

Mobicast: Just-in-Time Multicast for Sensor networks under Spatiotemporal Constraints

IPSN 2003

Huang, Q., Lu, C., and Roman, G.-C.

Po-Yu Chen

2003.11.26



Outline

- @ Introduction
- @ Problem definition
- @ Mobicast protocol
- @ Discussion and Conclusion
- @ Future works
- @ Reference



introduction

@ The methods of disseminating information

- @ Unicast

- @ Broadcast

- @ Multicast

- @ Geocast [1] [5]

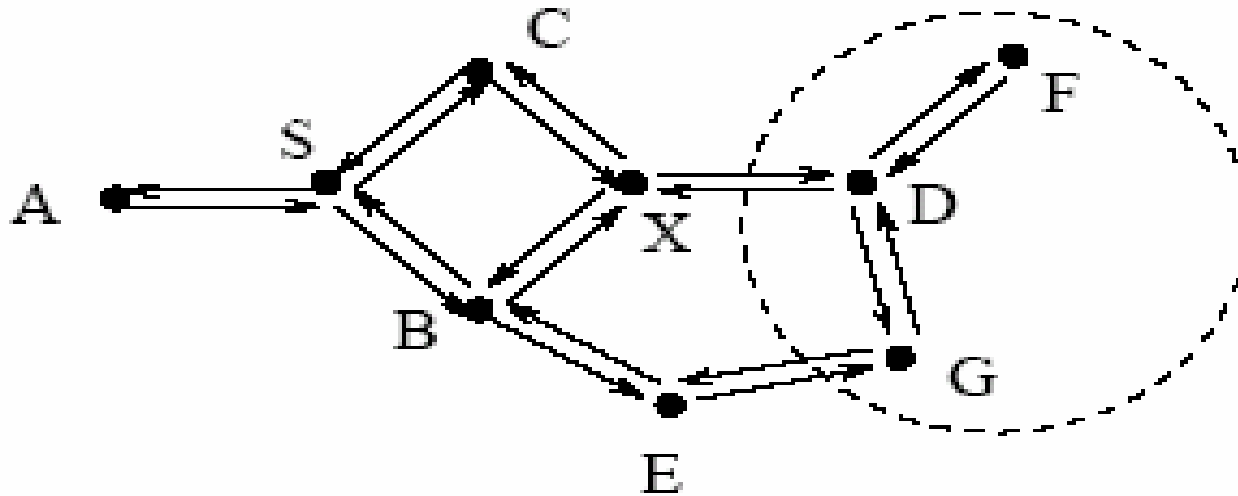
 - @ Location-based multicast

 - @ Multicast members are determined by their locations.

- @ Mobicast [2], [3], [4]



