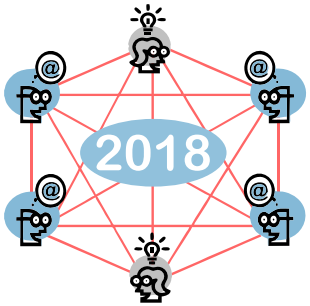
Community-based Mobility Model and Probabilistic ORBIT Mobility Model in OMNeT++

Vishnupriya Kuppusamy, Leonardo Sarmiento, Asanga Udugama and Anna Förster
Communication Networks (ComNets), University of Bremen



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Motivation

- Performance Analysis of Opportunistic Networks (OppNets)
  - Real tests beds – scalability
  - Simulation models
- Mobility models
  - Real-world traces
  - Synthetic models
- OMNeT++ - RWP, RW, SWIM, and BonnMotion for traces
- Less traces available – need for realistic Mobility models based on Sociality and individual schedules

Overview

- Mobility models
  - Community-based Mobility Model (CMM)
  - Probabilistic ORBIT
- Implementations in OMNeT++
- Evaluations and results
- Conclusion

Community-based Mobility Model (CMM)

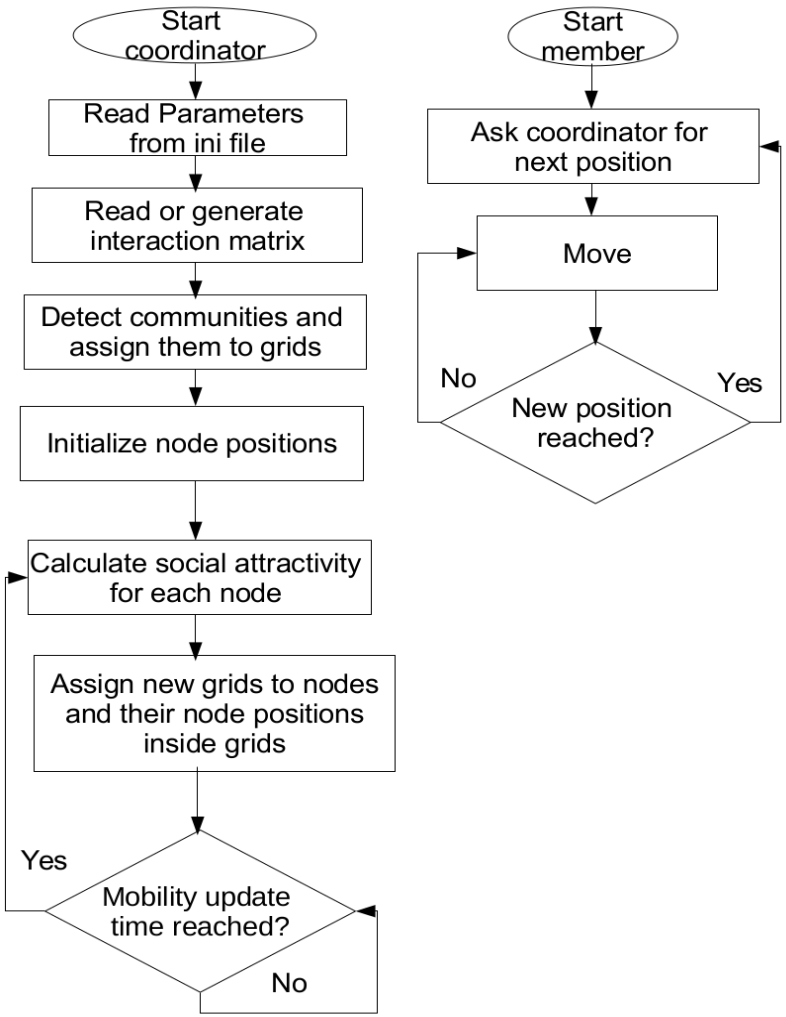
- Users with strong social ties
  - geographically co-located from time to time
  - move towards or within the same region
  - strongly associated nodes move as a community
- Social network interaction matrix
- Connectivity matrix
- Form communities
- Communities assigned to physical locations in simulation area called grids

Community-based Mobility Model

- Subsequent node movements –> influenced by the social interactions

$$\text{social attractivity factor of a grid for a host } i = \frac{\text{sum of interaction indicators of relationships between } i \text{ and other hosts in the grid}}{\text{Total number of hosts in the grid}}$$

