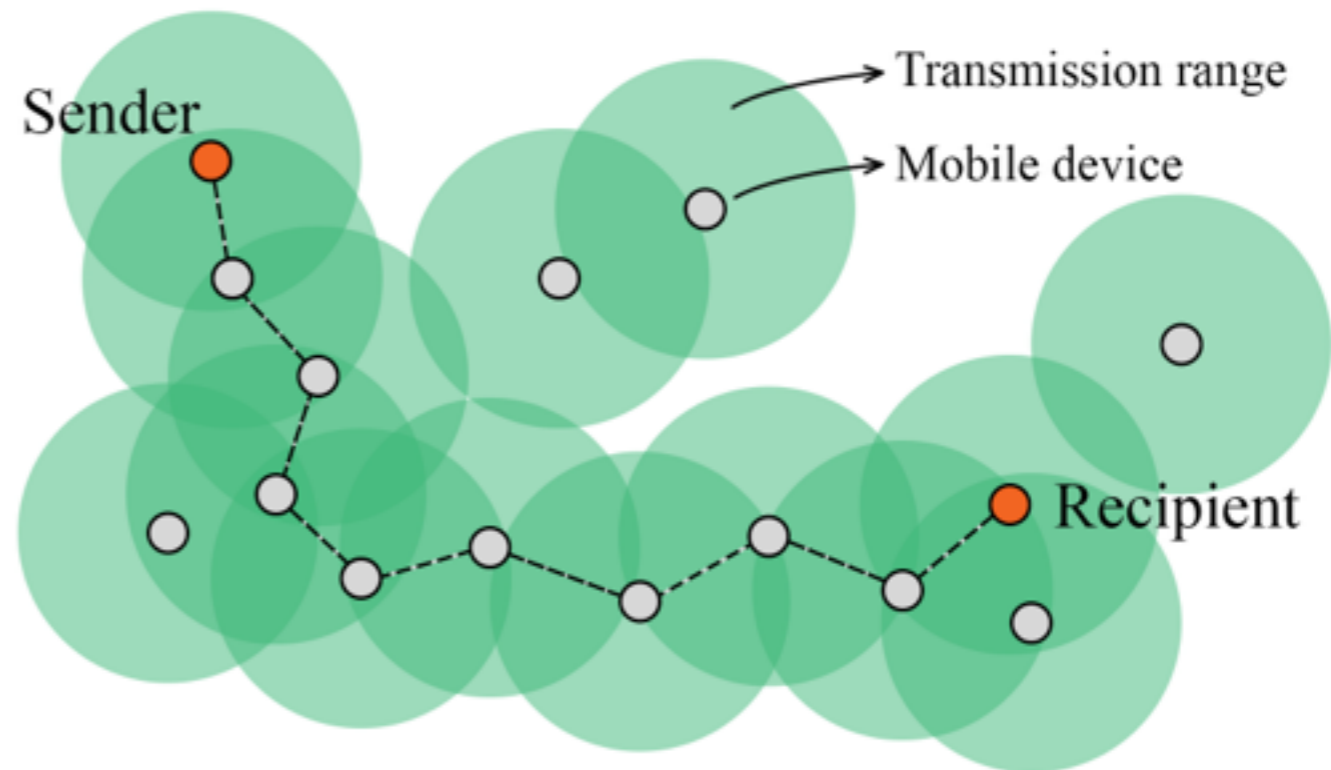


# GSAF: Efficient and Flexible Geocasting for Opportunistic Networks

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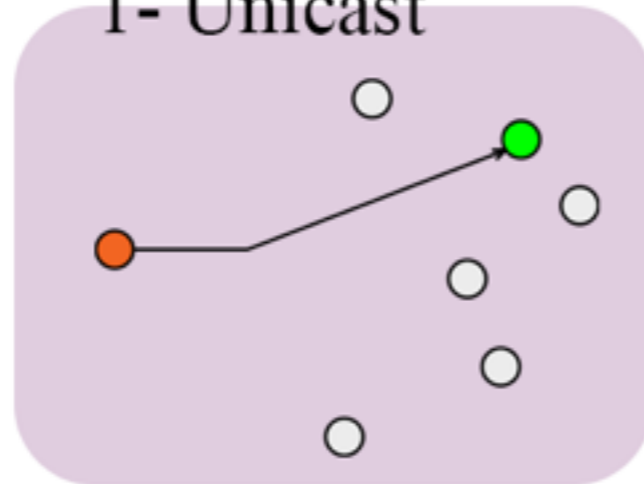
# Opportunistic Networks

- Infrastructure-less wireless networks
- Mobile devices, instead of connecting to an access point or a wireless modem, connect to each other using their short-range wireless interface (i.e. Bluetooth or WiFi-Direct)