Introduction



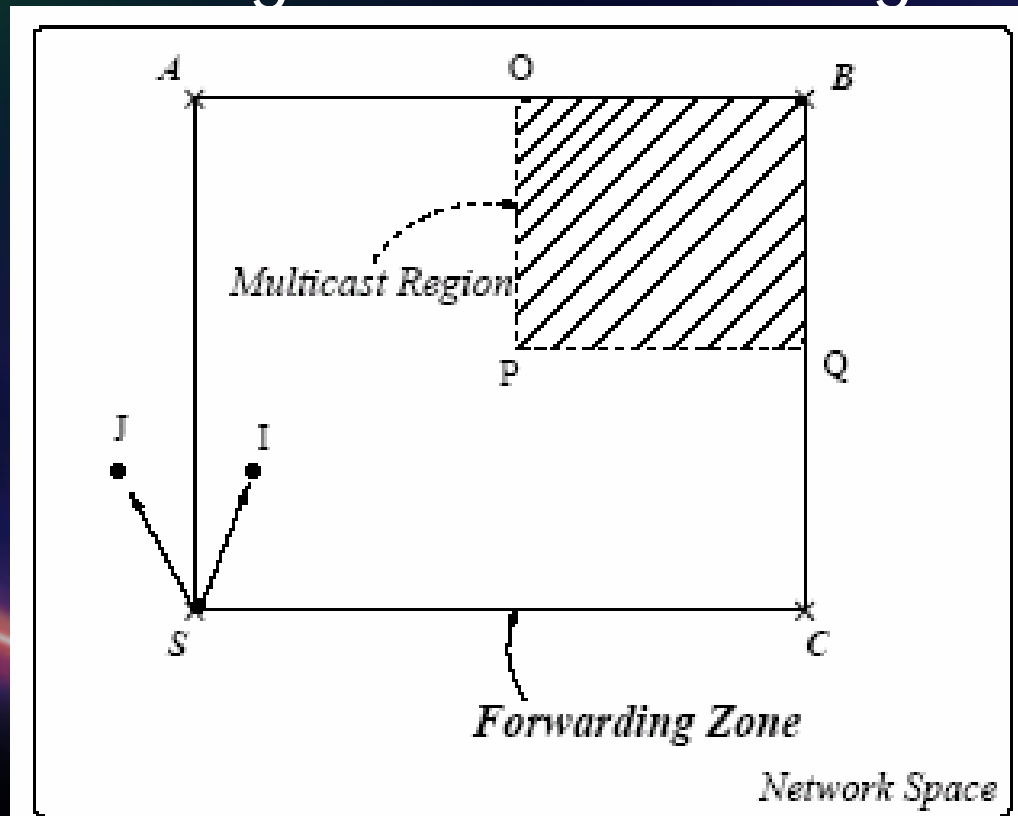
multicast data packet




Introduction

@ Geocast

- @ Location-based/geographical multicast
- @ Multicast region and forwarding zone



Introduction

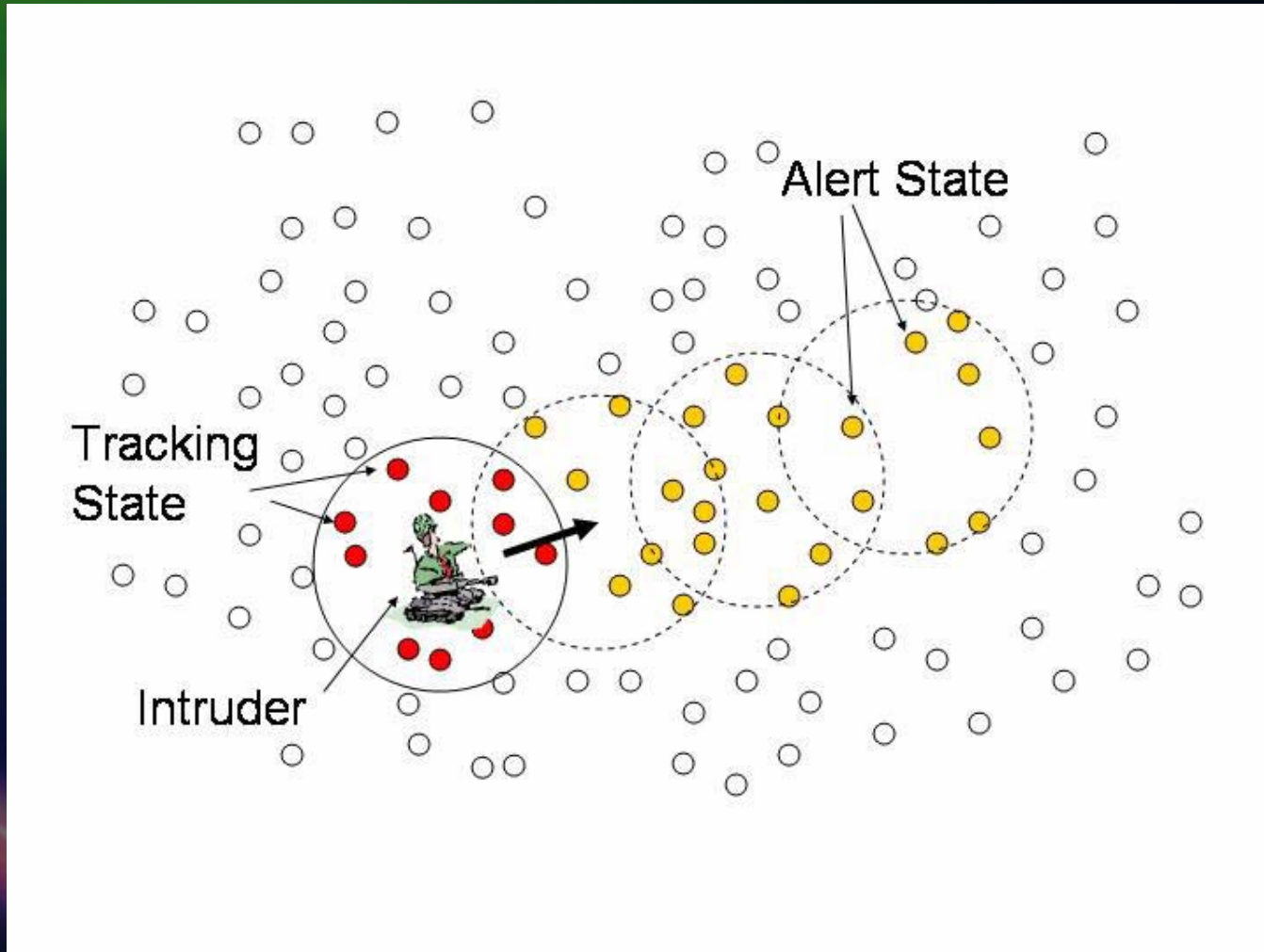
- @ Large-scale wireless sensor networks
 - @ Smart highway system
 - @ Emergency response system
 - @ Disaster recovery system
 - @ Data aggregation
 - @ End-to-end route from source to BS
 - @ Group coordination among sensors
 - @ Group management protocol
 - @ Communication mechanism (unicast or multicast)
- 

