

Opportunistic Spatial Gossip over Mobile Social Networks

A. Chaintreau, P. Fraigniaud, E. Lebhar
Thomson & CNRS-Université Paris Diderot

Monday, August 18th 2008, talk @ workshop WOSN

Objectives of this talk

- Discuss the future of Social Networks Applications
 - emphasis on **mobile** users and peer to peer architecture



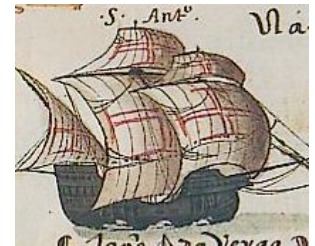
- Present one main result:
 - Mobility helps maintaining **favorable** structural properties

Structure of this talk

- Mobile social network applications
- Model and opportunistic connection scheme
- Application to resource location
- Concluding remarks

In a near future ...

- Most users may access OSNs (and the Internet) through a mobile devices
- Their respective locations become relevant
 - “who is my closest friend and where he/she is?”
 - “what is the closest event happening?”
- Bandwidth:
 - Infrastructure may exist and perhaps remains expensive
 - Opportunistic contacts with users and APs explode



Challenges: the role of mobility

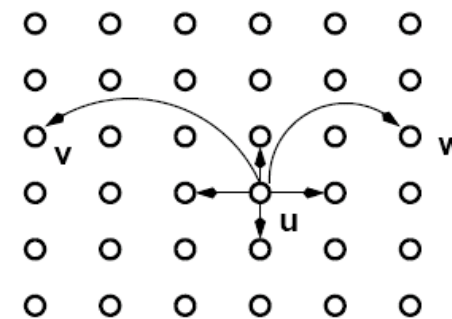
- Is mobility only a troublemaker? Can it be helpful?

- may increase ad-hoc capacity [Grossglauser/Tse 01]
- Can random mobility induces **favorable** structural properties ?



- As an example, can mobility facilitate **Navigation**?

- Add a small number of links, used by routing **incidentally** such that $O(\text{polylog } d)$ steps ? [Kleinberg00].

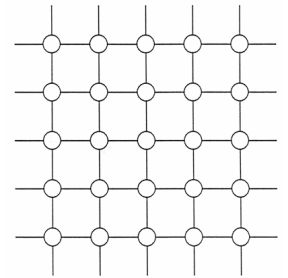


Structure of this talk

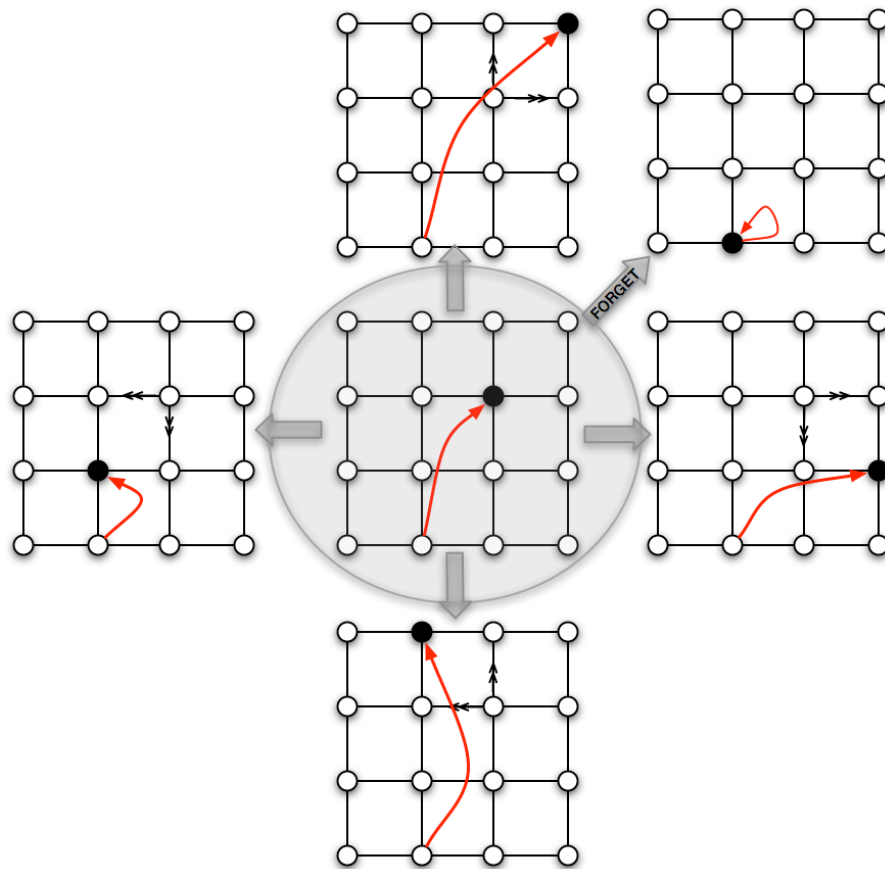
- Mobile social network applications
- Model and opportunistic connection scheme
- Application to resource location
- Concluding remarks

Our network assumptions

- Nodes are located on a lattice (dimension k)
 - Static: fixed access points
 - Mobile: mutually independent random walks
- Opportunistic connections
 - Each static/mobile node has a small number m of **mates**, chosen as nodes that are met opportunistically.
 - A node may contact any of its mate later
 - A mate with age $a \geq 0$ is forgotten with probability $\phi(a)$
e.g. such that the age distribution of a mate is $\pi(a) = \frac{c}{a^\nu}$



Why such opportunistic scheme for OSNs?



- (Physicist):
 - Understand mobile social networks.
 - Simple ageing scheme.
- (Computer scientist):
 - easy to enforce as a p2p augmentation scheme
- (Economist):
 - Can be done inside community of interest

Structure of this talk

- Mobile Social Network Applications
- Model and Opportunistic connection scheme
- Application to resource location
- Concluding remarks

Key building block

- Navigation [Kleinberg00], Spatial gossip [Kempe-Kleinberg-Demers01] exploits **specific** random shortcuts
 - For any $\rho \geq 1$, shortcuts length distribution as $\frac{1}{d^{\rho \cdot k}}$
- For any $\rho \geq 1$, there exists a forget function ϕ_ρ such that the shortcuts length distribution satisfies

$$\frac{c}{||\mathbf{d}||^{\rho k}} \leq f(\mathbf{d}) \leq \frac{c' \cdot \ln^{k\rho/2} ||\mathbf{d}||}{||\mathbf{d}||^{\rho k}}.$$

- Proof follows from properties of symmetric random walks
- It corresponds to $\nu = 1 + \frac{k(\rho-1)}{2}$

Application to Resource location

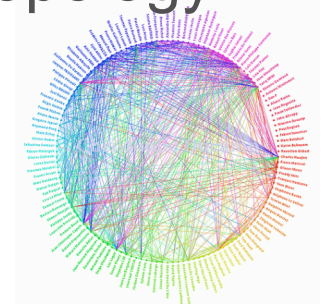
- The goal is to locate the nearest item
 - a copy of a file, or a node with a given property.



- With this scheme, gossiping with mates finds the item using $O(\ln^2 d)$ steps (d is the distance to the nearest item).

Concluding remarks

- Social Network Applications can exploit mobility
 - To answer efficiently locality aware query.
 - Key result: benefit from favorable augmentation topology
- Future steps:
 - Gossiping with mates among mobile nodes only
 - How different mobility affects the forgetting distribution?
 - Can we use the same property without infrastructure?



Thank you!