Matt Stabeler

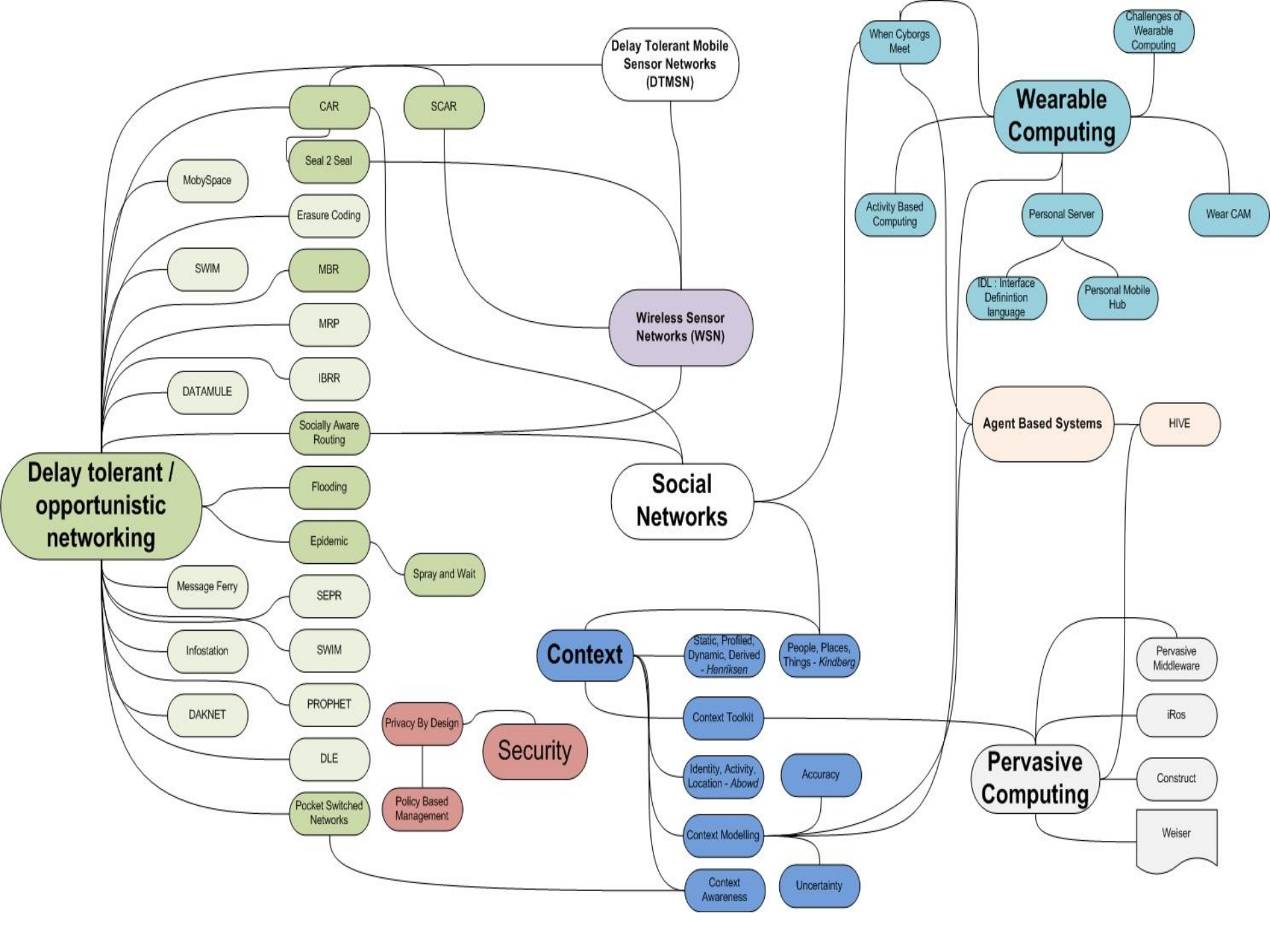
Paddy Nixon & Simon Dobson
Systems Research Group