Introduction

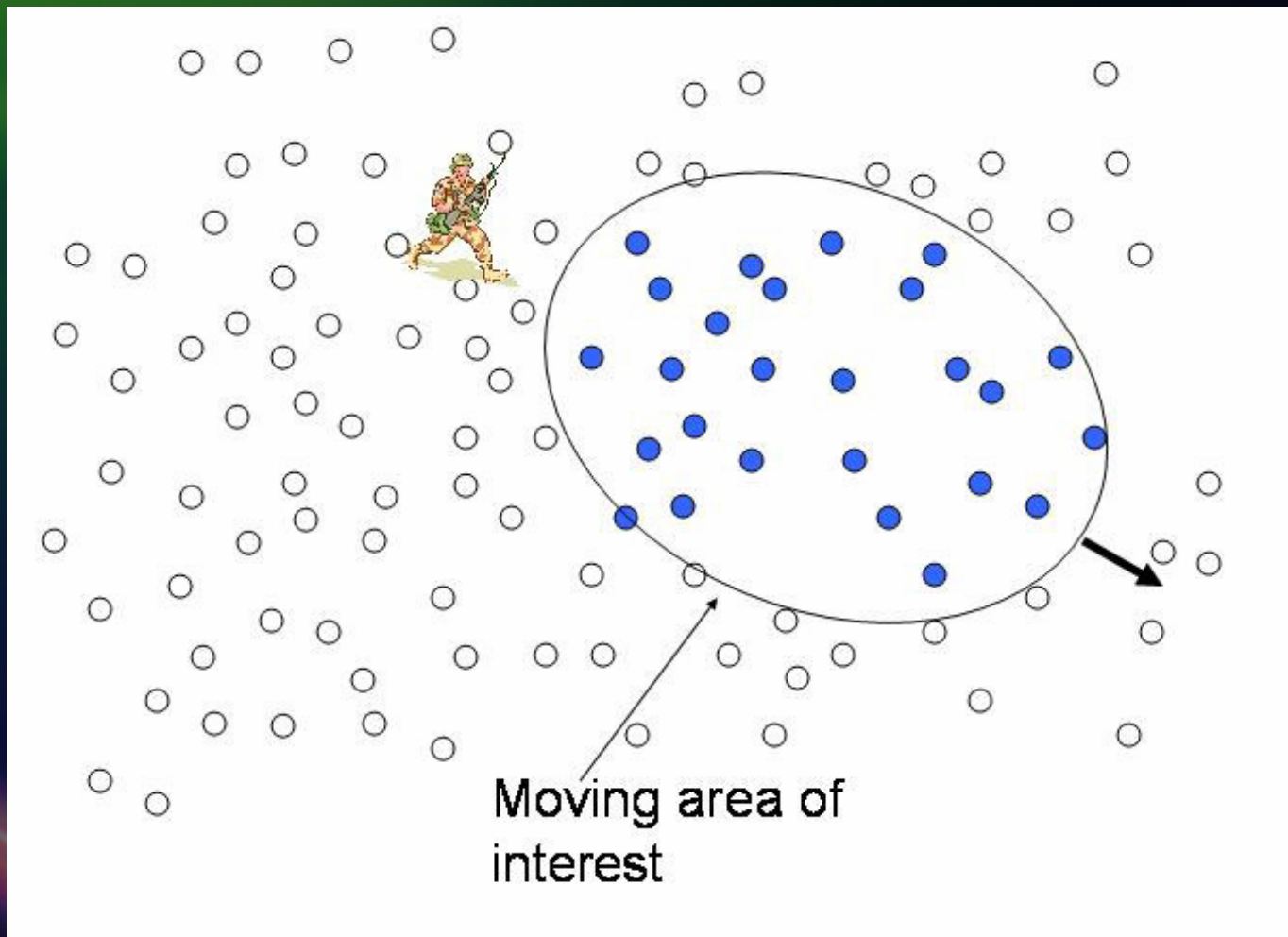
- @ Local coordination is often subject to spatiotemporal constraints due to mobility in the physical environment.
- @ Environment mobility
 - @ Personal tracking in emergency sites
 - @ Mobile robots in factories
- @ Spatiotemporal constrain
 - @ Spatial constrain
 - @ Timing constrain



