

Ubiquitous Computing

Moving Interaction Beyond the Desktop (and into the City)

Vassilis Kostakos

February 4, 2011

Presented at the University of Athens

Outline

- HCI & Ubiquitous computing
- Beyond the desktop...
- ... into the city

Human Computer Interaction

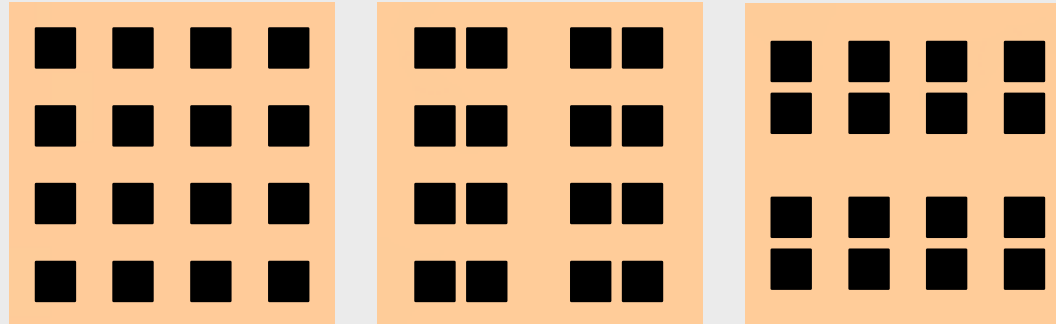
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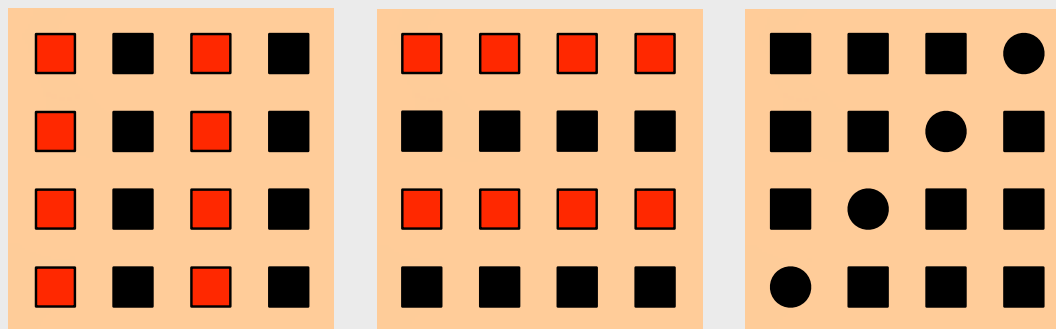
I user I computer

Grouping things

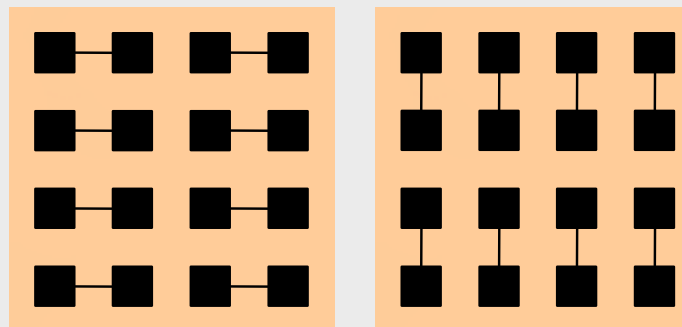
Proximity



Similarity

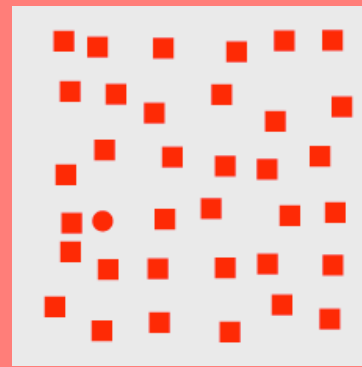
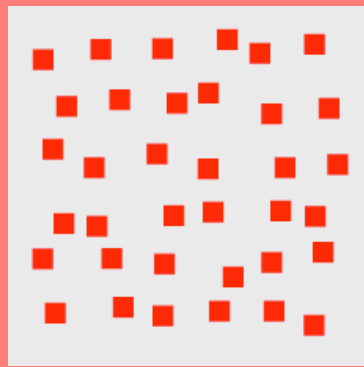
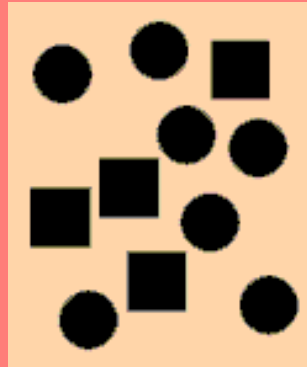


Connected

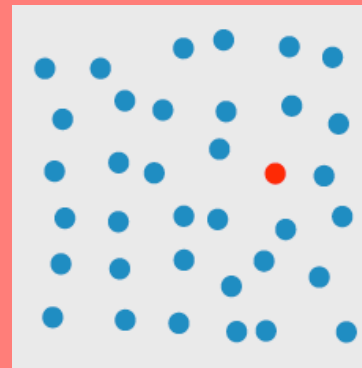
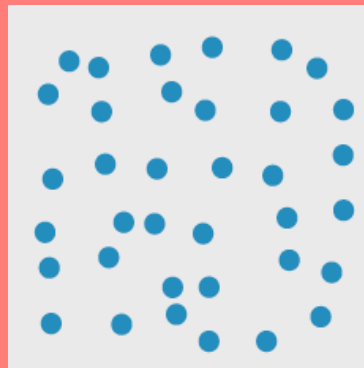
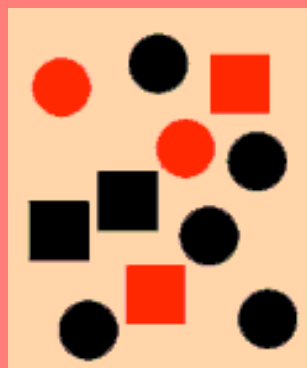