Overview

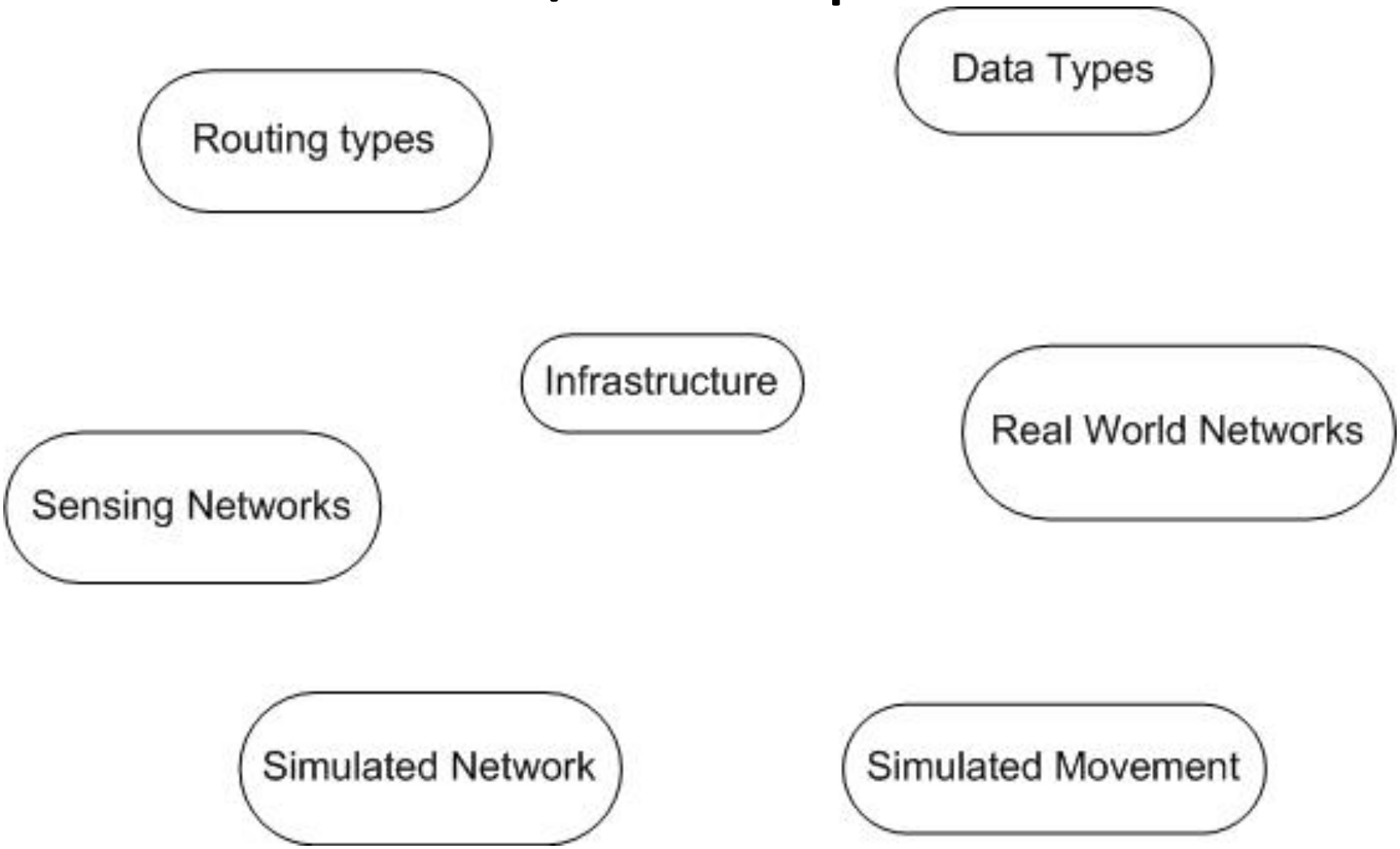
- Areas of Research
- Objective
- Plan
- Publications and Current Projects

Research interests

- Pervasive Computing
  - Wireless Sensor Networks
  - Context Awareness
  - Wearable Computing
  - Agent based systems
  - **Delay Tolerant / Opportunistic Networking (DTN / ON)**


