

Navigable Overlays for Information Dissemination in Decentralized Online Social Networks

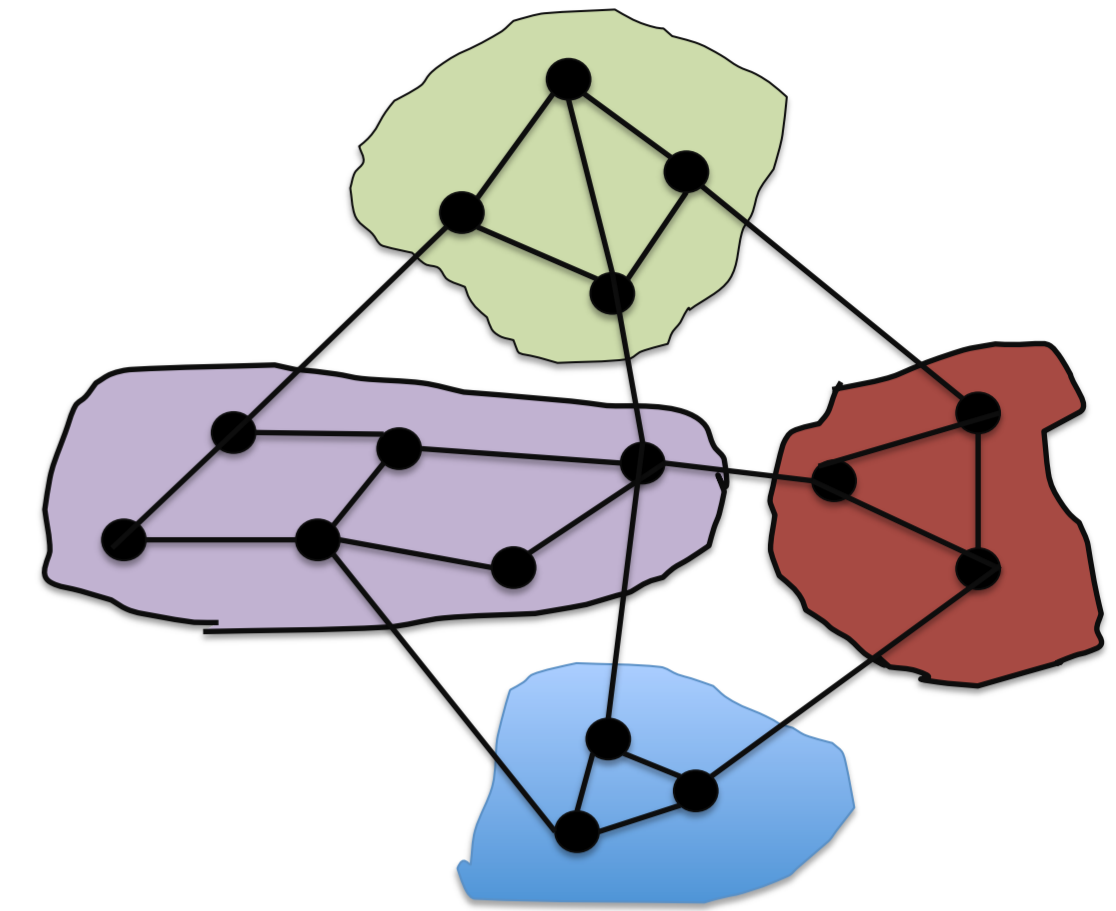
Muhammad Anis Uddin Nasir¹, Chen Chen², Hariton Efstathiades³, Šarūnas Girdzijauskas¹
¹KTH Royal Institute of Technology, ²IBM Research Lab Haifa, ³University of Cyprus (UCY)

1. Motivation

- **Privacy** and **Scalability** cause a shift towards decentralized online social networks
- Existing solutions do not provide an efficient solution for **fixed sized friend-to-friend** network
- **Navigable Overlays** can help in efficient dissemination of information

