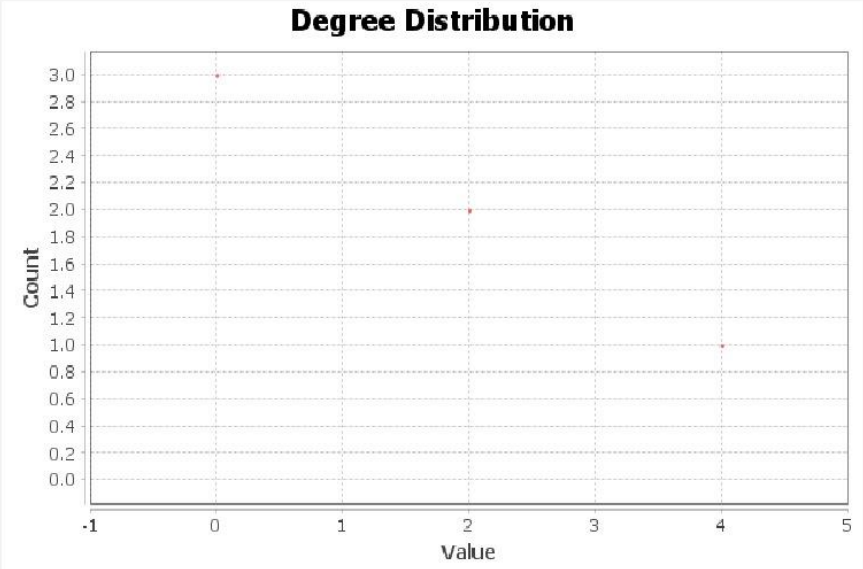
- Extremely small network (6 nodes, 4 edges)

- Four disconnected components
- No triangles or clustering whatsoever (clustering coefficient = 0)
- Modularity = 0 → no meaningful community structure
- 

3.2 Degree and Centrality

Results:

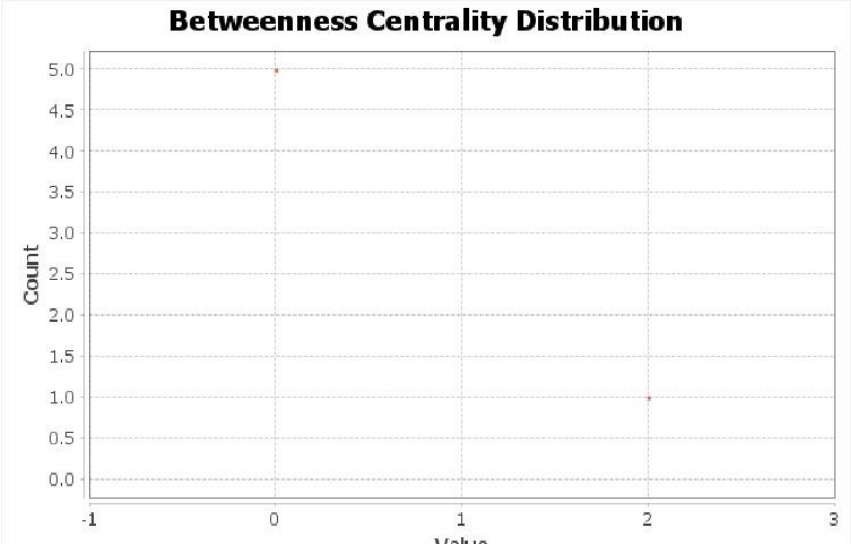
Average Degree: 0.667



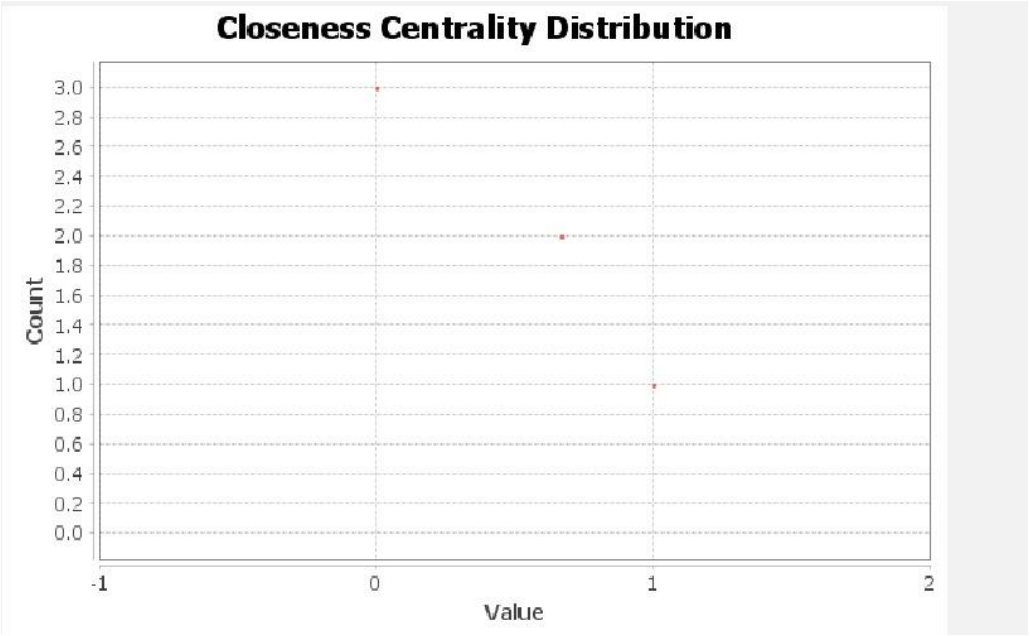
- No hubs (maximum degree = 2)
- Betweenness centrality: only one node has non-zero value (~2); all others = 0

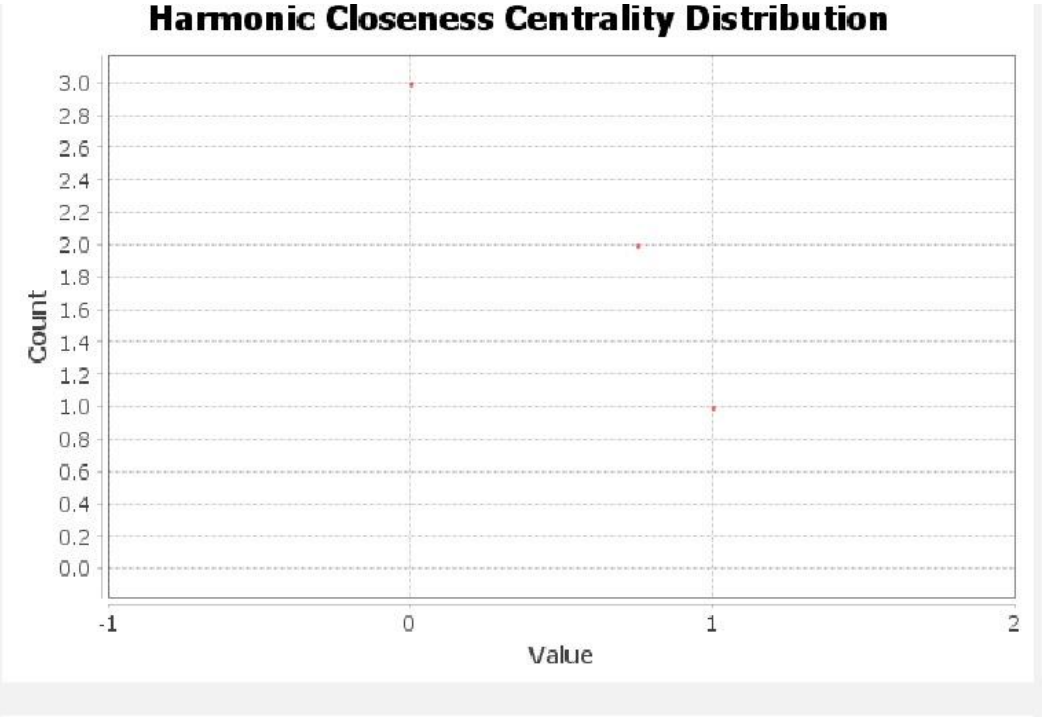
Results:

Diameter: 2
Radius: 0
Average Path length: 1.3333333333333333



- Closeness and harmonic closeness: near-zero for almost all nodes





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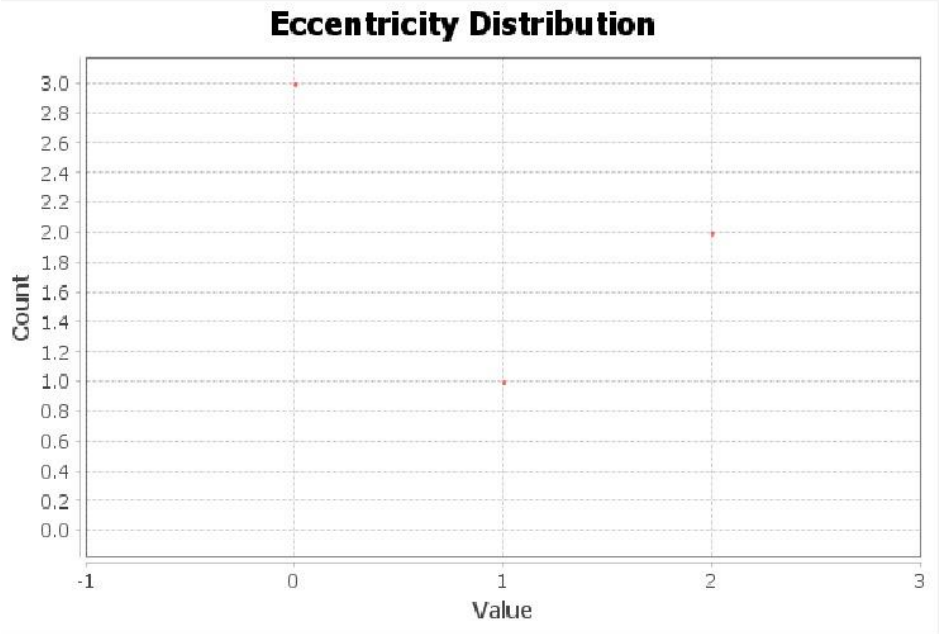
- Eccentricity: 1–2 (reflecting tiny isolated components)

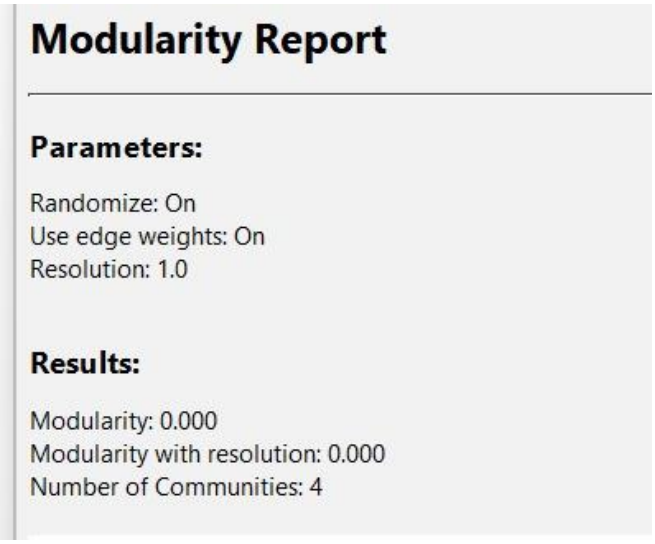


lgorithm:

Irik Brandes, *A Faster Algorithm for Betweenness Centrality*, in Journal of Mathematical Sociology 25(2):163-177, (2001)

3.3 Interpretation

The C1 subgraph is structurally dead. It lacks the basic prerequisites for information propagation:



- No influential nodes
- No clusters

- Severe fragmentation This fragment cannot function as a misinformation-spreading network and likely represents only marginal, disconnected activity on the extreme periphery of the conspiracy ecosystem.