Delay tolerant / opportunistic networking
Delay Tolerant Mobile Sensor Networks (DTMSN)
CAR
SCAR
Seal 2 Seal
MobySpace
Erasure Coding
SWIM
MBR
MRP
IBRR
DATAMULE
Socially Aware Routing
Flooding
Epidemic
Spray and Wait
Message Ferry
SEPR
SWIM
Infostation
PROPHET
DAKNET
DLE
Pocket Switched Networks
Wireless Sensor Networks (WSN)
Social Networks
Context
Static, Profiled, Dynamic, Derived - Henriksen
People, Places, Things - Kindberg
Context Toolkit
Identity, Activity, Location - Abowd
Accuracy
Context Modelling
Context Awareness
Uncertainty
Privacy By Design
Security
Policy Based Management
When Cyborgs Meet
Challenges of Wearable Computing
Wearable Computing
Activity Based Computing
Personal Server
Wear CAM
IDL : Interface Definintion language
Personal Mobile Hub
Agent Based Systems
HIVE
Pervasive Middleware
iRos
Pervasive Computing
Construct
Weiser

DTN/ON Aspects



Why?

Problem

- Infrastructure is expensive
- Infrastructure is not there
- No established model of human movement

Motivation

- People move about, have social networks and own powerful mobile computing devices.
- Scope to exploit this ready made network

Objective

By exploiting the *features* of **social, ad-hoc, mobile networks**, **opportunistic** movement of *sensing* and *messaging* data, can be **efficient** and **delay tolerant,** with *guaranteed* delivery in most cases, **without** reliance upon installed **infrastructure**.

Exploit

- Social / Mobile Networks (Opportunism)
- Situation / Context Awareness (Opportunism)
- Mobility (Profiling)

Opportunistic Networking

- Combined approach
  - With or without infrastructure
  - Knowledge of social networks
  - Situation/Context awareness
  - Mobility

Exploit opportunistic networking, with the side effect of Delay Tolerant Networking

Plan

- Literature review
  - Opportunistic/ DTN protocols,
  - Evaluate models of human movement and social networks
    - Reality Mining Data Set, Social Sensing Study, Random Waypoint + Caveman, WaveLAN traces, second life network
- Implement and compare existing DTN protocols
- Analyse the +ve and -ve of each existing protocol
- Design approach to address +/-ves
- Prototype designs
- Compare system against existing protocols using chosen model/models

Evaluation

Simulation

- Urban environmental sensing
- Using reviewed mobility traces
- Simulated context data
  - places, activity recognition, routes, familiar strangers

Deployment

Publications and Current Projects

Steve Neely, Matthew Stabeler, and Paddy Nixon **SensorMash: Exploring System Fidelity through Sensor Mashup**. *Adjunct Proceedings of the Sixth International Conference on Pervasive Computing, 2008*.

(Winner of best one-minute-madness presentation, Pervasive 2008)

Lorcan Coyle, Juan Ye, Susan McKeever, Stephen Knox, Matthew Stabeler, Simon Dobson and Paddy Nixon. **Gathering datasets for activity identification**. *In Proceedings of the Workshop on Developing Shared Home Behaviour Datasets to Advance HCI and Uniquitous Computing Research at CHI 2009.* Boston, MA.

Construct – context datastore and dissemination

Basadaeir – User profile store, API, and simple location system.

- use to build dataset for mobility traces

UCD WaveLAN Dataset – deriving movement patterns and synthesising social networks from wireless access point logs.