Making things separate

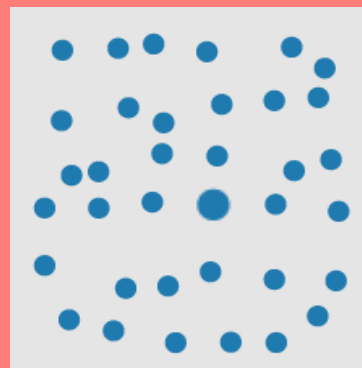
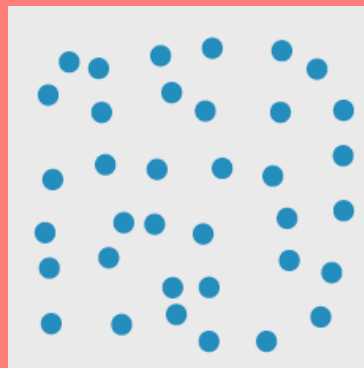
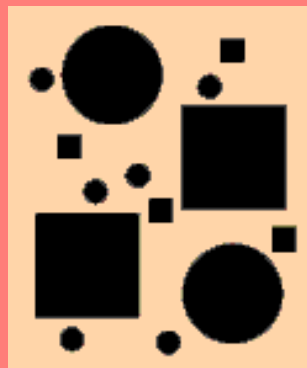
Shape