Flow chart - CMM

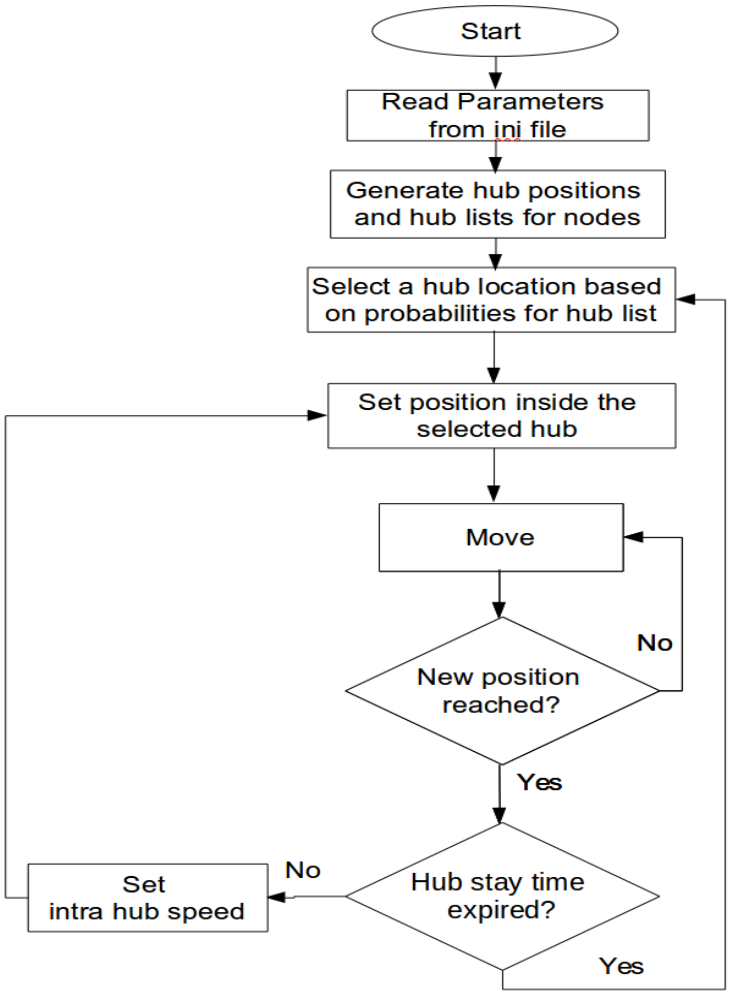


- Initialization phase
  - Load or create interaction matrix
  - Create communities
  - Assign communities to grids
- Mobility Phase
  - Calculate social attractivity
  - Move

Probabilistic ORBIT Mobility Model

- Most users move in a terrain consisting of certain locations with different probabilities
- Macro-mobility model; not concerned about exact position co-ordinates but approximate locations
- Different movement patterns for users – individual schedules, weekdays, weekends – configurable
- Every user has a set of assigned locations and move around these locations with different probabilities

Flow chart - Orbit



- Initialization phase
  - Get number of hubs, hub stay time, hub size
  - Set intra-hub and inter-hub speed
- Mobility Phase
  - Next hub location of node based on probability
  - Move to a random position in the selected hub