Introduction



Introduction



Problem definition

- ④ The ultimate goal of mobicast is to achieve just-in-time information dissemination to all nodes in some prescribed spatial area in the network.



Mobicast protocol

@ Sensor network model

- @ No network partition

- @ All nodes are location-aware (GPS)

- @ The clock-drift among sensors is negligible

- @ Local wireless broadcast is reliable



Mobicast protocol

- @ Three components
 - @ Delivery zone
 - @ Forwarding zone
 - @ Hold & Forwarding zone



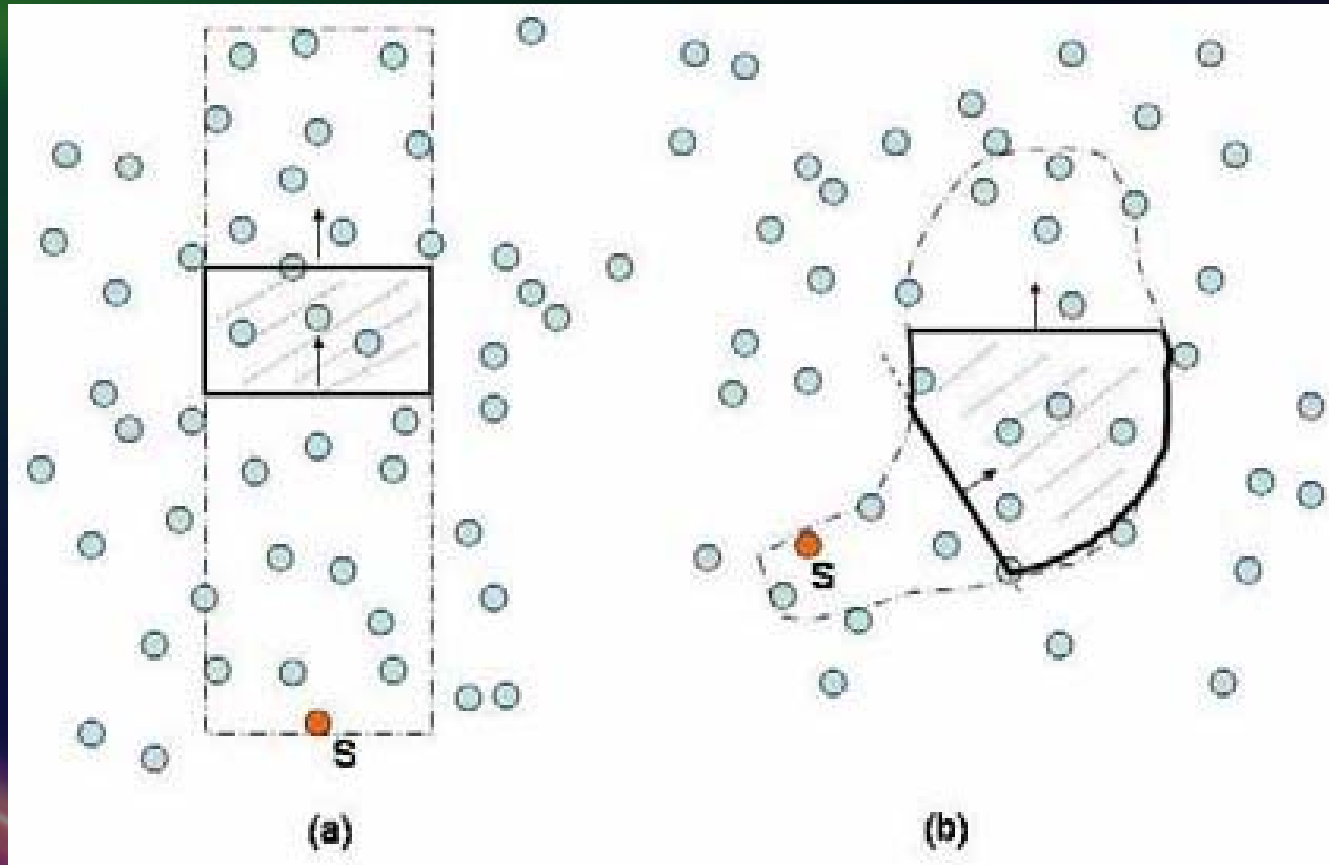
Mobicast protocol

@ Delivery zone