2. Design Goals

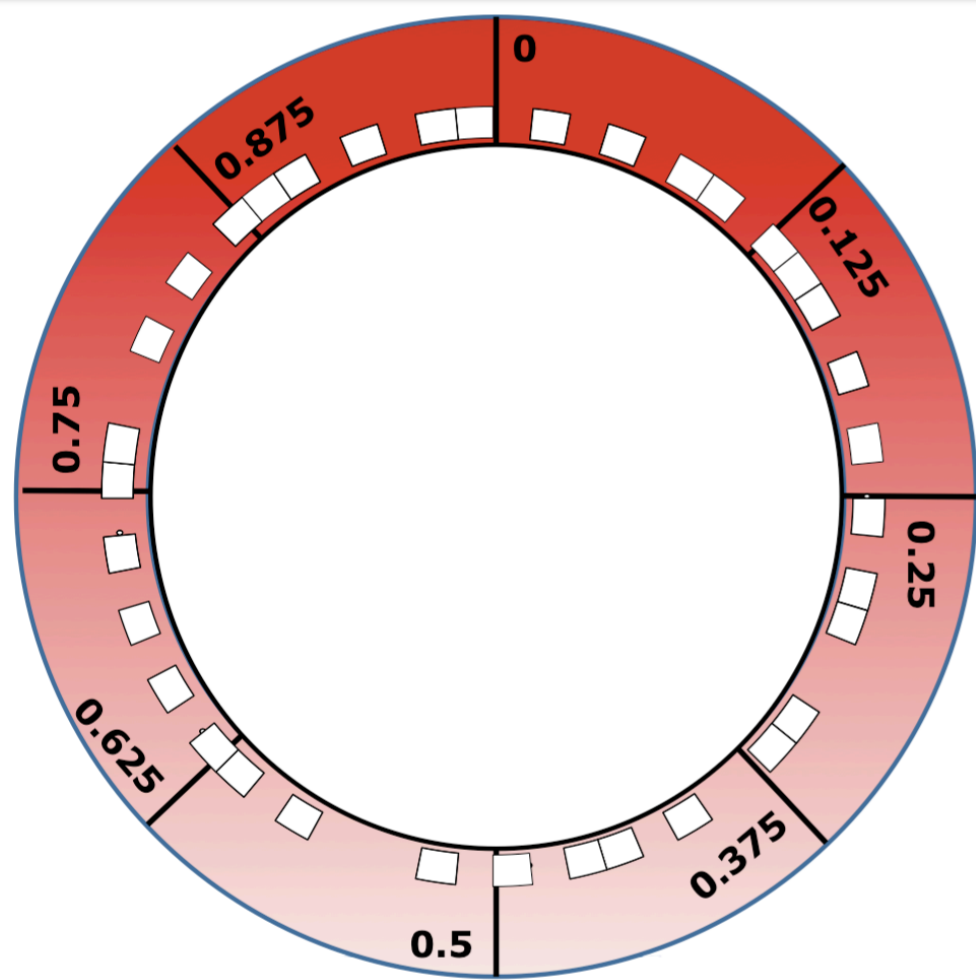
- Efficient and secure message propagation, i.e., no uninterested nodes should participate in propagation; propagation should involve minimum forwarding nodes
- Load balancing in both computation and communication
- Fault tolerance with robust churn handling mechanism



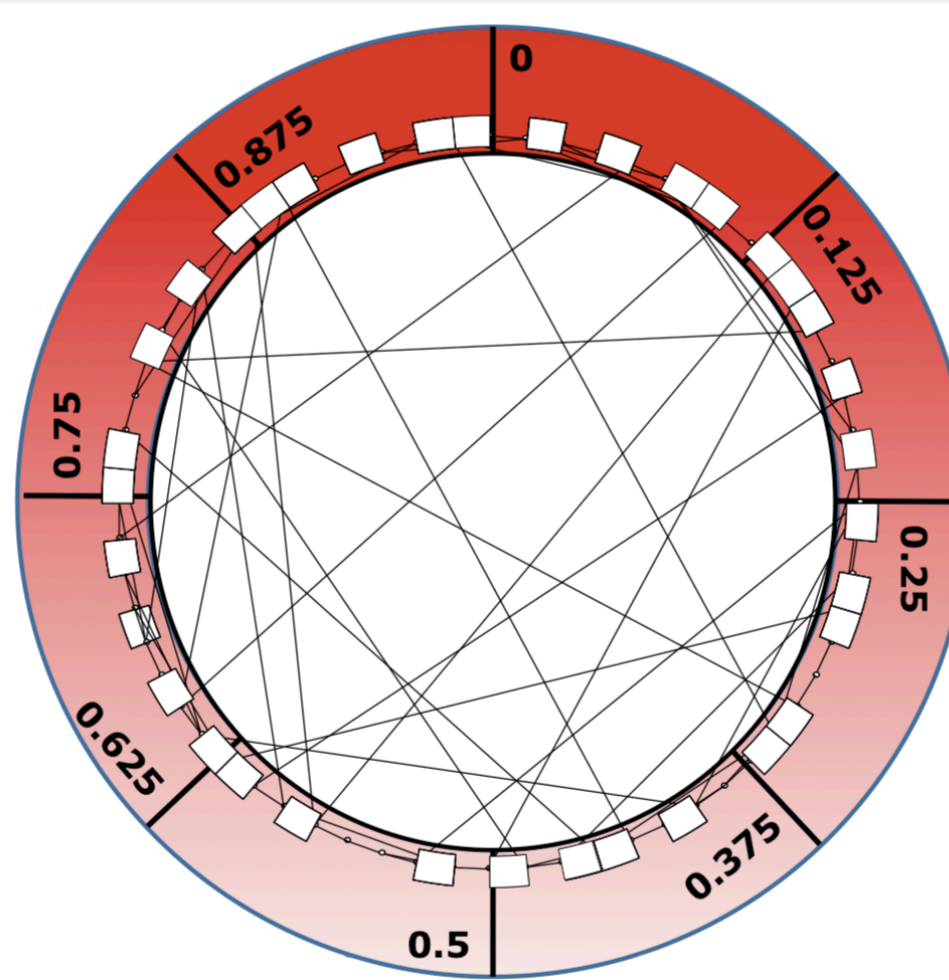
3. Approaches

Approach	Examples	Dissemination	Pros	Cons
DHT	DECENT, PeerSON, Cachet	Pull based	Scalable, Fault Tolerant	No locality awareness, High Network Traffic
Friends to Friends	Safebook	Pull based	Security	Not Scalable
Publish/Subscribe	PuSH	Push based	Efficient Dissemination	Not Scalable
Hierarchical Systems	Diaspora	Push based	Client-Server Model	Poor Security
Personal Storage	PrPL	Pull based	User Control	Load Imbalance/ Poor Availability
Gossiping/Flooding	GoDisco	Push based	Fault Tolerant	High network traffic

