Code reprogramming and dissemination in Mobile WSN
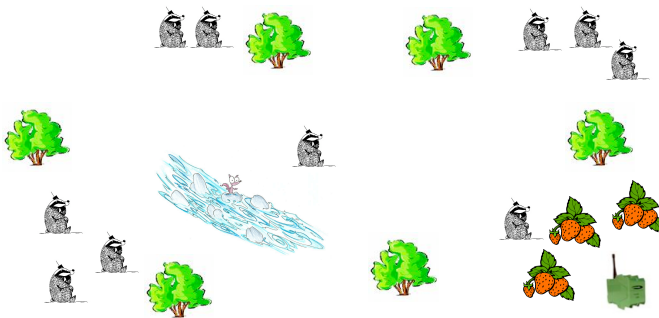
Bence Pásztor

University of Cambridge, Computer Laboratory

bence.pasztor@cl.cam.ac.uk

Problem: How to delivery code-updates/new applications efficiently to a specified subset of nodes in a mobile wireless sensor network?
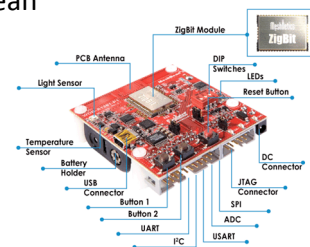
Scenario: Wildlife Monitoring


Sensors:
-Tmote Sky

-Meshbean

Challenges:

-Very sparse, mostly disconnected network

-Limited energy resources, thus very limited radio range and memory capacity

-Once the network is deployed, it is rarely possible to recollect the devices

-Requirements might change after initial results collected from deployment – reprogramming/new applications are needed!

*Proposed solution*: use the social characteristics of the network!

-Nodes (attached to animals) tend to form groups, thus meet some nodes more often then others – e.g. families -> Identify the groups/social links to delivery updates to specific nodes!

-Nodes tend to follow patterns in their movement – e.g. they go to feed to the same place

-Some nodes are more active then others – e.g. males go for food, while females/young animals stay around their "home-range" -> Identify more active nodes ("group leaders") to delivery updates to specific groups!

-Not necessary to update all nodes – e.g. "update nodes often going to river X" or "update the node from each group, who stays around the nest most of the time" -> Characterise the nodes with attribute-value pairs (e.g. frequent-location= {nest, river}), and let the programmers decide which nodes to update using constraints based on the attributes

Initial Results of the dissemination protocol: (using ZebraNet traces, 20-node network)

Graph showing the total contact time for some nodes – note the bipolar distribution!
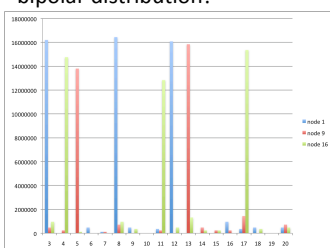
Graph showing update delivery of the group-based dissemination against an epidemic-like protocol
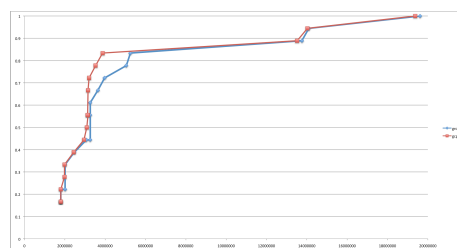
We used 30% less update transmissions than the epidemic-like protocol and achieved a similar delivery ratio!

Current direction: Selective update – provide the programming constructs to define constraints on the set of updated nodes, and combine this with the dissemination protocol