# Addressing Methodology

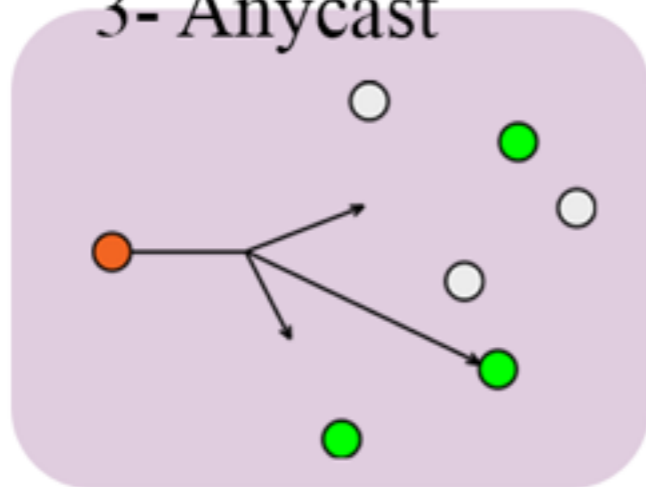
1- Unicast



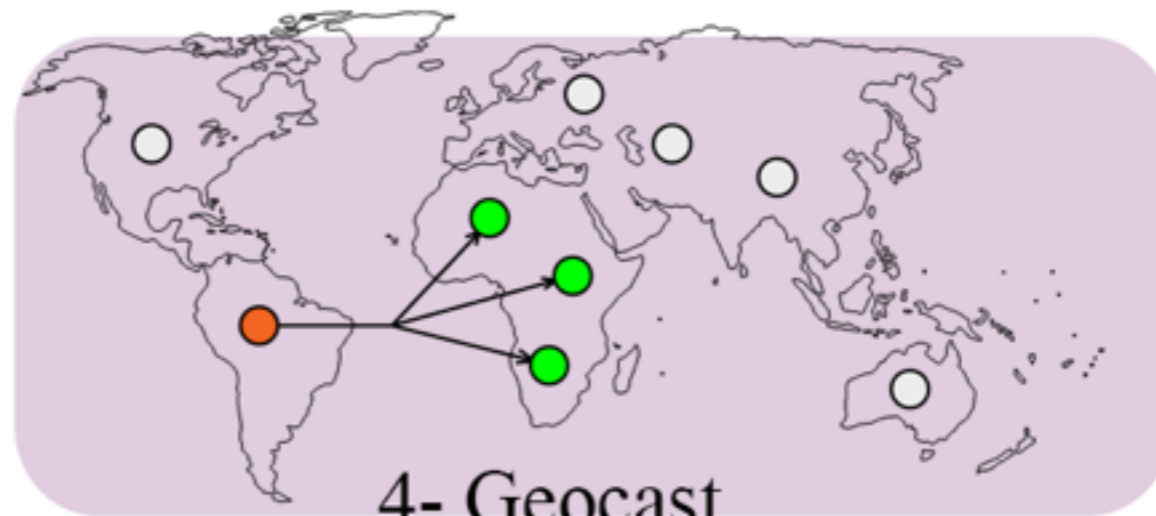
2- Multicast



3- Anycast



4- Geocast



# Geocasting in Opportunistic Networks; Why it is important?

- Geographical notifications for emergency scenarios such as: fire alarm, natural disaster, earthquake rescue and awareness by police stations
- Location targeted advertising - large volume of users concentrated at specific locations
  - ▶ open festival venues, large stadiums, demonstrations
- Geographically restricted service discovery

# Two Main Challenges

1. Defining Geographical casts and using them in opportunistic networks
2. Routing data in the network

# 1st. challenge: Cast Definition

Related work:

*Pros:*

- Simple
- Fast

*Cons:*

- Coarse-grained
- Inefficient
- poor privacy





# 1st. challenge: Cast Definition

Our Approach:

*Pros:*

- Simple
- Efficient
- Fine-grained
- Locally resolvable



# 2nd. challenge: Routing Protocol

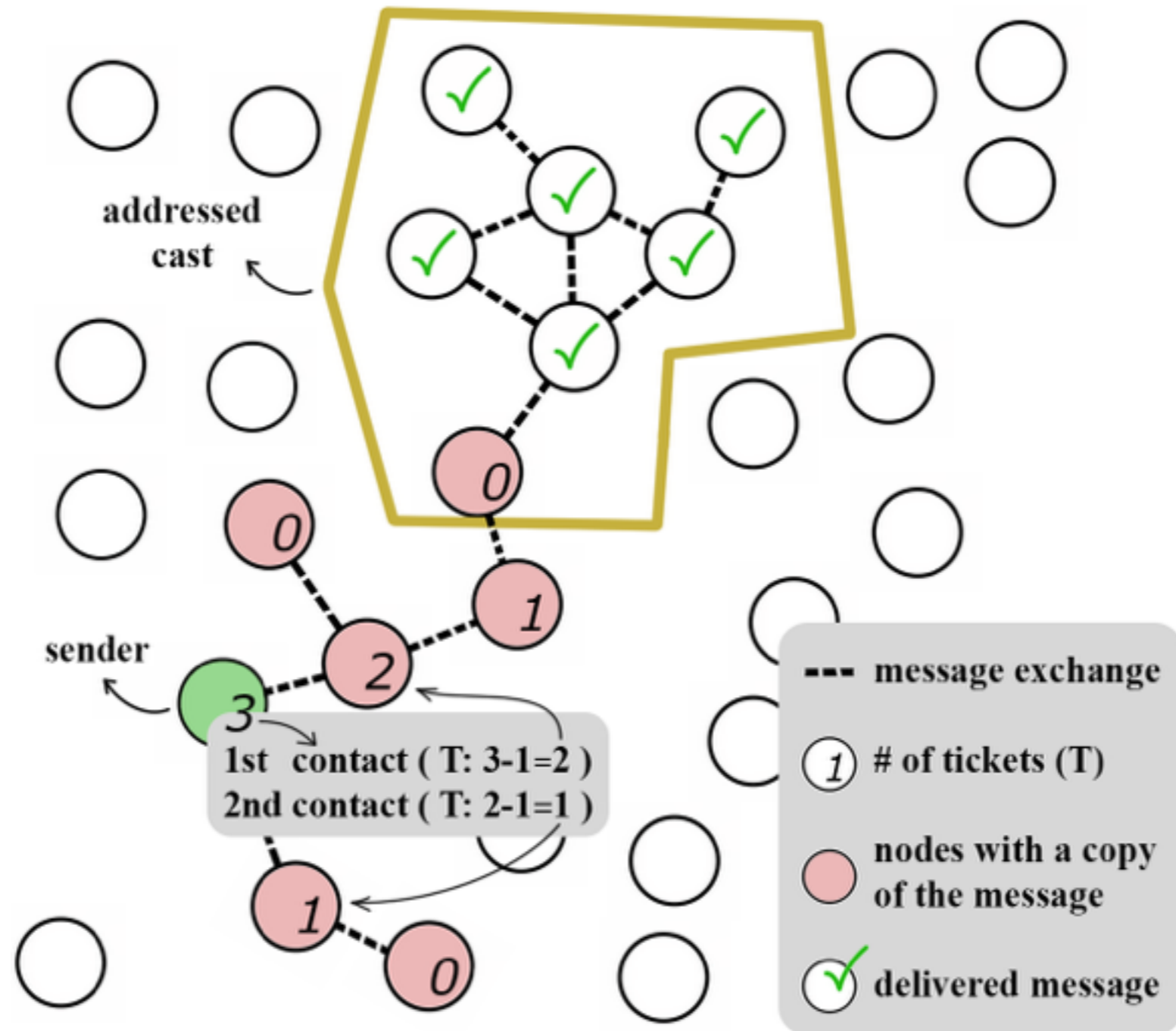
- Why do we need a new protocol?
  1. Unicast protocols require a node identifier as destination - no notion of destination location
  2. Existing Geocasting solutions are limited and not efficient enough (e.g. GeoEpidemic, EVR and Geoopp)



# 2nd. challenge: Routing Protocol

- GSAF (Geocasting Spray and Flood) protocol
- The routing procedure is divided into two phases:
  1. Reaching to the destination cast
  2. Intelligent flooding the message to all users inside the cast