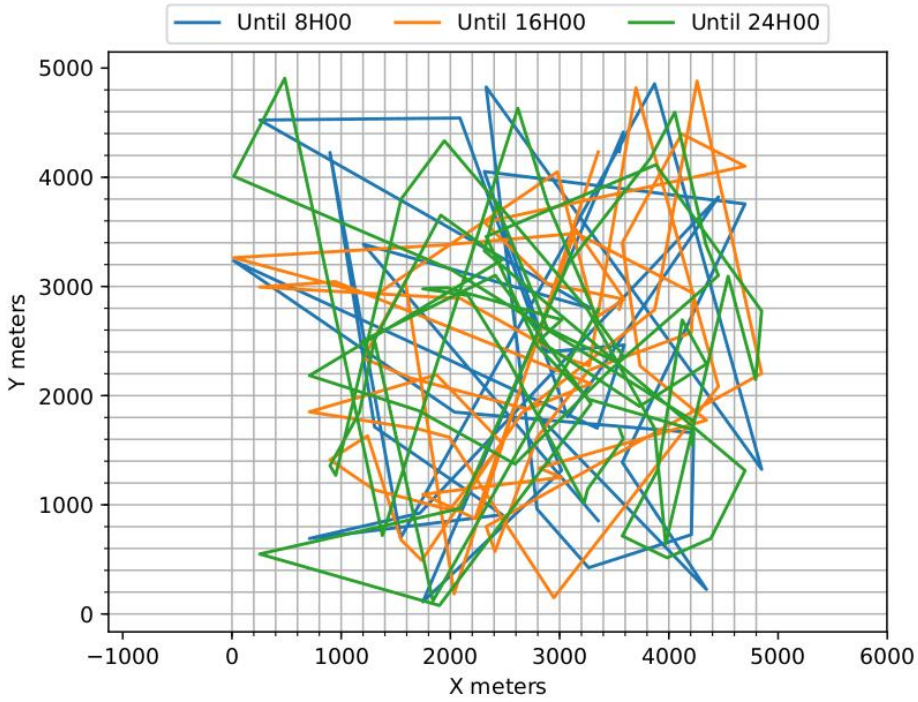
Evaluation setup

Parameter	RWP	CMM	ORBIT
Nodes	100	100	100
Area	5 km x 5 km	5 km x 5 km	5 km x 5 km
Simulation time	24 hours	24 hours	24 hours
Community size / Hub size	-	200 m x 200 m	200 m x 200 m
Speed	1 - 6 meters/sec	1 - 6 meters/sec	intra-hub speed: 1 - 3 meters/sec inter-hub speed: 1- 6 meters/sec
Mobility update interval	1 second	1 second	1 second
Hub stay time	-	-	50 - 100 seconds
Timeout / Reconfiguration interval	-	8 hours	8 hours

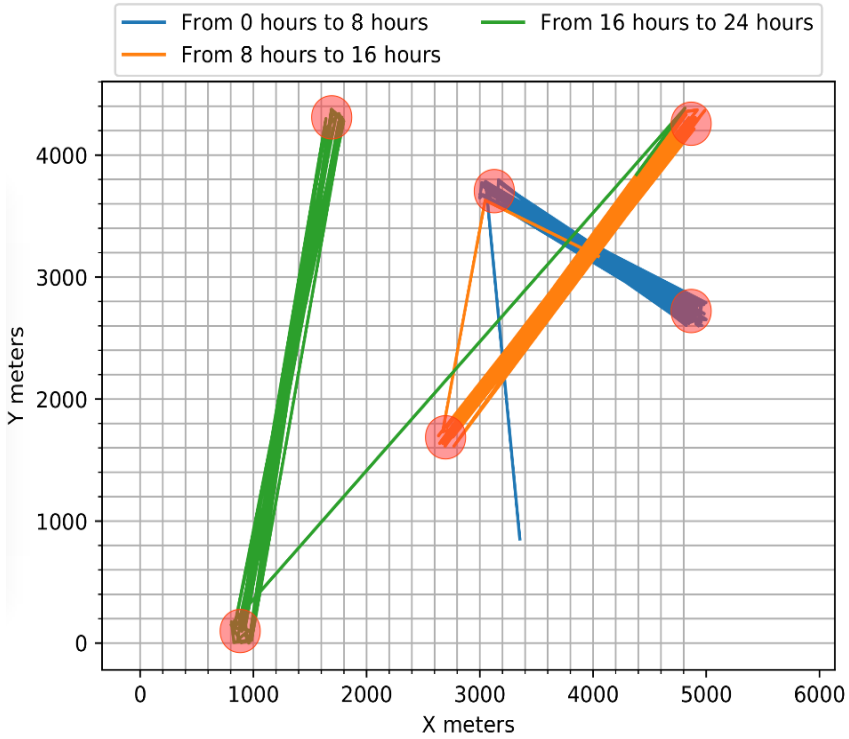
Table 1: **Simulation Configuration for RWP, CMM and ORBIT mobility models**

- Random-waypoint to compare the differences
- Reconfiguration interval of 8 hours
- Node movements refreshed for CMM and ORBIT and not RWP

