Experiences with urban deployment of Bluetooth

Vassilis Kostakos





UCL, London, 11 May 2007

Overview

- Bluetooth scanning
- User-related
- Bluetooth CSI
- BlueVirus (ebola?!)

Bluetooth scanning

Requirements

- Capture BT address & BT name
- Static environments (pub)
- Dynamic environments (shopping street)

Bluetooth protocol

• Get list of addresses (within range)

Iterate on each address: request name

Address resolution: multiples of 1.28s

• Name resolution: ???

Single dongle

Name resolution takes too long

- >5sec per device
- ~100sec timeout

During name resolution, new devices are not recorded



Single dongle

Optimisations

- Name resolution timeout
- Enable/disable name resolution
- Address resolution interval



Multiple dongle

- Some devices still missed
 - if all dongles are doing name resolution



"Smart" multi-dongle



Comparison

- Single dongle: OK for fairly static environments
- Mutli-dongle: Good for detecting changes in static environments
- Smart multi-dongle: Good for capturing highspeed flows

User-related



Bluefish

RM

LAB - 1W2.27A

ampornpan

CHI 2007 (Concept)



Bluefish

What is your Bluetooth name?

- Name-changing patterns
 - Data is too noisy
- Intentional categories
 - Sexual, greeting, invitation, insult
- Lexical categories
 - Default, custom
 - Identifiers, associations, t-shirt, graffiti

O'Neill et. al., Ubicomp 2006

Bluetooth & Graffiti a.k.a. "Juicy Lucie"





Do you ever send stuff? (Bluetooth honeypots)

- Bluetooth honeypot
- Various names
- Various device classes

• Are you the girl in the corner! :o);

Do you receive stuff? (BlueSpamming)

- Hypothesis: name of sender affects recipient's reaction
- Issues in automating this process
 - Protocol behaviour, user prompts

Viruses, diffusion, mobility









Timeline view



Gatecount timelines



Gatecount 5







20 0 0.0 5.0 10.0 15.0 20.0 25.0 30.0 Minutes















Power laws and exponential decays



Kostakos & O'Neill, Space Syntax Symposium 2007 (forthcoming)

Gatecounts



Bluetooth visibility

 Around 7.5% of observed pedestrians had discoverable Bluetooth devices



Dynamic properties

- Our data is not static
- 3D structure
- Chain of events



Chain of events

- John, Mary, 14:20:30
- John, Paul, 14:20:32
- Mary,Nick, 14:20:33

...

Game of real life







Emulation

- Class "device"
- Class "virus"
- During encounter, virus is transmitted
- Device recovers (SIS) or dies (SIR)



Virus spread - bath_sir.txt





DTN forwarding algorithm

- Static features
 - Node degree
 - Node betweenness
 - Node closeness
 - Average geodesic path (Bath = 3.3)
 - Community detection (21 using Newman)

Considering time



Thinking about...

- Time not used enough!
- Location not space!
 - "Easter present"

Late-breaking results

• Growth & preferential attachment?

- Rich-get-richer
- Temporal aspects are scale free
 - Those who try hard get richer



Thank you

Vassilis Kostakos vk @ cs. bath. ac. uk

http://www.cityware.org.uk