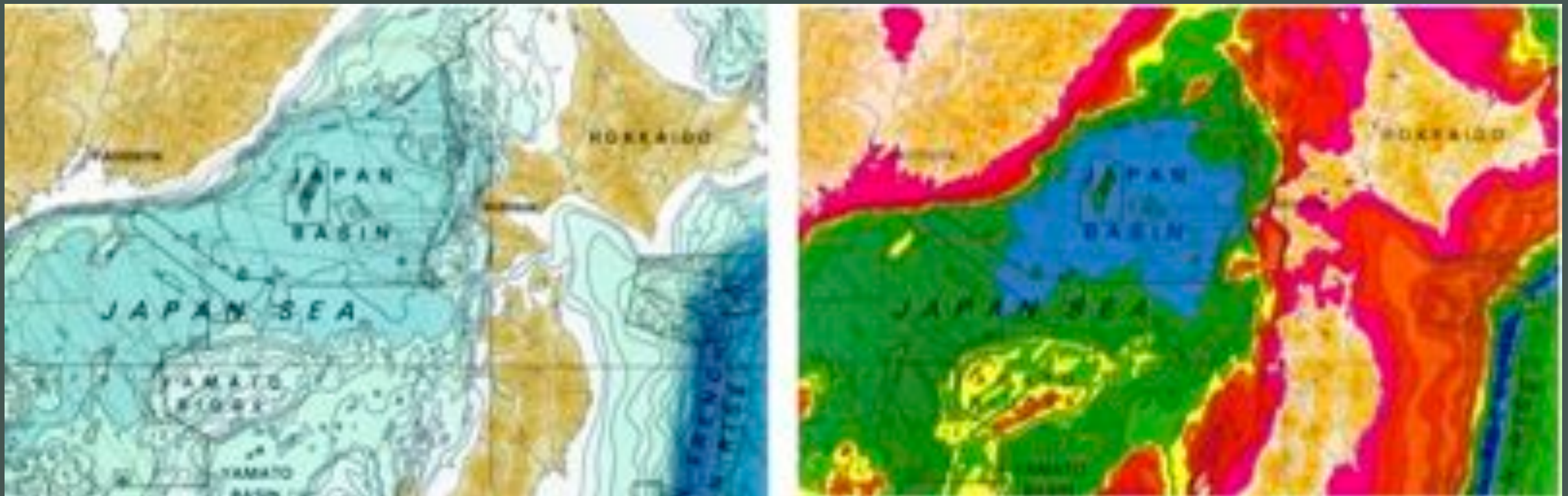
Color



Size

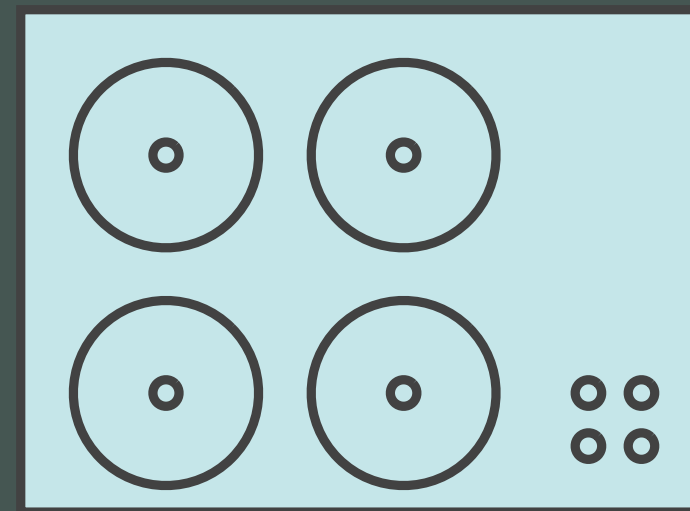
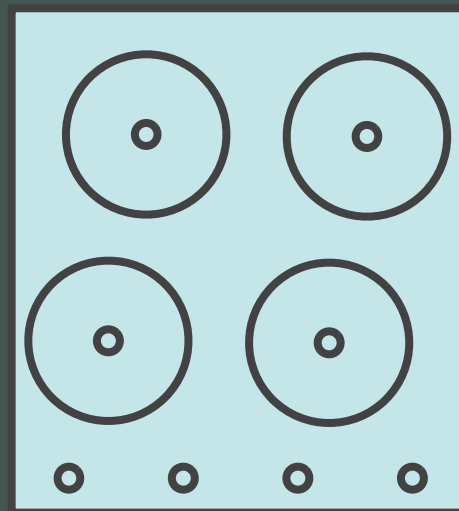
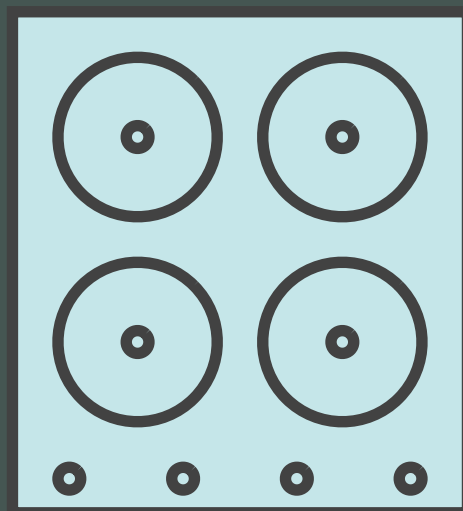


Intensity vs. Hue



The human eye has 10 times more rods than cones. This means that humans are better at interpreting changes in **intensity** rather than changes in **color**.

Mappings





Mappings

Confusion over Palm Beach County ballot

Although the Democrats are listed second in the column on the left, they are the third hole on the ballot.

Punching the second hole casts a vote for the Reform Party.

Party	Candidate	Position	Punch Hole
(REPUBLICAN)	GEORGE W. BUSH	PRESIDENT	1
	DICK CHENEY	VICE PRESIDENT	1
(DEMOCRATIC)	AL GORE	PRESIDENT	3
	JOE LIHERMAN	VICE PRESIDENT	3
(LIBERTARIAN)	HARRY BROWNE	PRESIDENT	2
	ART OLIVER	VICE PRESIDENT	2
(GREEN)	RALPH NADER	PRESIDENT	4
	WINDA LADUNE	VICE PRESIDENT	4
(SOCIALIST WORKERS)	JAMES HARRIS	PRESIDENT	5
	MARGARET TROWE	VICE PRESIDENT	5
(NATURAL LAW)	JOHN HAGELIN	PRESIDENT	6
	NAT GODEHABER	VICE PRESIDENT	6
(REFORM)	FAY SCHARMAN	PRESIDENT	4
	EDLA FOSTER	VICE PRESIDENT	4
(SOCIALIST)	DAVID McREYNOLDS	PRESIDENT	5
	MARY CAL HOLLIS	VICE PRESIDENT	5
(CONSTITUTION)	HOWARD PHILLIPS	PRESIDENT	6
	J. CURTIS FRAZER	VICE PRESIDENT	6
(WORKERS WORLD)	MONICA MOOREHEAD	PRESIDENT	10
	GLORIA LA RIVA	VICE PRESIDENT	10
WRITE IN CANDIDATE			
To vote for a write in candidate, follow the directions on the long stub of your ballot card.			