Results - Trajectories



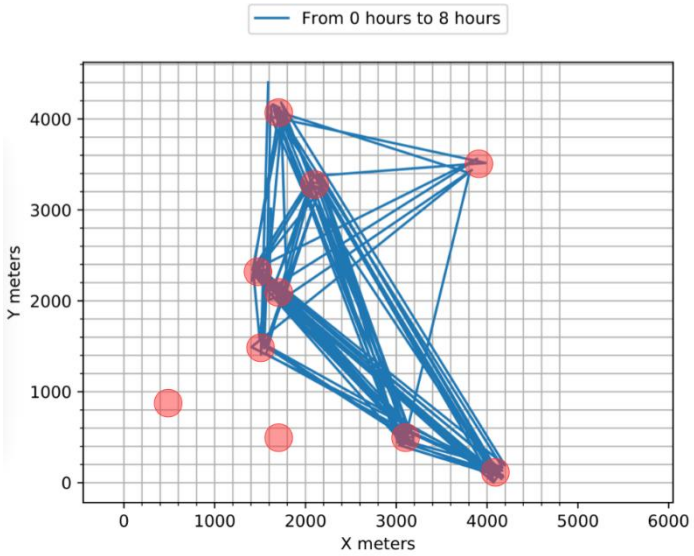
Random Waypoint

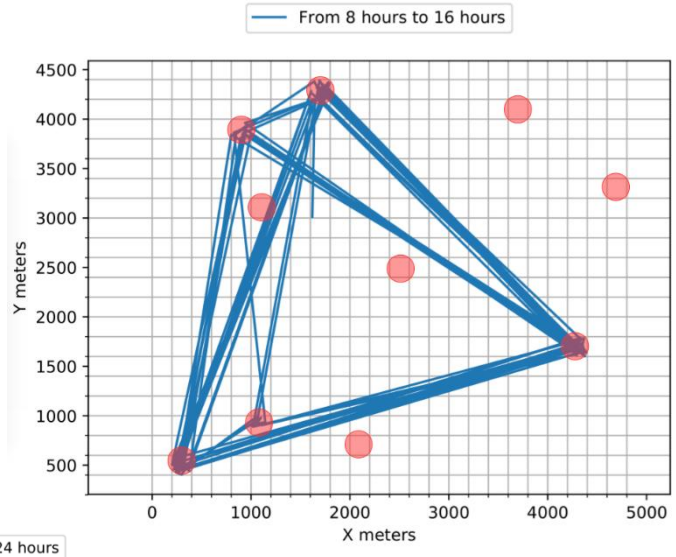


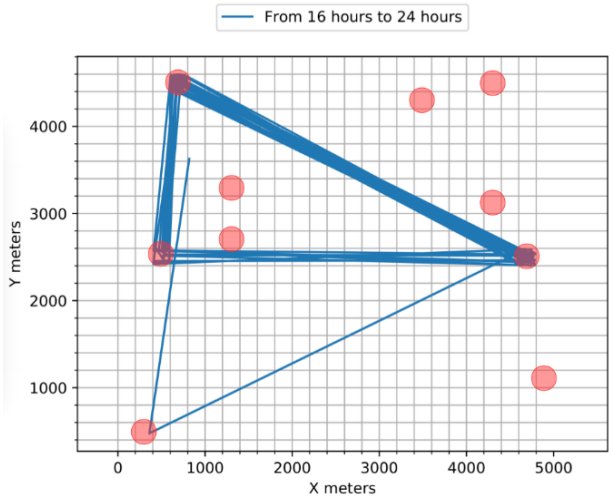
CMM

Movements for reconfiguration interval of 8 hours and simulation time of 24 hrs

Results - Trajectories

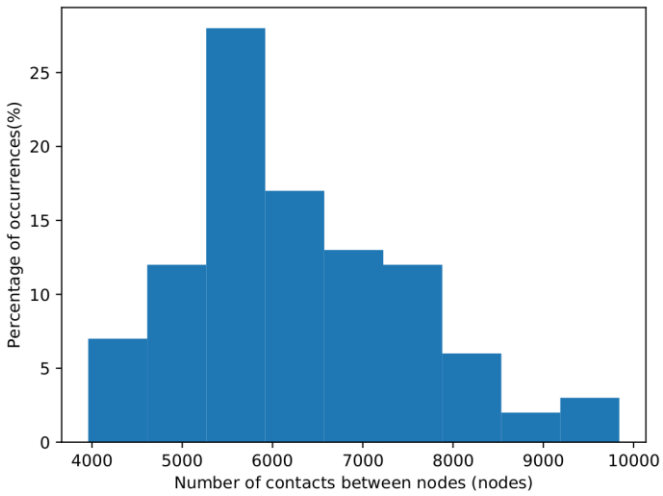