$Z[t]$

- @ All nodes inside zone Z at time t should have information D .
- @ The shape and motion of $Z[t]$ are defined/specified by mobicast users.
- @ The information D is applied to application
- @ It is the core of forwarding zone

Mobicast delivery zone



Mobicast protocol

@ Forwarding zone

$F[t]$

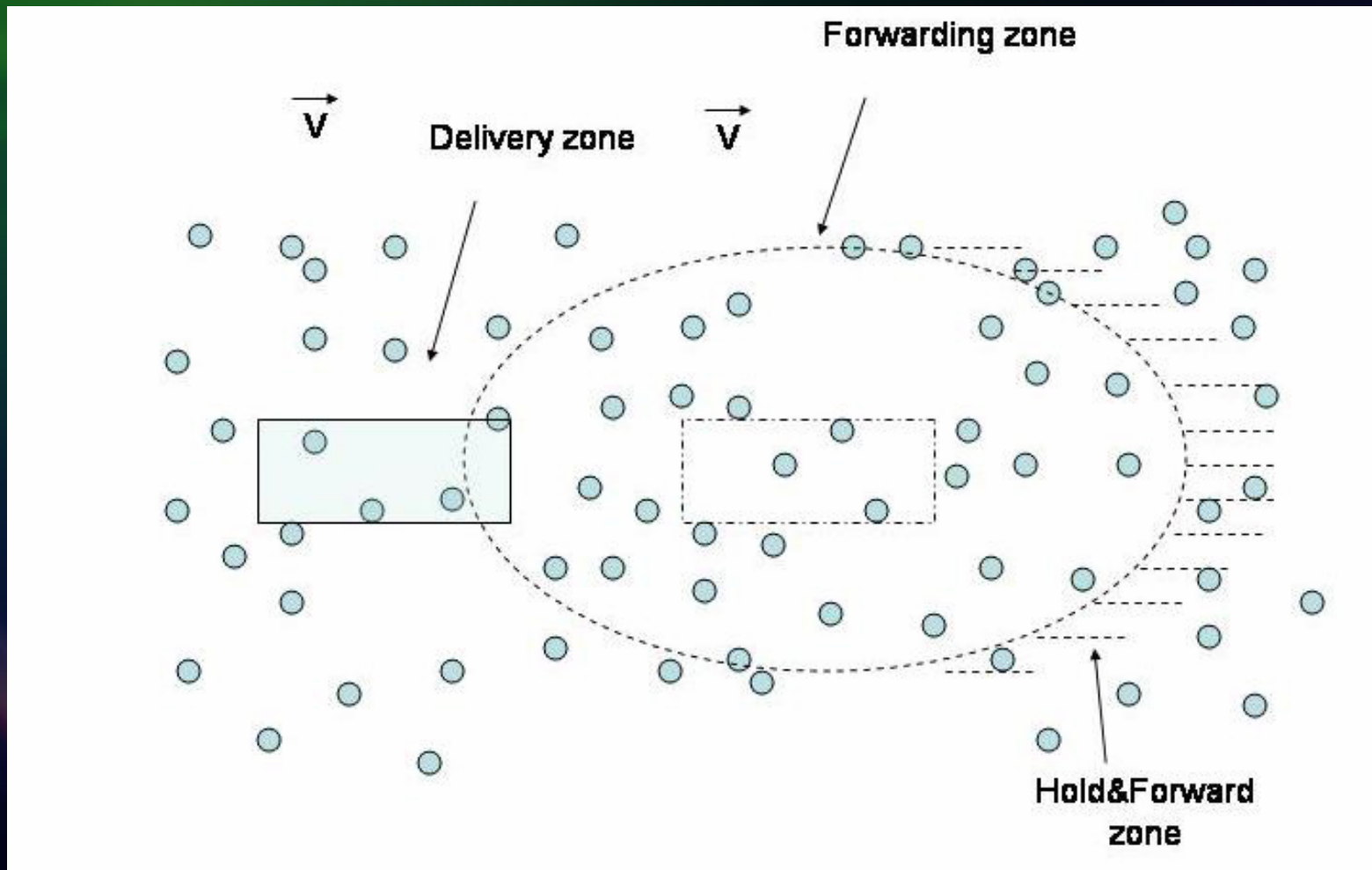
- @ Moving at some distance (headway distance) ahead of delivery zone
- @ A node forwards messages only if it belongs to the forwarding zone.
- @ It guarantees that all nodes entering the delivery zone will have received mobicast messages