Sum-Sentinel graphic, Daniel Niblock

Emergence of networking

- Many users - many computers
- Online collaborative systems

Making eye contact



Perception of authority

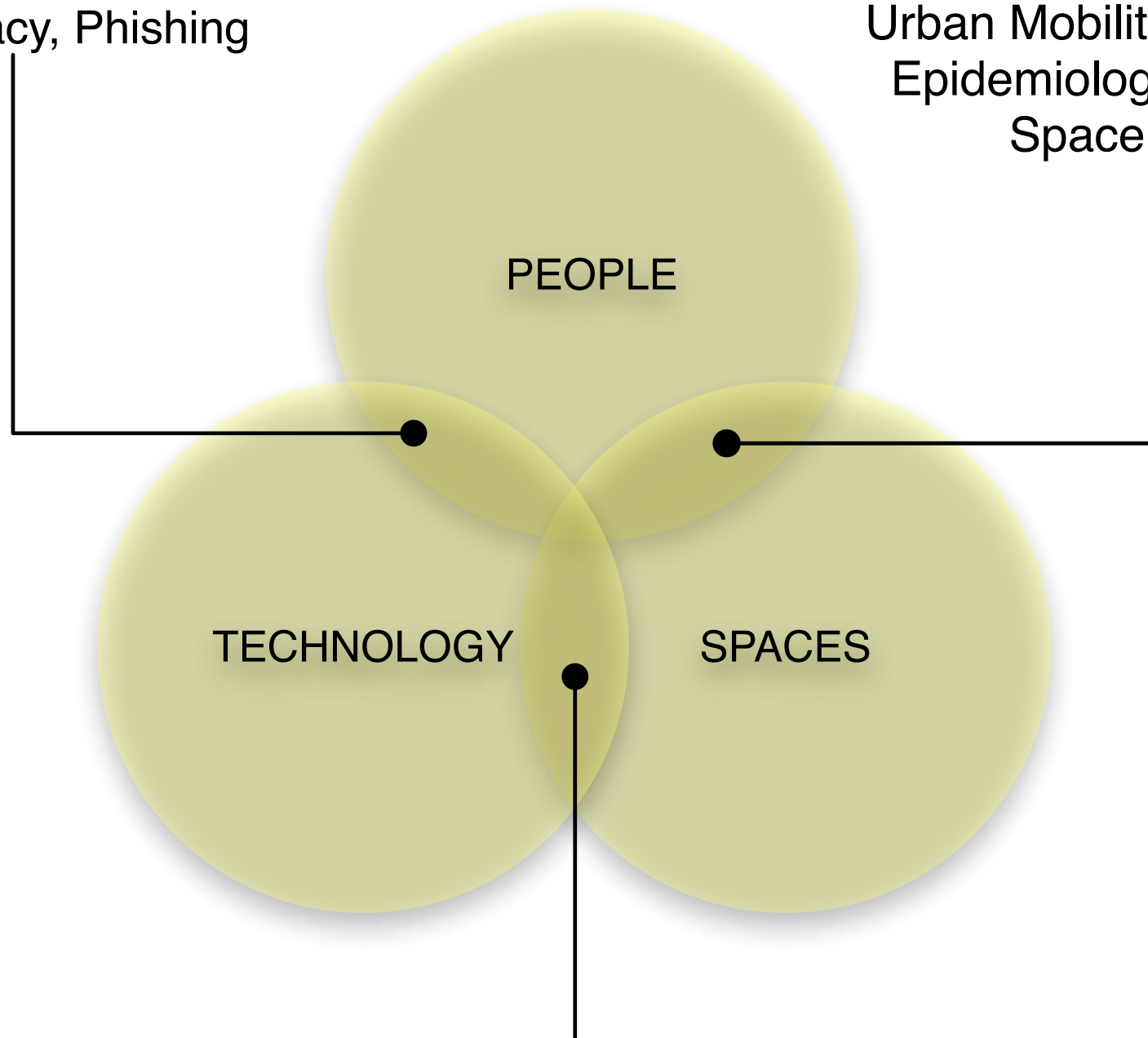


Emergence of mobility & embeddedness

- Ubiquitous/Pervasive research