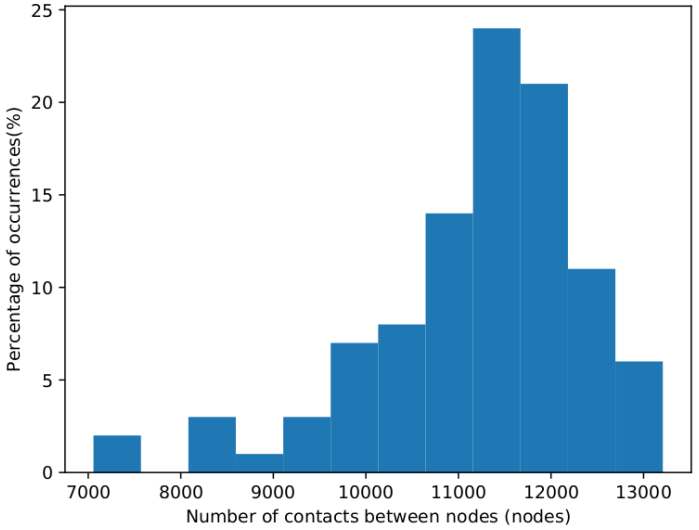


ORBIT

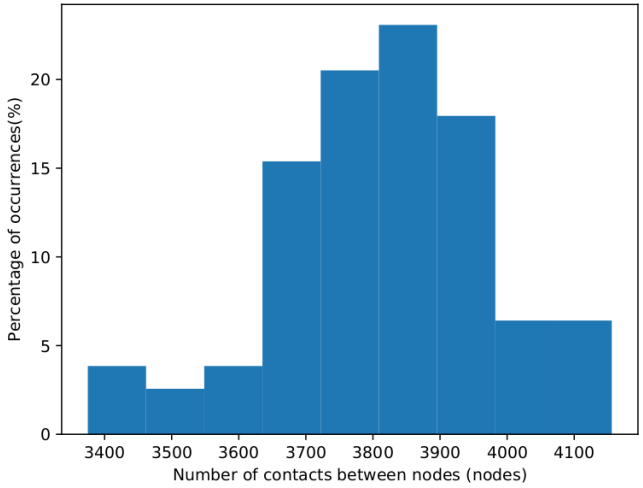
Results – Total number of contacts



CMM

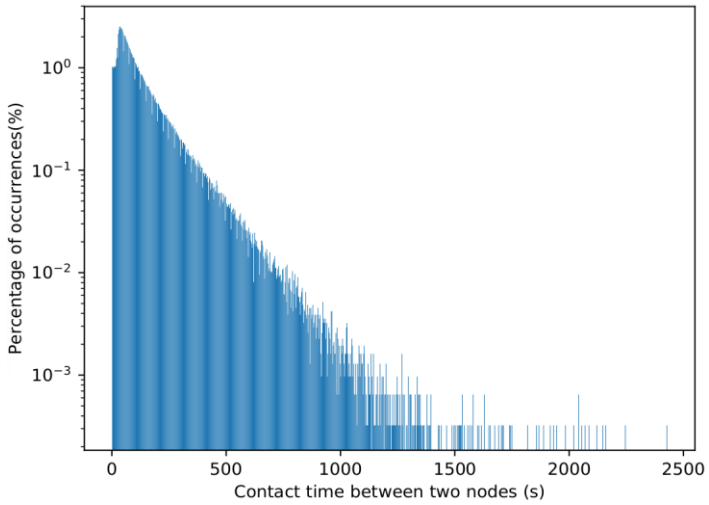


ORBIT

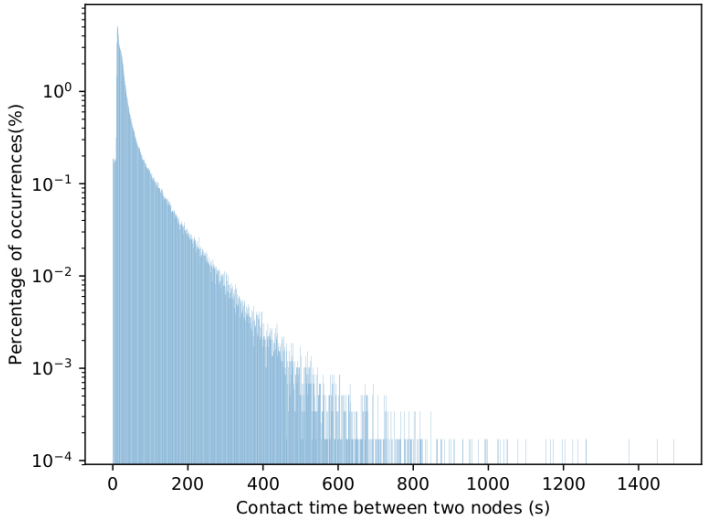


Random Way-point

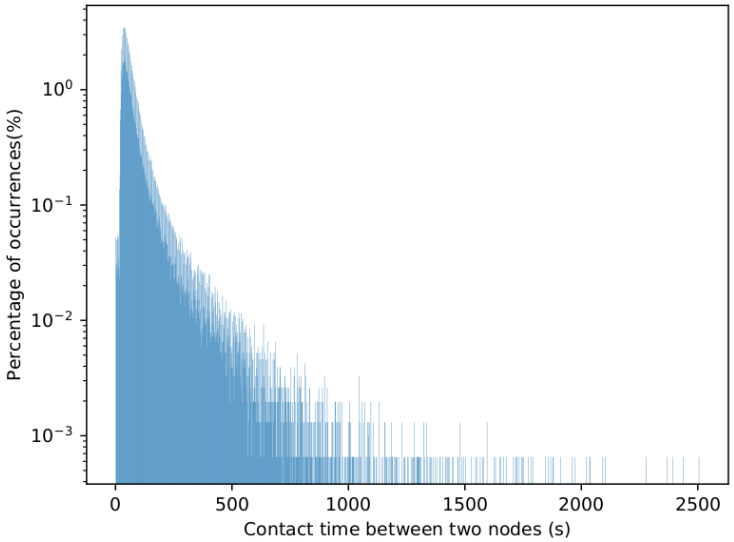
Results – Contact Times (Durations)