# 2nd. challenge: Routing Protocol



# Evaluation & Results

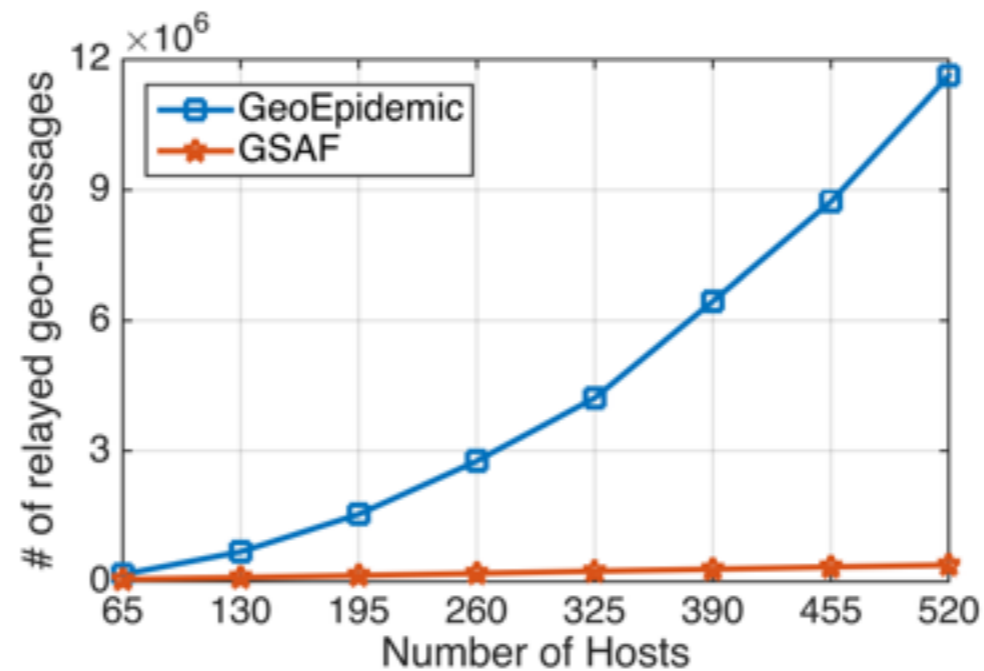
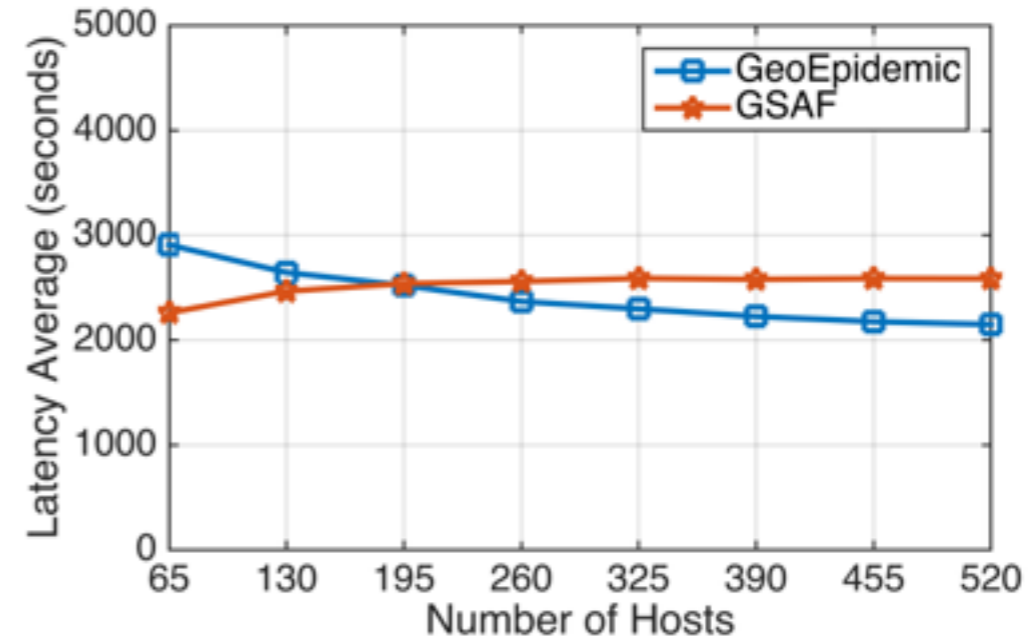
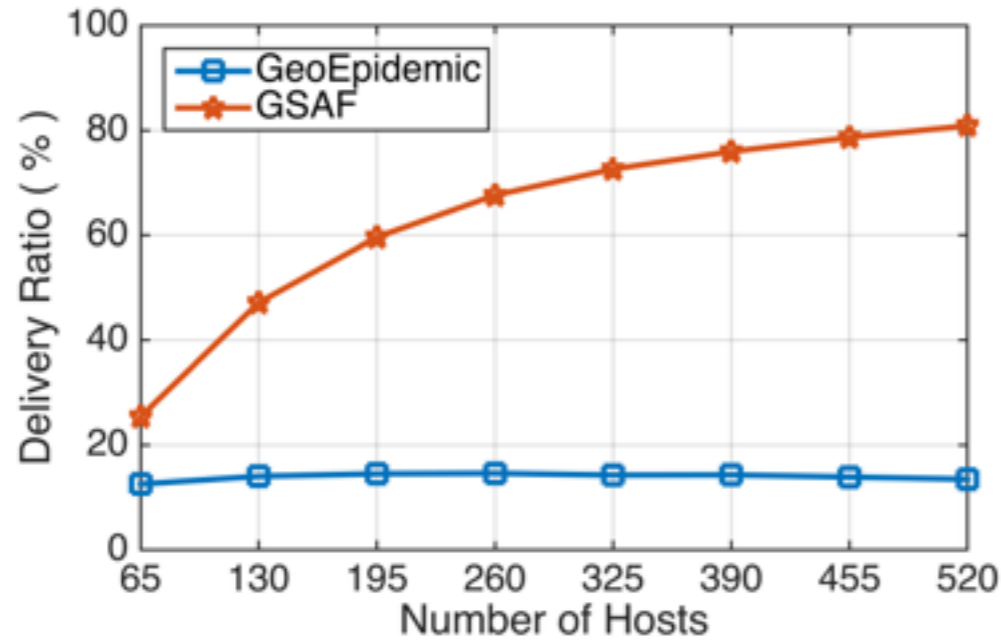