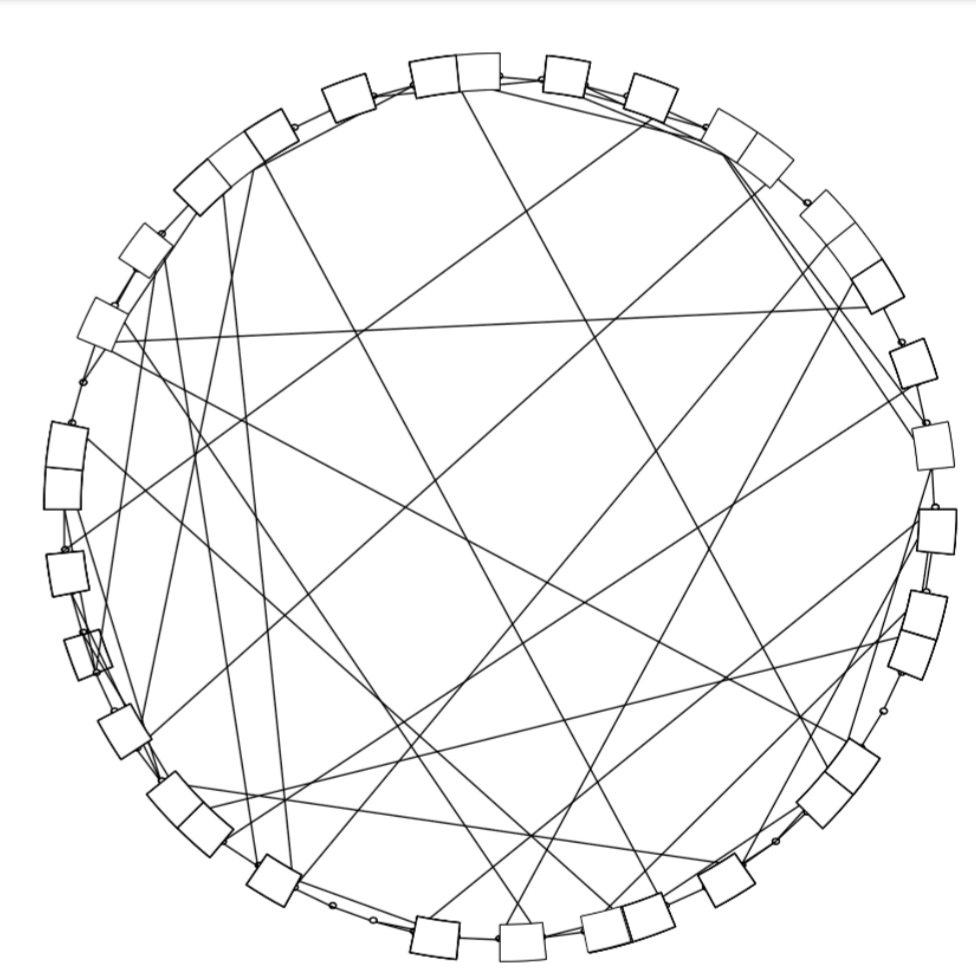
4. How can we construct a navigable overlay for an existing friend-to-friend network?



(a). Ring like structured overlay, where each node (square box) is assigned an identifier from an identifier space, e.g., [0,1], uniformly at random



(b). Social network embedded on top of the ring, resulting in involvement of many uninterested nodes for information dissemination



(c). What if we remove the randomly assigned identifiers, can we assign the identifier following small world network

5. Problem Formulation

- Suppose, we have a $G = (V, E)$, where
 - V is the set of vertices
 - E is the set of edges among those vertices
 - Each $v \in V$ has a bounded degree, i.e., $d_v \leq k$
- The algorithm should disseminate information from a user, to all of its neighbors, using the minimum number of interested nodes

6. Proposed Approach

- Initialize by assigning random node identifiers and edge labels
- Use gossip based algorithm to create an overlay and reassign node identifiers and edge labels for the purpose of navigability
- Leverage the social ties information in order to place strongly connected nodes closer in overlay

7. Applications

- Distributed Search
- Distributed Storage
- Secured Network
- Publish/Subscribe
- Advertisement



Contact: {anisu, sarunasg}@kth.se, h.efstathiades@cs.ucy.ac.cy, chenc@il.ibm.com