Mobicast protocol

@ Hold & Forwarding zone

- @ The nodes in front of forwarding zone enter a hold-and-forward state if they receive mobicast message.
- @ They don't retransmit message until becoming members of the forwarding zone.

Mobicast protocol



Mobicast protocol

@ Request : $\langle D, Z[t], T \rangle$

@ D: information

@ Z[t]: delivery zone

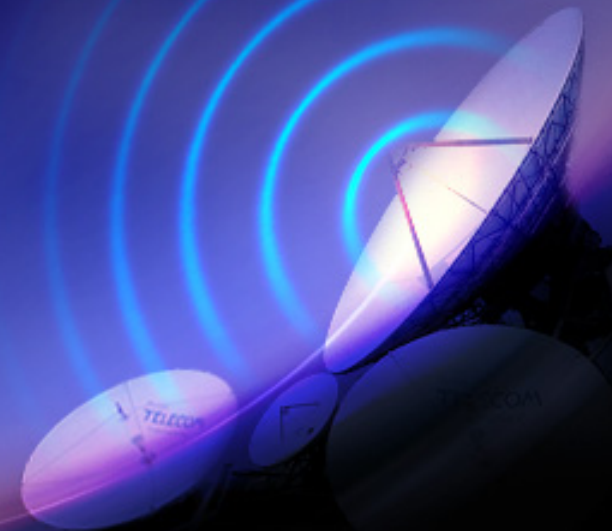
@ T: a period of time

@ When a request is presented to mobicast service at time t_0 , it constructs and broadcasts a mobicast message to all the neighbors.

Mobicast protocol

@ Mobicast packet m

- @ A unique message identifier
- @ A delivery zone descriptor
- @ A forwarding zone descriptor
- @ The session starting time t_0
- @ The session lifetime T
- @ The message data D



Mobicast protocol

@ Initial phase

- @ The node in the path of forwarding zone receives message for the first time, it will rebroadcast message as soon as possible.

@ Cruising phase

- @ The forwarding zone moves at the same velocity as the delivery zone.



Discussion

- @ Delivery zone covers at least one node in the network.
 - @ Big hole?
- @ The network topology is static.
 - @ It can not scale well to large and dynamic networks
- @ The protocol needs global information about the network.
- @ Solutions
 - @ [3], [4], but the network topology is still static

Conclusion

- @ This paper proposes a new multicast paradigm for disseminating information to a set of nodes in a sensor network under spatiotemporal constraints.
- @ The key element is a dynamic forwarding zone moves ahead of the delivery zone.

Reference

- ① [1] Ko, Y., Vaidya, N.: Geocasting in mobile ad hoc networks: Location-based multicast algorithms (1998)
- ① [2] Huang, Q., Lu, C., and Roman, G.-C., "Mobicast: Just-in-Time Multicast for Sensor Networks under Spatiotemporal Constraints," in Proceedings of The 2nd International Workshop on Information Processing in Sensor Networks (IPSN), Springer, April 2003
- ① [3] Huang, Q., Lu, C., and Roman, G.-C., "Spatiotemporal Multicast in Sensor Networks," SenSys 2003
- ① [4] Huang, Q., Lu, C., and Roman, G.-C., "Reliable Mobicast via Face-aware Routing," INFOCOM 2004
- ① [5] Time-stable geocast for ad hoc networks