- New set of problems

Human Computer Interaction,
Trust, Privacy, Phishing

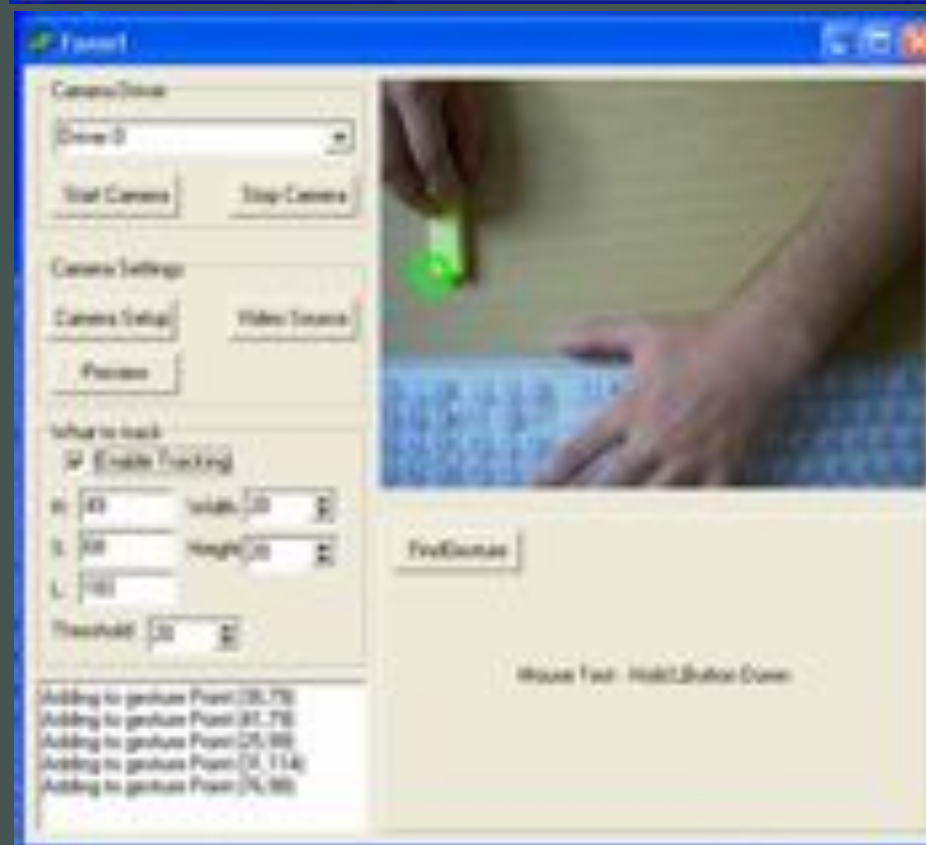
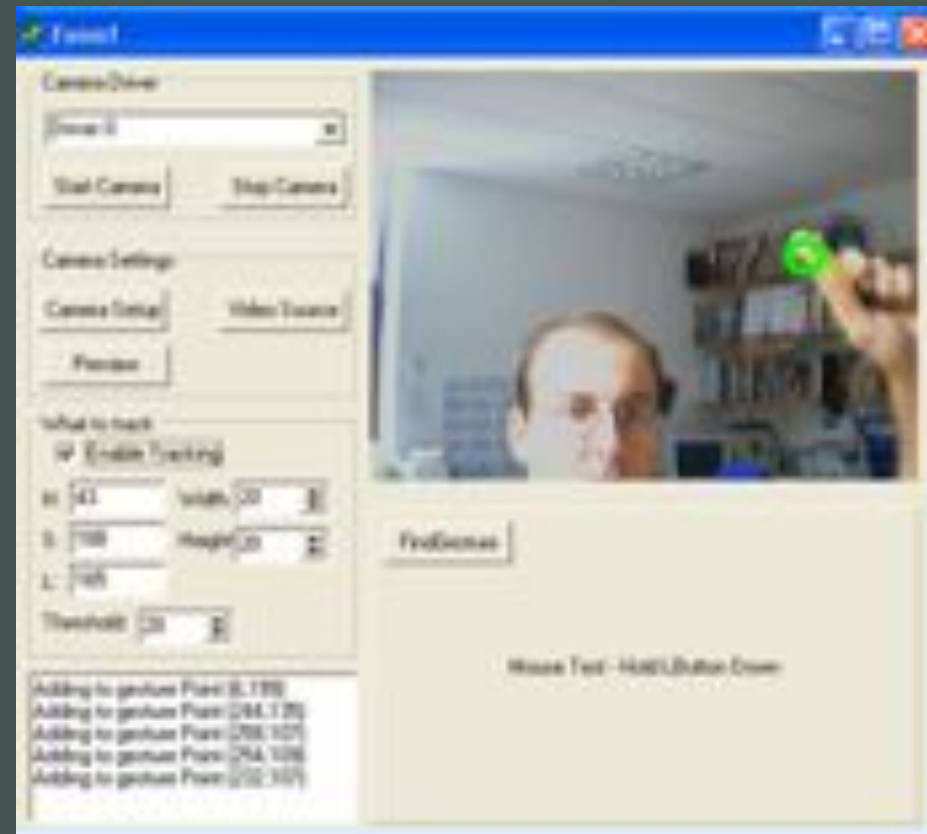
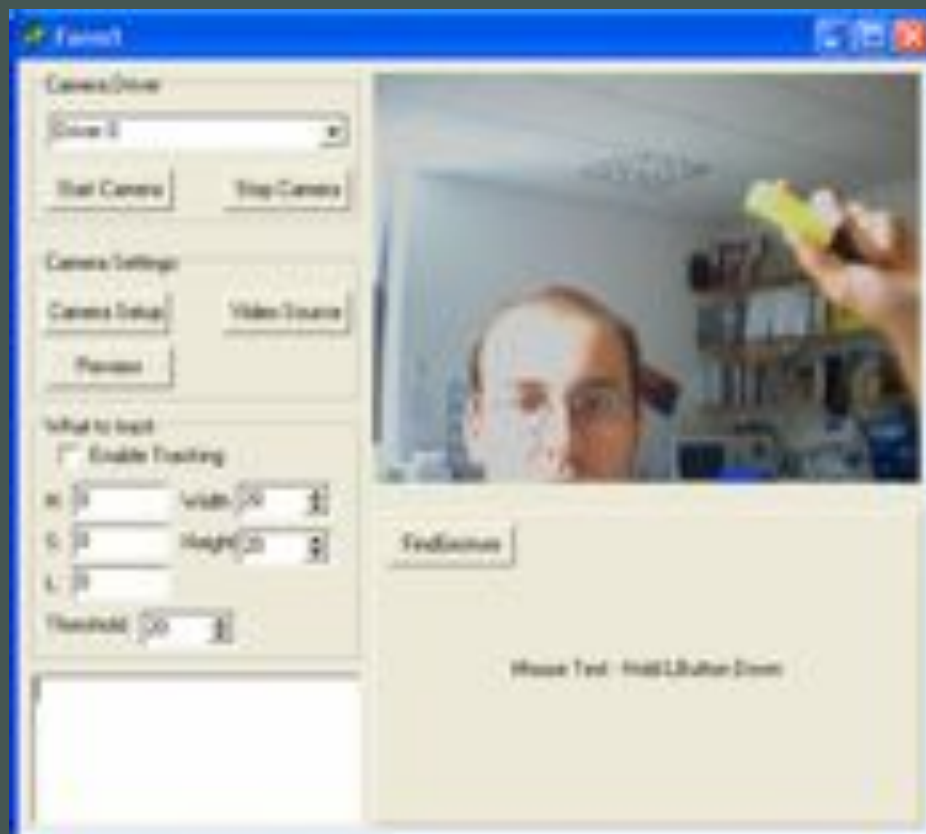
Spatial & Transpatial Social Networks
Urban Mobility & Encounter
Epidemiology & Diffusion
Space Syntax