Graph Distance Report

Parameters:

Network Interpretation: directed

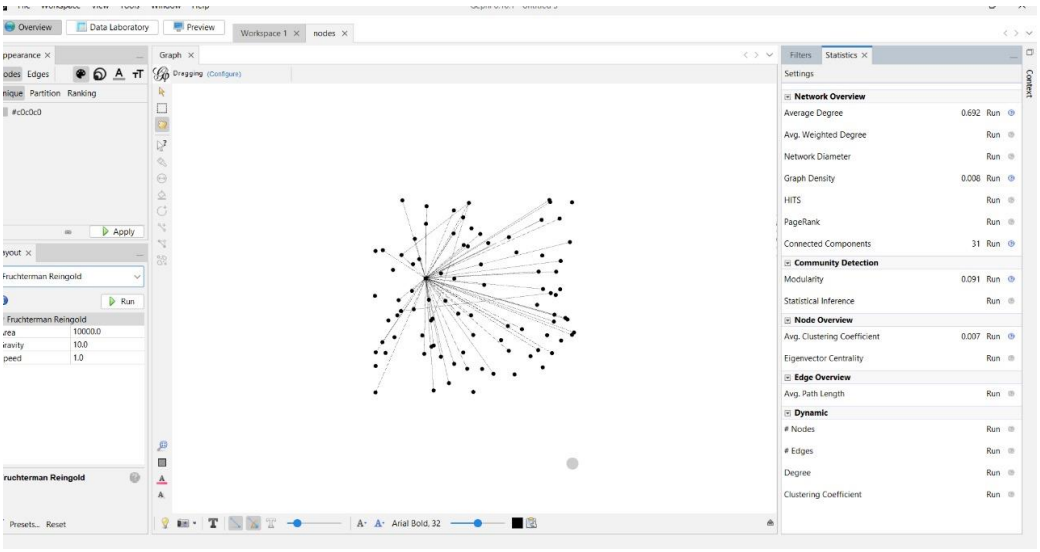
Results:

Diameter: 2
Radius: 0
Average Path length: 1.3333333333333333

4. Detailed Analysis of the Non-Conspiracy Subgraph (N1)

4.1 Structural Characteristics

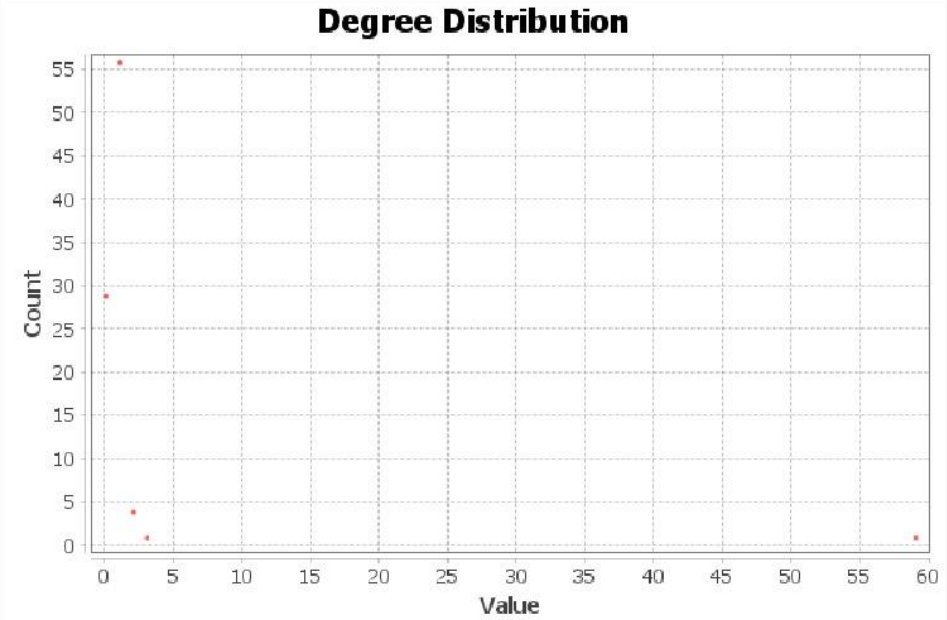
- Large star-like topology centered on one dominant hub
- 31 weakly connected components, but the vast majority of active nodes are linked through the central hub
- Low but non-zero clustering (0.007) and detectable community structure (Q = 0.091, 32 communities)