CMM

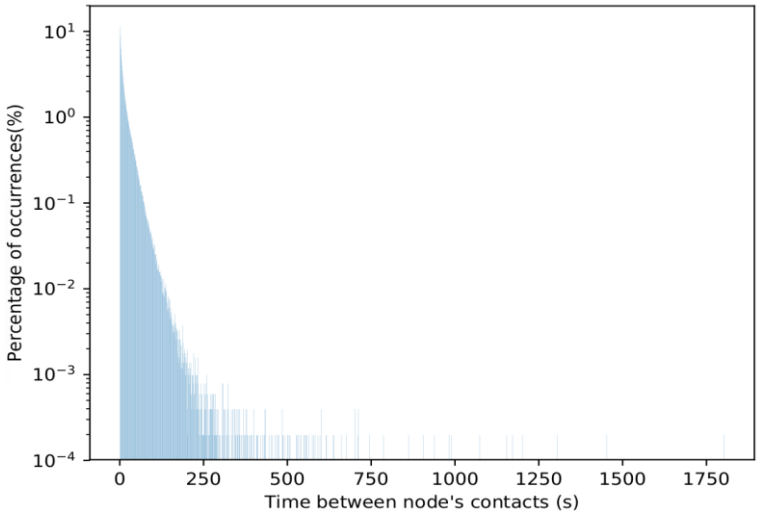


ORBIT

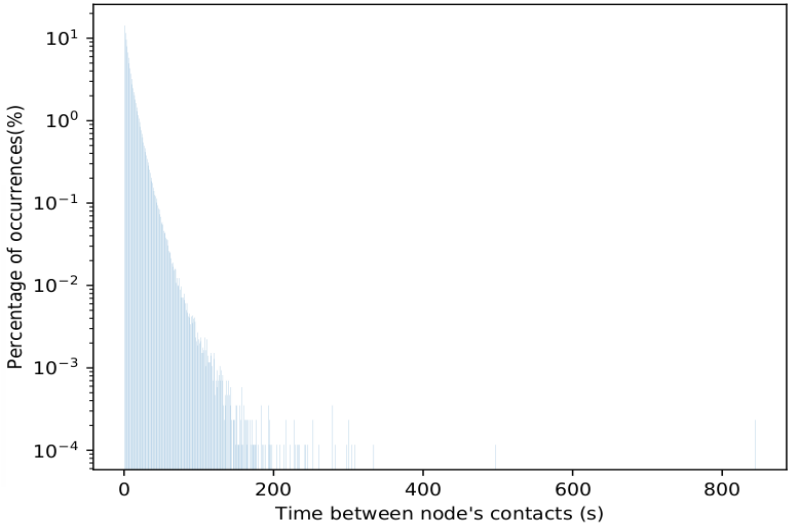


Random Way-point

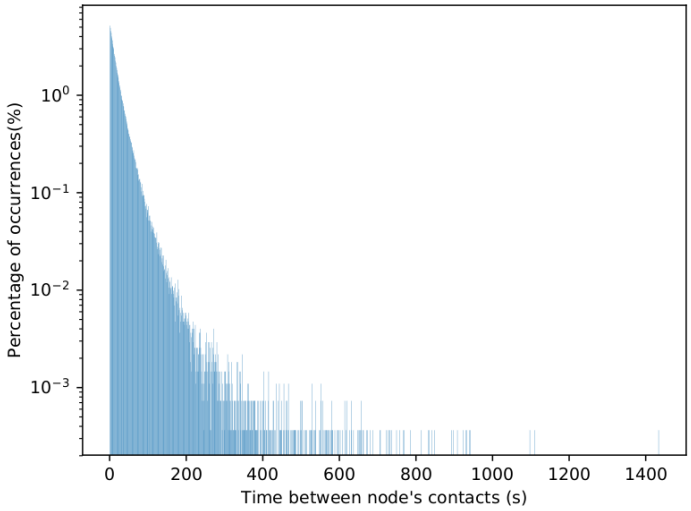
Results – Time between contacts



CMM

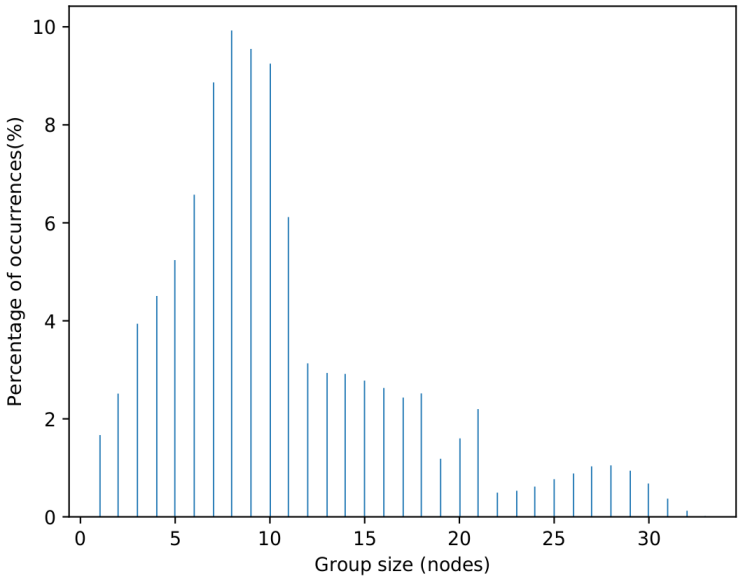


ORBIT

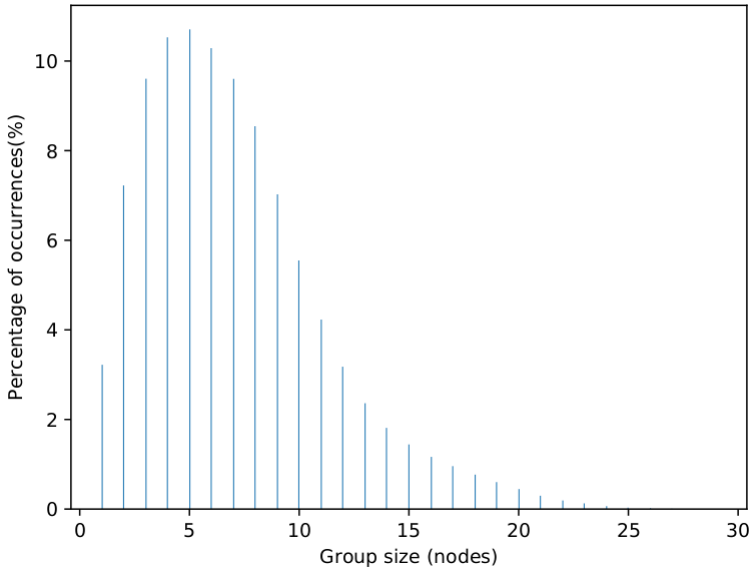


Random Way-point

Results – Community size / Hub size



CMM



ORBIT

Conclusion and Future Work

- CMM and ORBIT implementations in OMNeT++
- Functions verified using simulation configurations
- Use traces in the future to evaluate these models

Thank You