Conferences Targets

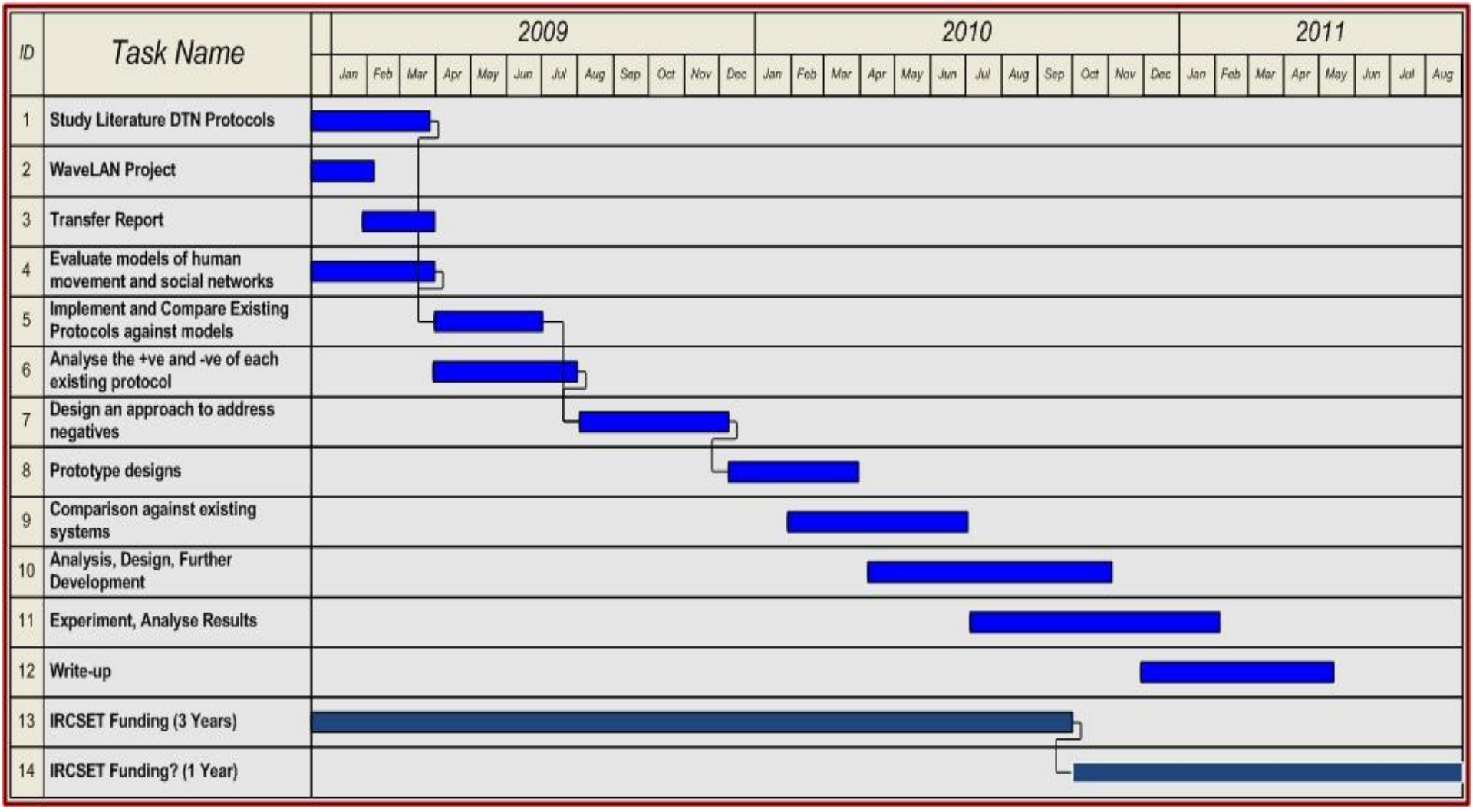
- Percom
- Pervasive 2009 – LBR – 27th Jan
- Ubicomp – 17th April
- LoCa 2009 – 9th Jan
- Mobiquitous – 20th March

Questions?

Questions?