Helsinki city

# Evaluation & Results

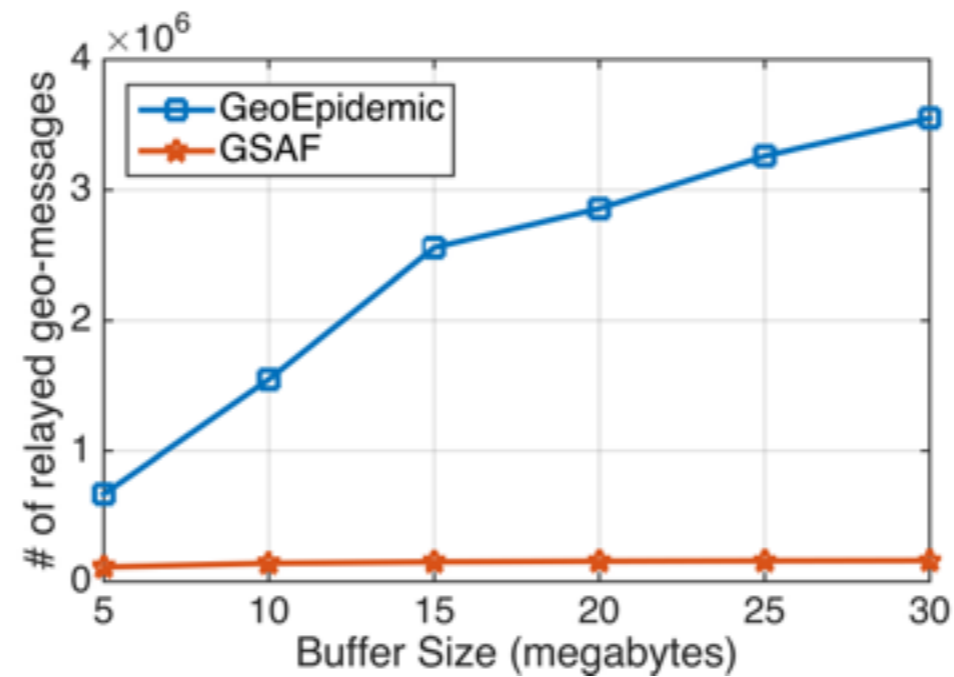
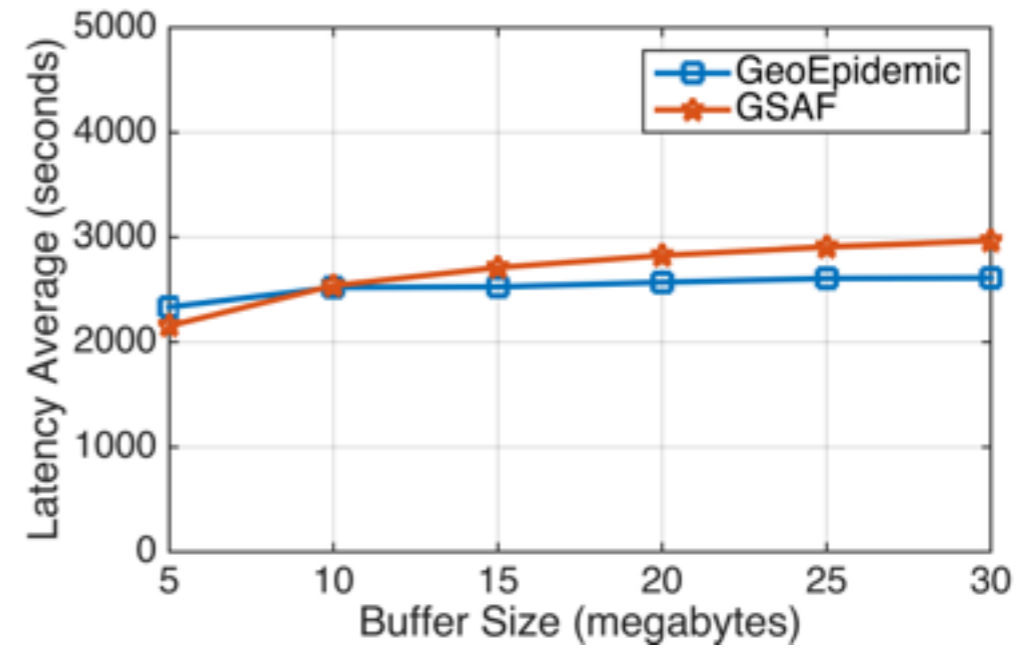
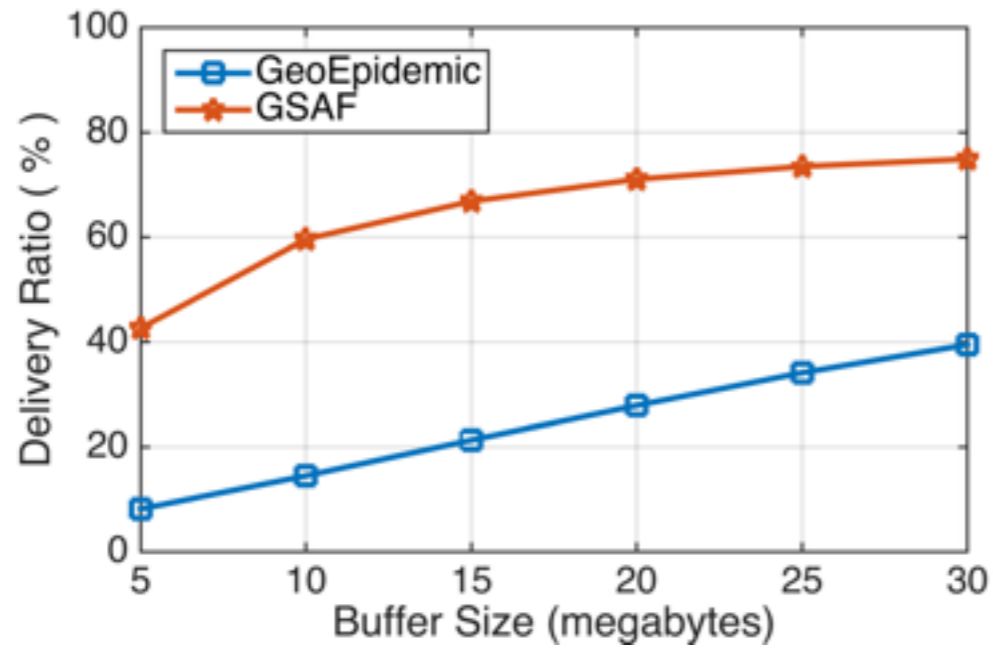
- Evaluation Parameters:
  - ▶ # of Users (65 to 520 nodes)
  - ▶ Buffer Capacity (5 to 30 MB)
  - ▶ Message lifetime (Time to live; 30 to 240 Min.)
- Metrics: Delivery Probability, Average Latency and # of relayed copies in the network.