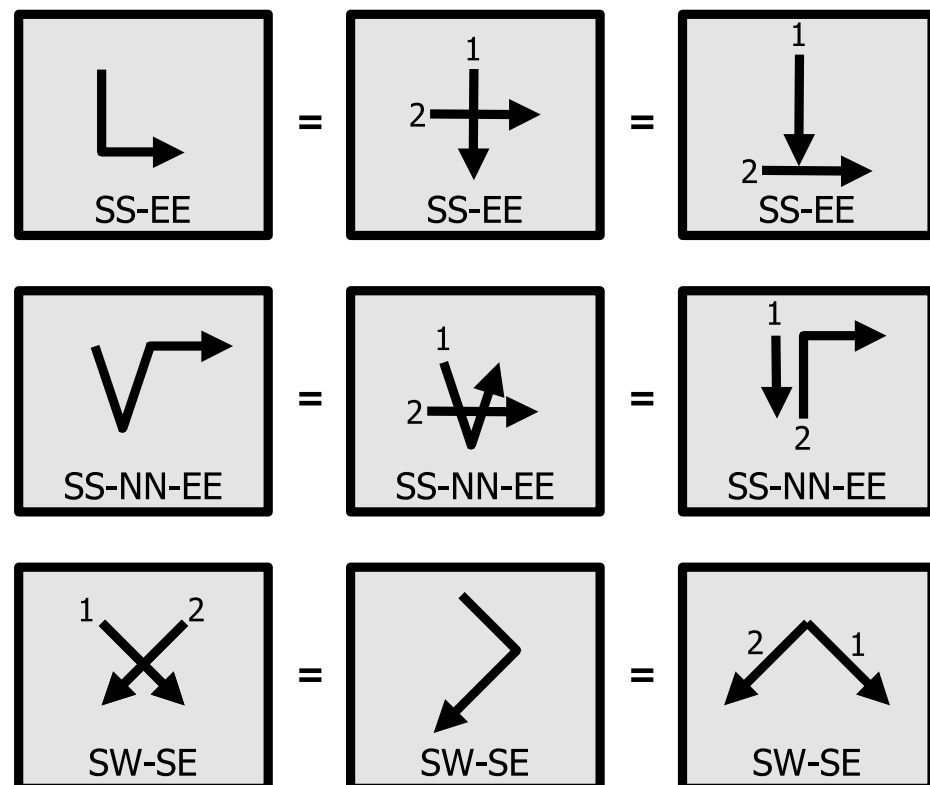
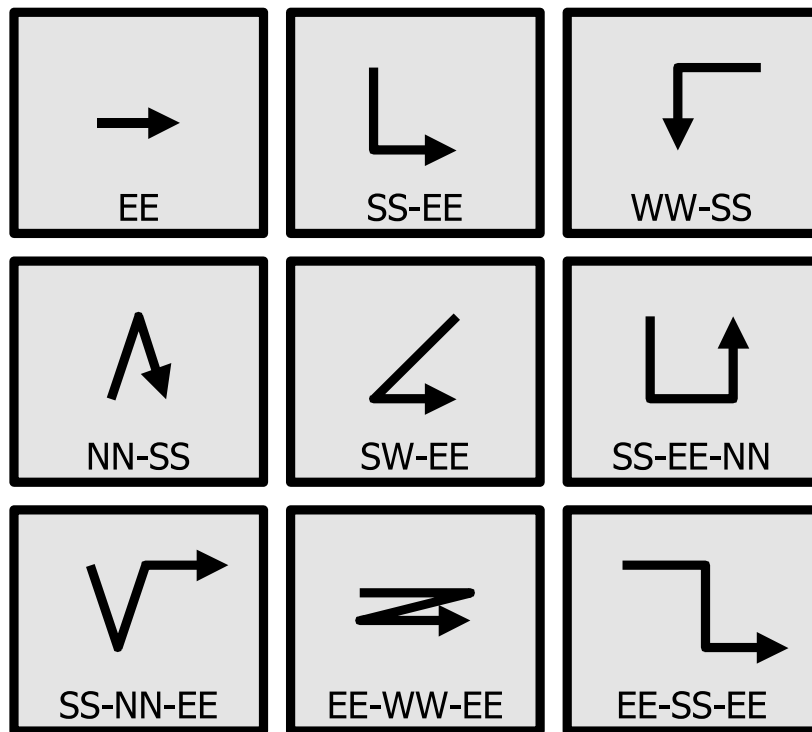
Augmented Spaces
Situated Services
Delay Tolerant Networks

Kostakos, V., O'Neill, E. and Penn, A. (2006). Architectural Space, Interaction Space and Information Spheres: Designing Urban Pervasive Systems. **IEEE Computer**, 39(9):52-59.