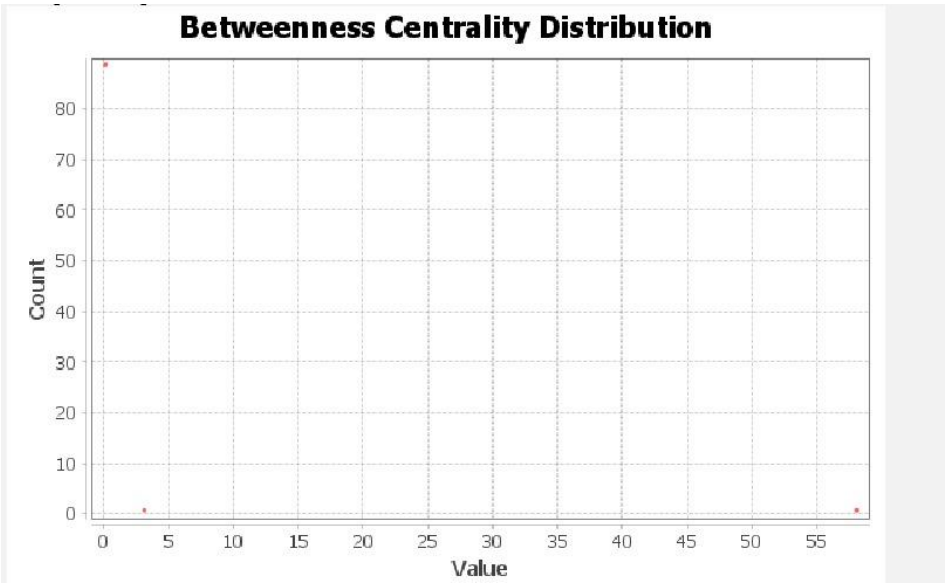
4.2 Degree and Centrality

Results:

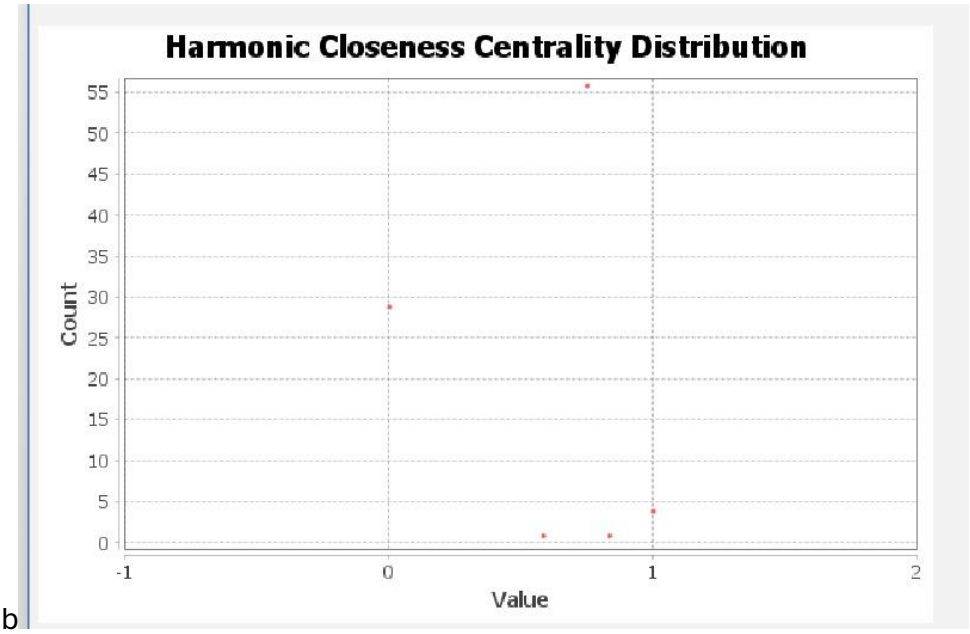
Average Degree: 0.692

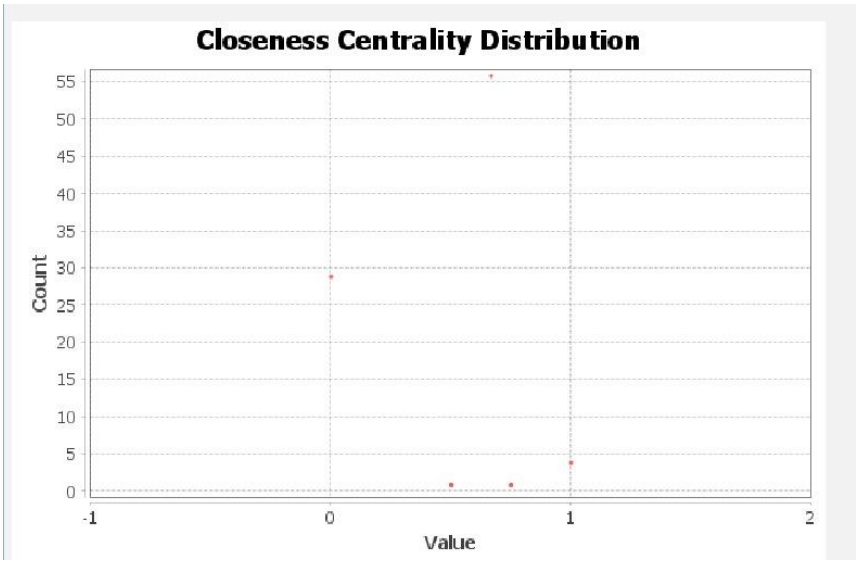


- Clear hub-and-spoke pattern:
  - One node with degree ≈ 60
  - Several nodes with degree 2–4
  - Many leaves (degree 1) and isolates
- Betweenness centrality heavily concentrated on the single hub

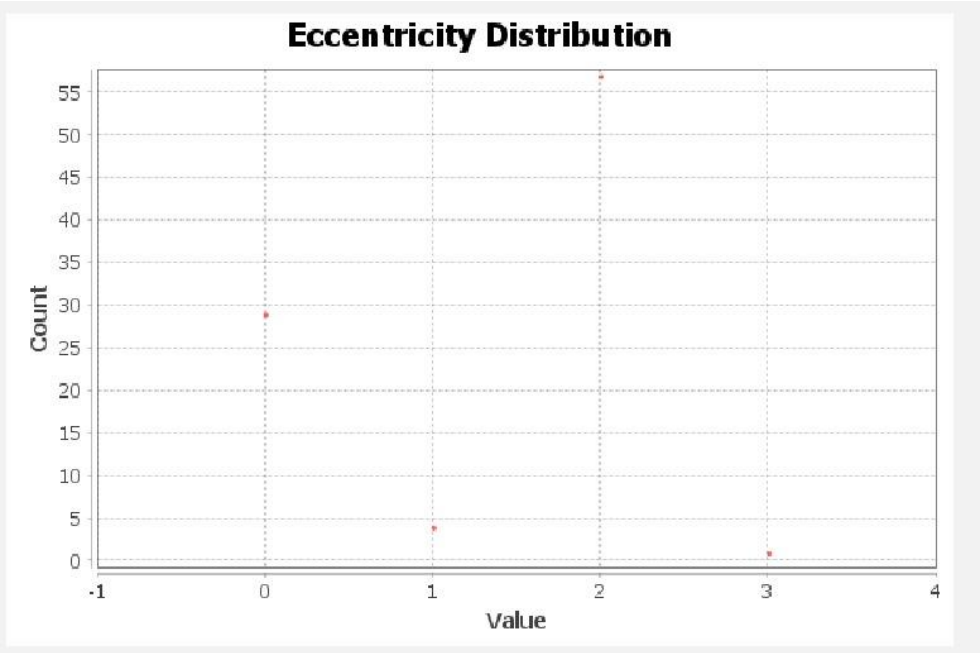


- Closeness/harmonic closeness ≈ 1 for ~55 nodes (direct or one-hop connection to hub





