Evolving Logistics: Physical-Objects Sneaker Transport
Idea, Problems, Concept, Simulation

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Physical
Objects
Sneaker
Transport
Idea

Deaddrops → mobile Store & Forward → Transport

Physical Objects: Letters, Memory Sticks, Data,...
Sneaker Transport using existing movement
Idea

Deaddrops $\rightarrow$ mobile Store & Forward $\rightarrow$ Transport

Physical Objects  Letters, Memory Sticks, Data,…
Sneaker Transport  using existing movement
Opportunistic Transport

Standard Post Transport:

Opportunistic Transport:
Opportunistic Routing

- moving routers
- meet eventually
- projected path decision
- closest path to dest

(source: Leontiadis, Mascolo 2007: GeOpps: Geographical Opportunistic Routing for Vehicular Networks)
Feasibility

CAN WE, YES?
Simulation Parameters

- **Area**: 100 [km$^2$]
- **Bots**: 100, Random Waypoint
- **Speed**: 1.2 [m/s]
- **Packets**: 100, Uniform at Random
- **Range**: 5 - 45 [m]

![Destination Angle based Routing Diagram]

$\alpha > \beta \rightarrow$ B carries next
Simulation Parameters

Area 100 [km²]
Bots 100, Random Waypoint
Speed 1.2 [m/s]
Packets 100, Uniform at Random
Range 5 - 45 [m]

\[ \alpha > \beta \rightarrow B \text{ carries next} \]
Preliminary Results: Dilation

Simulation 15 x 100 Packets, Ranges 5 – 40
Problems Ahead
Bag of Problems

- Central vs. Decentral
- Illegal Goods

Enablers:
- Ubiquitous positioning
- Ubiquitous RF-Interfaces
- Small-World-Phenomenas (?)

Things to Work on:
- Feasibility / Critical Mass
- Routing Decision
- Privacy
  - Local Location Disclosure
    - Precision
    - Order of Disclosure ✓
  - Packet Tracking (?)
  - User Identities
  - Receipts (?)
- Transport Security
- Payment
Bag of Problems

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- Payment
Routing Negotiation

Carrier currently holding a packet
Candidate offering to take packet

Objectives:
▶ Packet Propagation
▶ Sinkhole Prevention
▶ Minimum Precision Disclosure
▶ User Determined Privacy

Solution:
▶ Routing Negotiation
▶ Incremental Precision Disclosure
▶ Carrier in Control, Carriee offers
Routing Protocol

- Discovery
- Pre-Routing
- Route Negotiation
- Handover

Carrier → Candidate:
- beacon
- transport offer
- packet params
Routing Protocol

- **Discovery**
- **Pre-Routing**
- **Route Negotiation**
- **Handover**

**Carrier** → **Candidate**
- beacon
- transport offer
- packet params

- **Carrier**
- **Candidate**
Routing Protocol

- **Discovery**
- **Pre-Routing**
- **Route Negotiation**
- **Handover**

**Carrier** to **Candidate**
- beacon
- transport offer
- packet params
Routing Protocol

- Carrier
- Candidate

**Discovery**
- beacon

**Pre-Routing**
- transport offer
- packet params

**Route Negotiation**

**Handover**
Routing Protocol

Discovery

Pre-Routing

Route Negotiation

Handover

Carrier

Candidate

beacon

transport offer

packet params
Negotiation Protocol

Carrier

pert(cand_dest)

pert(pack_dest, car_dest)

Candidate

UserPrefs

UserPrefs
Negotiation Protocol

Carrier

Candidate

pert(cand_dest)

User Prefs

Route?

pert(pack_dest, car_dest)

User Prefs
Negotiation Protocol

Carrier

Candidate

pert(\text{pack}_{\text{dest}}, \text{car}_{\text{dest}})

pert(\text{cand}_{\text{dest}})

Route? Maybe

User Prefs

User Prefs

- perturbation
Negotiation Protocol

Carrier

Candidate

pert(cand_dest)

pert(pack_dest, car_dest)

User Prefs

Route Y/N

Maybe

Route Y/N

User Prefs

Maybe

--perturbation
Anonymisation Box

Spatial and temporal "Cloaking"

N 50,908291° E 8,074677° wird zu N 50,908° E 8,074°
Anonymisation Box

Spatial and temporal “Cloaking”

N 50.908291° E 8.074677° wird zu N 50.908° E 8.074°
Wrap-Up
Conclusion and Future Work

- P2P Opportunistic Transport
- Might be working (+)
- Open Questions to work on
  - Routing Decision (?)
  - User Motivation (?)
  - Transport Security (?)
  - Added Values (?)
- Yes, illegal goods

Next Steps:
- Refine Simulation
- Protocol Implementation
- Position Prediction
- Cooperation Partners / Funds
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End...