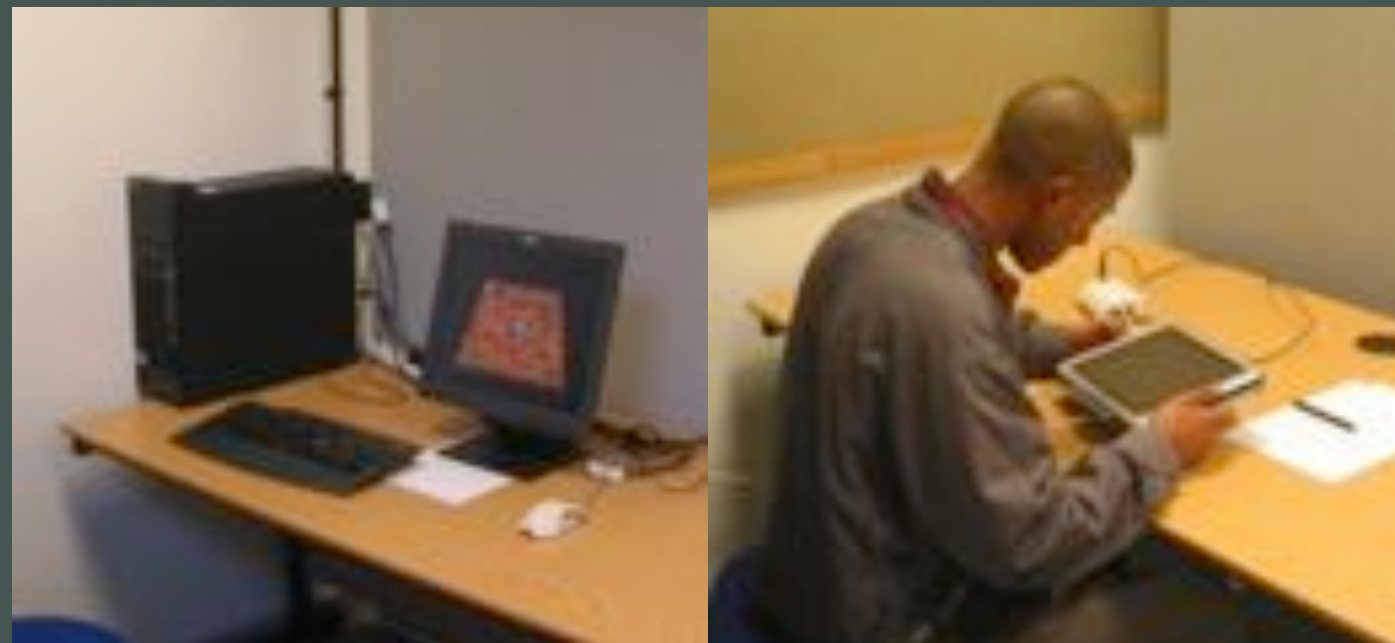
Beyond the desktop



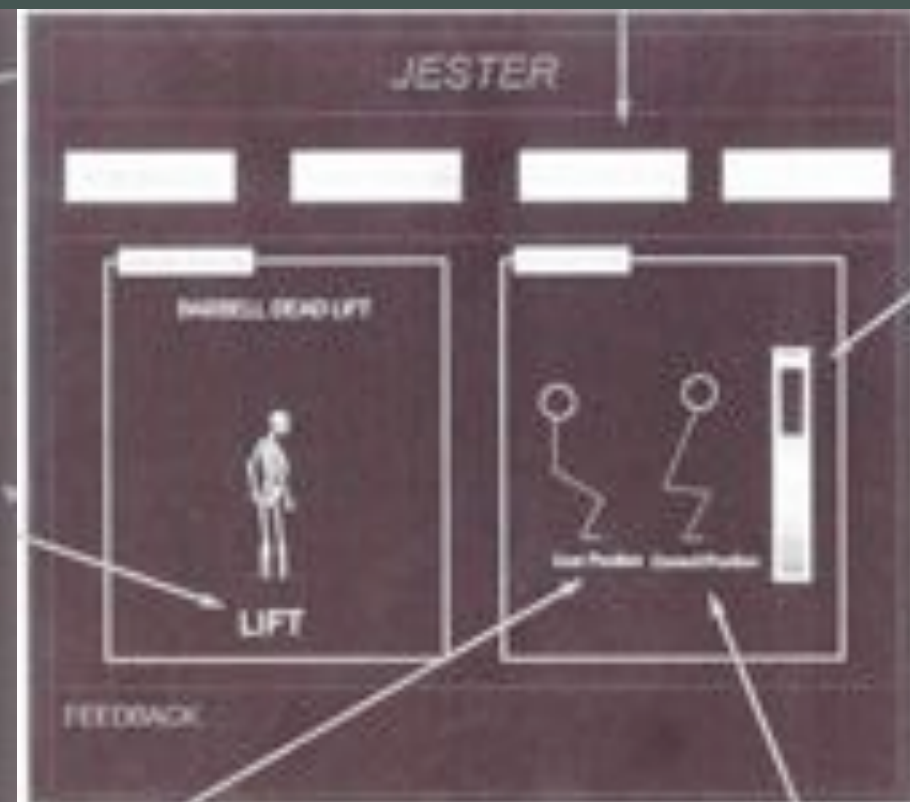
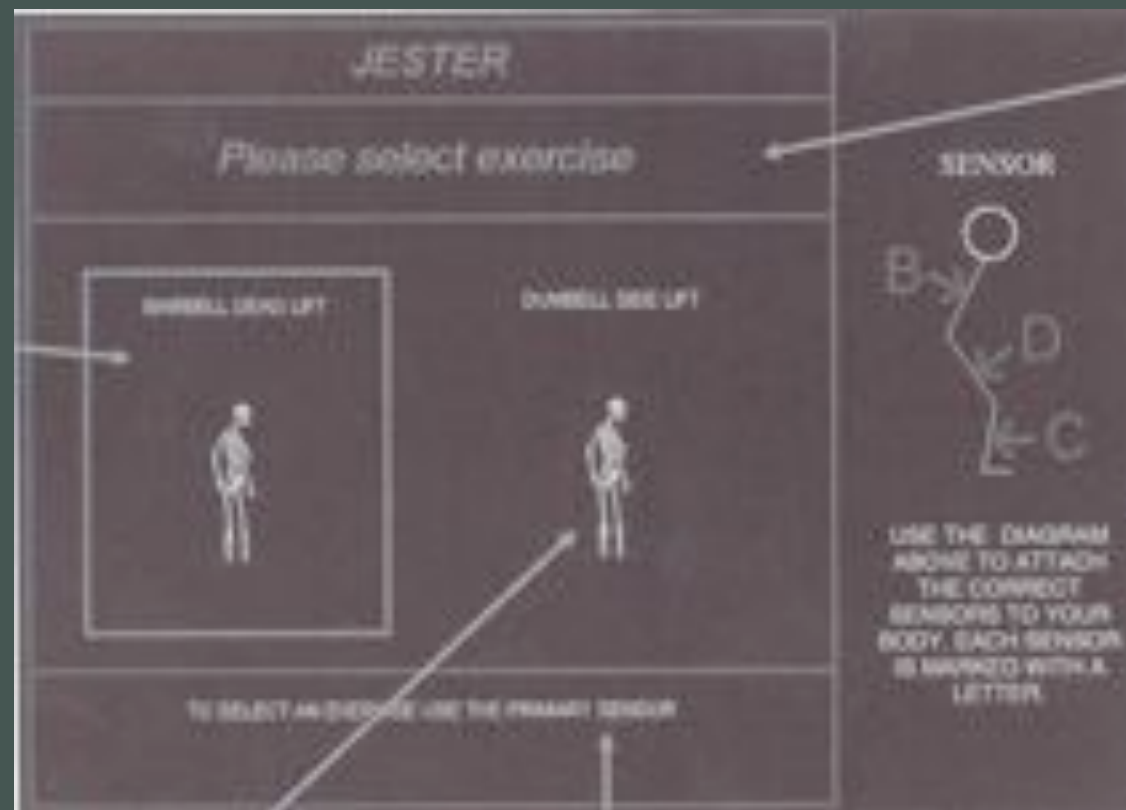
Kostakos, V. and O'Neill, E. (2003). A directional Stroke Recognition Technique for Mobile Interaction in a Pervasive Computing World. **Proceedings of HCI**, pp. 197-206