# User Density

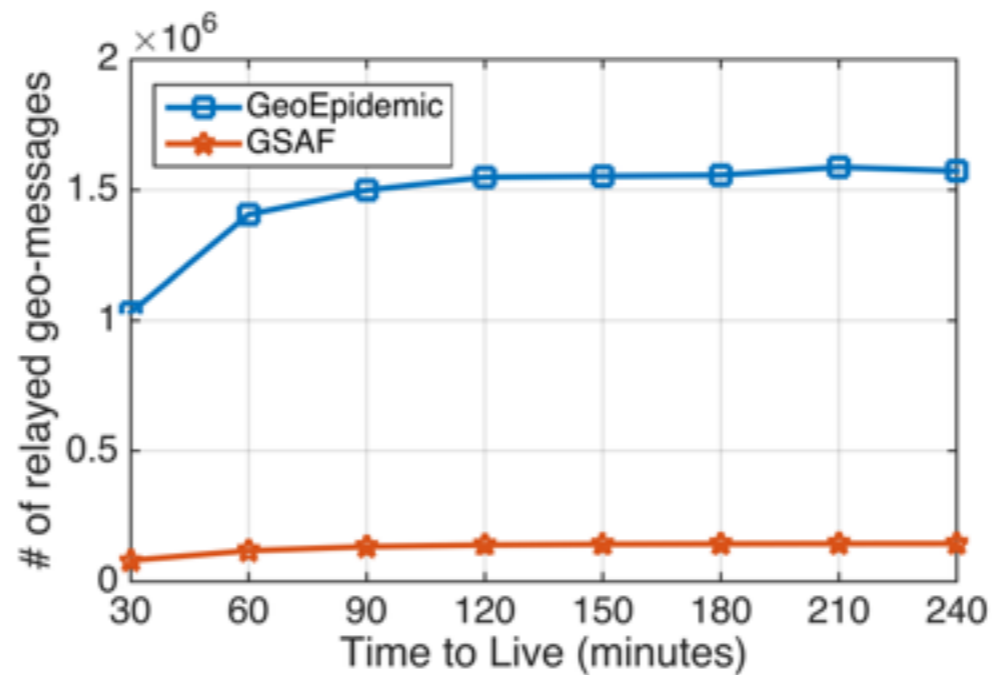
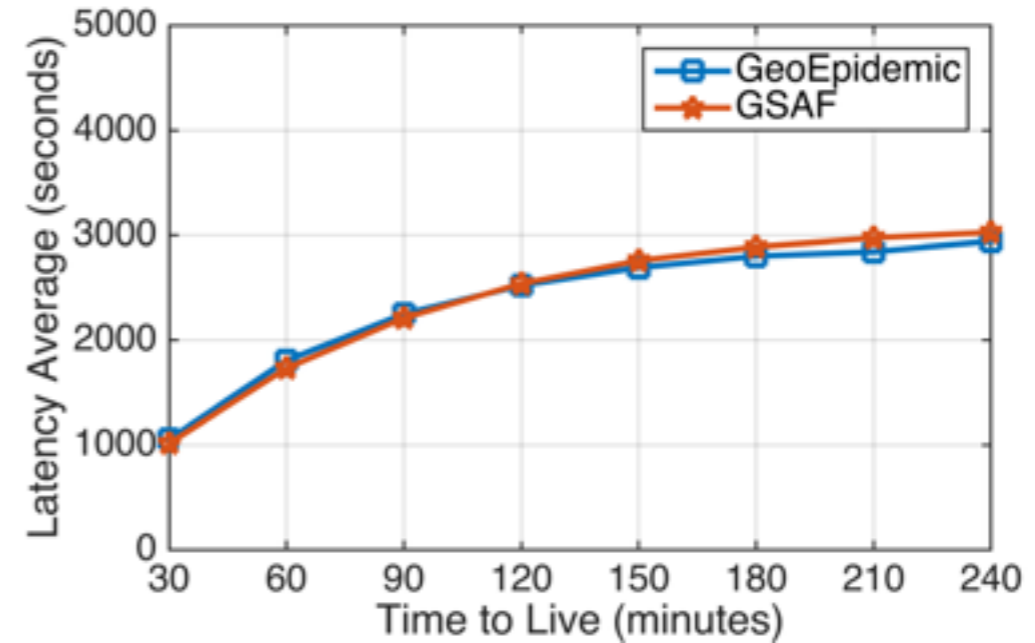
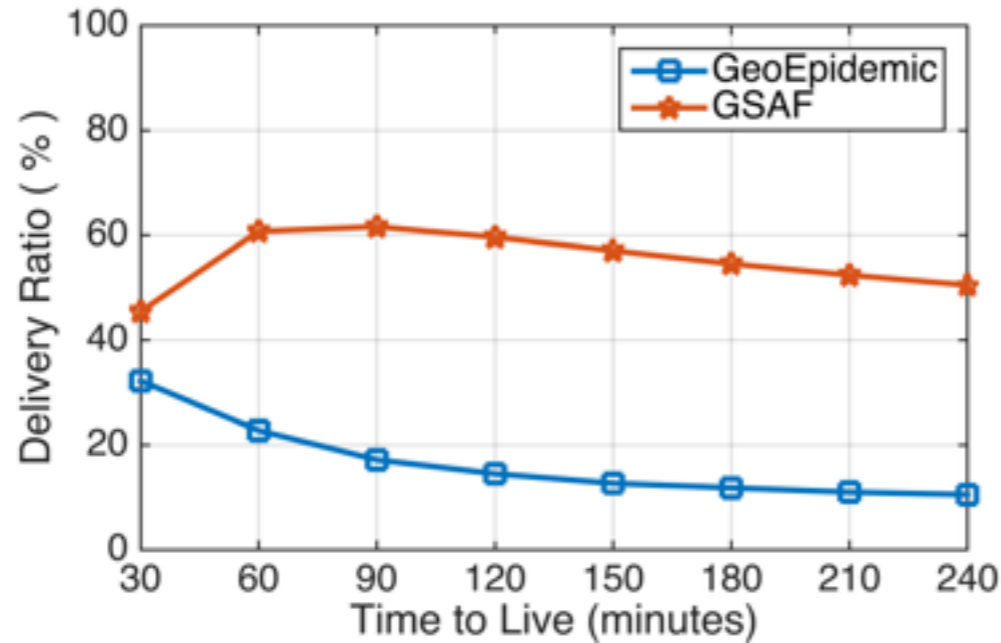




