



Graph Models of Information Spreading in Distributed Networks

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Motivation

Ad hoc/sensor/vehicular/personal networks will be the future of distributed computing (as efficiency+integration \uparrow while cost-per-unit \downarrow)



Mobile Devices Networks



Vehicular Networks



Wildlife Surveillance Systems



Field Operations

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Motivation of my research

We need **theoretical knowledge** of the fundamental properties of these systems, in order to design efficient and scalable algorithms

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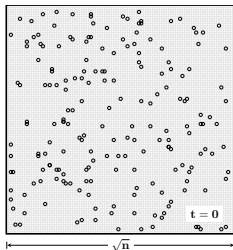
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- **Bonus** by-product: new techniques to study related phenomena (e.g. social networks, caching policies for digital content, . . .)

Example: Broadcast in Mobile Networks

Tight Bounds on Information Dissemination in Sparse Mobile Networks

A. P., A. Pietracaprina, G. Pucci and E. Upfal (PODC 2011)

- $[0, \sqrt{n}]^2$ 2D integer grid
- k agents, initially placed u.a.r.
- each agent performs a simple random walk
- time is discrete, movements are synchronous
- two agents communicate when they are within distance r (= tx radius)

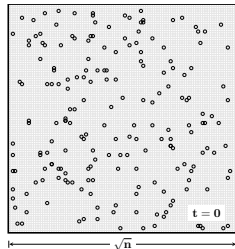


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Question: Broadcast Time T_B

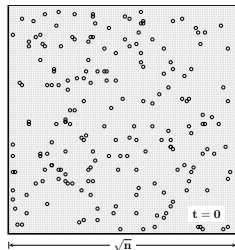
How long does it take to broadcast a message to all agents?

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Answer

In sparse networks (i.e. below percolation), $T_B = \tilde{\Theta}\left(\frac{n}{\sqrt{k}}\right)$ w.h.p.

Work in Progress and Open (Meta)Questions

- Other types of interaction (e.g. voter models)
- Biased random walk (e.g. popular places)
- Different domain topology (e.g. mirrors, barriers)
- Diffusion time vs. message complexity trade-off
- Caching policies for different contents

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HPC \Rightarrow Theory

Can we gain insight by simulating **large-scale** systems?

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Theory \Rightarrow HPC

Can we develop **realistic and useful** models for **unstructured** parallel and distributed computing?