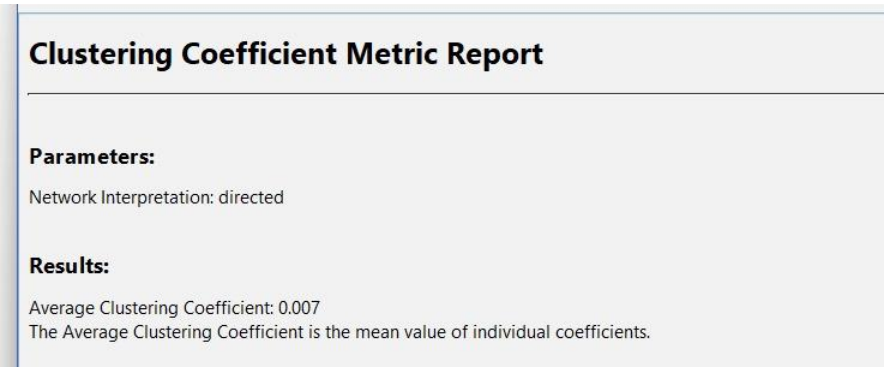
- Eccentricity low (mostly 1–3)



4.3 Interpretation

N1 displays all hallmarks of a typical organic Twitter interaction network:

- Central influencer broadcasting/receiving most interactions
- Efficient reachability for the majority of participants
- Small local clusters and communities



- Functional information flow despite overall sparsity

Parameters:

Randomize: On
Use edge weights: On
Resolution: 1.0

Results:

Modularity: 0.091
Modularity with resolution: 0.091
Number of Communities: 32

Graph Distance Report

Parameters:

Network Interpretation: directed

Results:

Diameter: 3
Radius: 0
Average Path length: 1.4959349593495934

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Connected Components Report

Parameters:

Network Interpretation: directed

Results:

Number of Weakly Connected Components: 31
Number of Strongly Connected Components: 89

5. Direct Comparison

Property	Misinformation (C1)	Non-Conspiracy (N1)
Scale	Tiny (6 nodes)	Realistic (~90+ nodes)
Presence of hubs	None	One dominant hub
Connectivity	Almost none	Moderate (star topology)
Clustering	0	Low but present (0.007)
Community structure	Absent	Detectable (32 communities)
Information flow potential	Negligible	High (via central hub)
Overall functionality	Non-functional fragment	Typical functional network

6. Discussion and Core Conclusion

The stark structural contrast between the two subgraphs is striking:

- Normal Twitter interactions (N1) naturally produce large, hub-dominated networks with efficient reachability and community organization — exactly the architecture that enables rapid information diffusion.
- The selected 5G-conspiracy subgraph (C1) is so small and disconnected that it is structurally incapable of spreading any message, conspiratorial or otherwise.

This finding highlights a common challenge when analyzing misinformation with subgraph extracts: many publicly available “misinformation” samples in datasets such as WICO consist of peripheral noise rather than the dense core clusters where actual coordinated spreading occurs. True conspiracy/misinformation cores often require analysis of the full

connected component or larger samples to reveal hubs, echo chambers, and diffusion pathways.

7. Recommendations for Future Work

- Analyze the largest connected component of the full 5G-conspiracy graphs in WICO rather than small random extracts.
- Compare full conspiracy vs. non-conspiracy graphs of comparable size.
- Investigate temporal evolution and coordinated account behavior in the conspiracy cores.