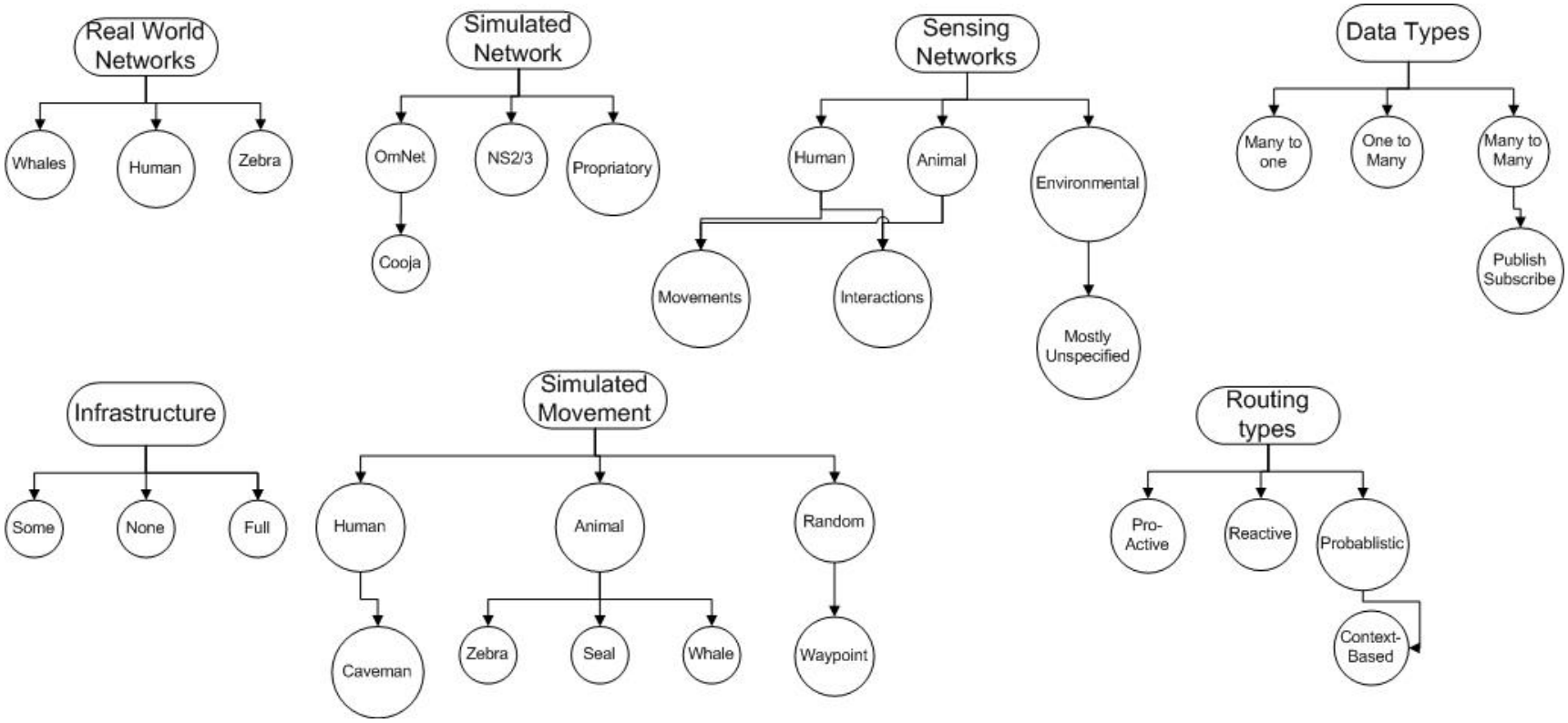
- How will you evaluate existing protocols?
  - Comparison in terms of
    - Movement models used, network overhead, speed, delivery ratio..
- How will you simulate your ideas?
  - Using simulators from the literature
- How long have you been looking at DTN's?
  - For about 3 months, but previous paths have contributed

Timescale


ID
Task Name
2009
2010
2011
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug
1 Study Literature DTN Protocols
2 WaveLAN Project
3 Transfer Report
4 Evaluate models of human movement and social networks
5 Implement and Compare Existing Protocols against models
6 Analyse the +ve and -ve of each existing protocol
7 Design an approach to address negatives
8 Prototype designs
9 Comparison against existing systems
10 Analysis, Design, Further Development
11 Experiment, Analyse Results
12 Write-up
13 IRCSET Funding (3 Years)
14 IRCSET Funding? (1 Year)

Areas of research - DTN

- Models of movement
  - Human
  - Animal
  - Other
- Routing
  - Pro-active / Re-active
  - Probabilistic
  - Flooding / Epidemic
  - Context-based
- Infrastructure
  - None / Mixed / Full


Real World Networks
Whales
Human
Zebra
Simulated Network
OmNet
NS2/3
Propriatory
Cooja
Sensing Networks
Human
Animal
Environmental
Movements
Interactions
Mostly Unspecified
Data Types
Many to one
One to Many
Many to Many
Publish Subscribe
Infrastructure
Some
None
Full
Simulated Movement
Human
Animal
Random
Caveman
Zebra
Seal
Whale
Waypoint
Routing types
Pro-Active
Reactive
Probablistic
Context-Based