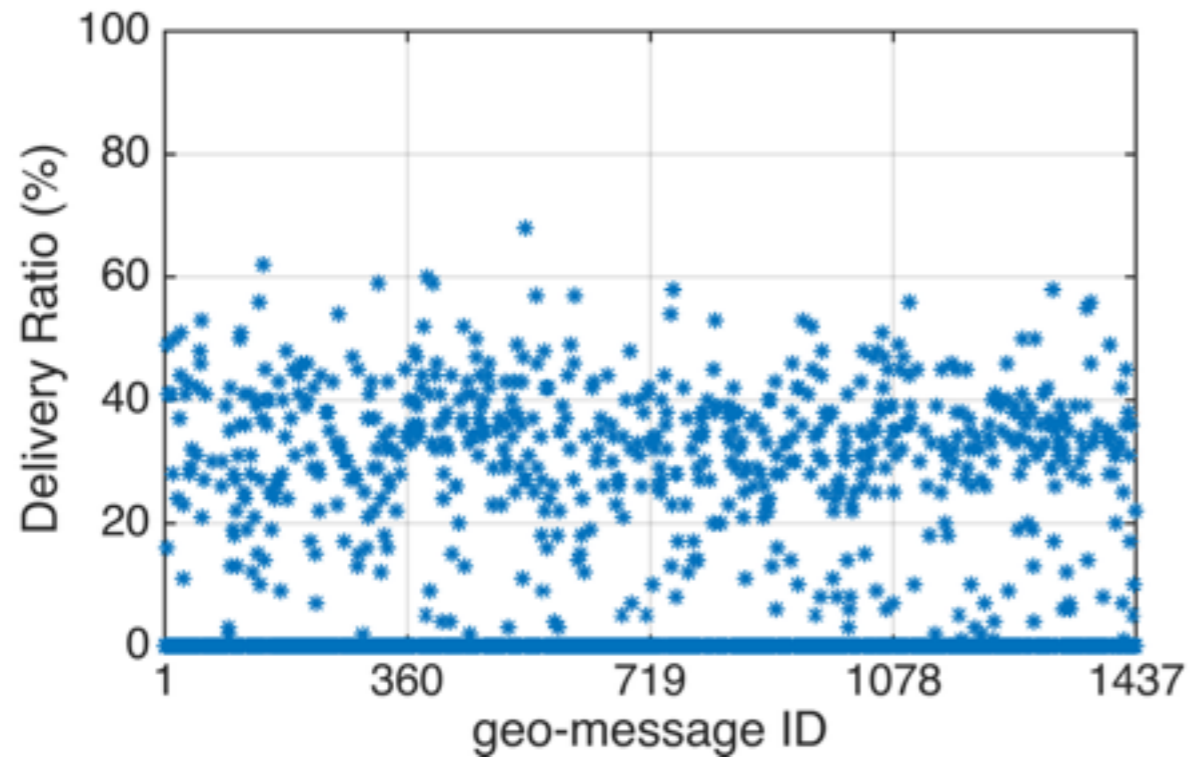
# Buffer Capacity



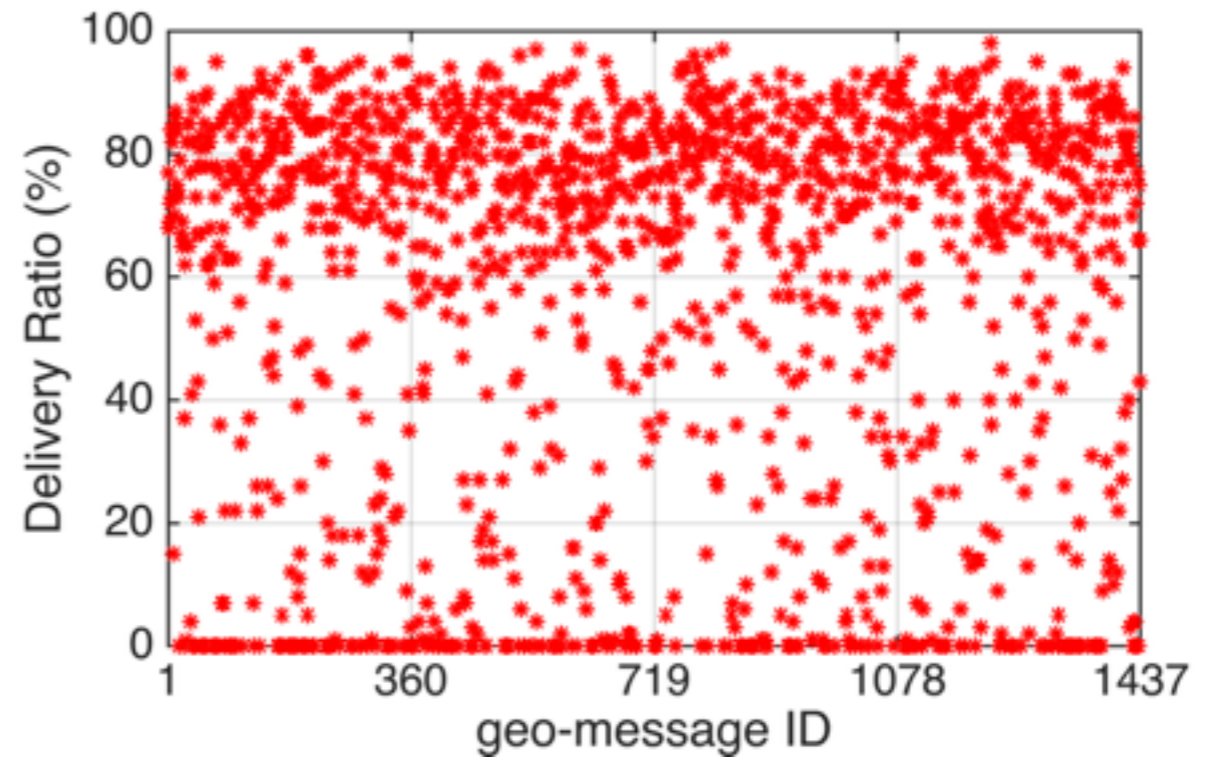
# Message Lifetime



# Per-Message Delivery



GeoEpidemic



GSAF

# Conclusions

- Geocasting in opportunistic networks - an existing challenge
  - ▶ A better approach to define casts
  - ▶ GSAF: an efficient routing protocol
- Future work: mobility models, maps, and comparison against other protocols (i.e. Geopp and EVR).

# Thank You Questions ?

**Publication:** A. Rajaei, D. Chalmers, I. Wakeman and G. Parisis (2016) "*GSAF: Efficient and Flexible Geocasting for Opportunistic Networks*". In 17th IEEE WOWMOM, Coimbra, Portugal.

If your are interested to see more results;  
Please visit: <http://www.aydinrajaei.com/research/gsaf-project/>