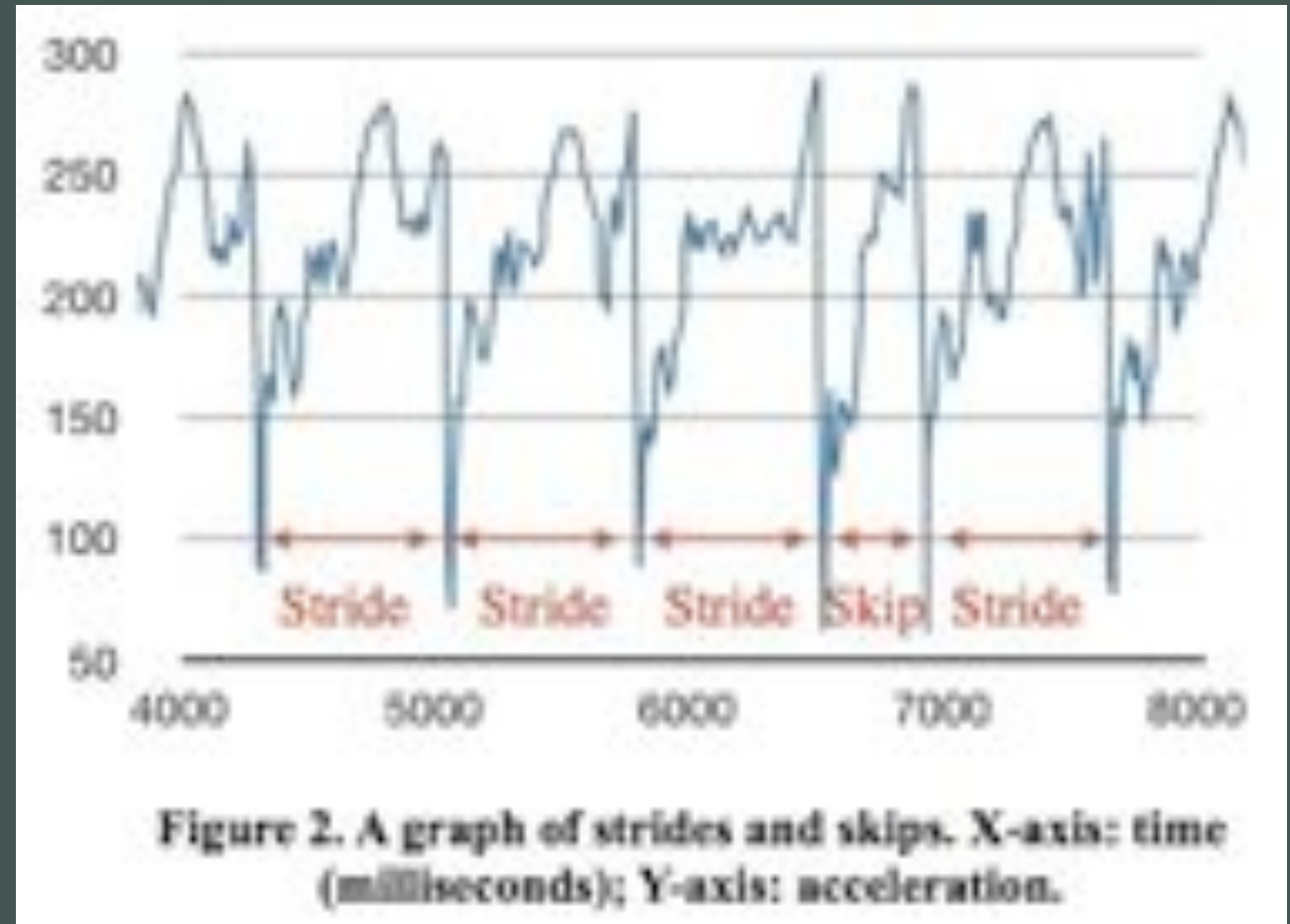


O'Neill, E., Kaenampornpan, M., Kostakos, V., Warr, A. and Woodgate, D. (2005). Can we do without GUIs? Gesture and speech interaction with a patient information system. **Personal and Ubiquitous Computing**, 10(5):269-283

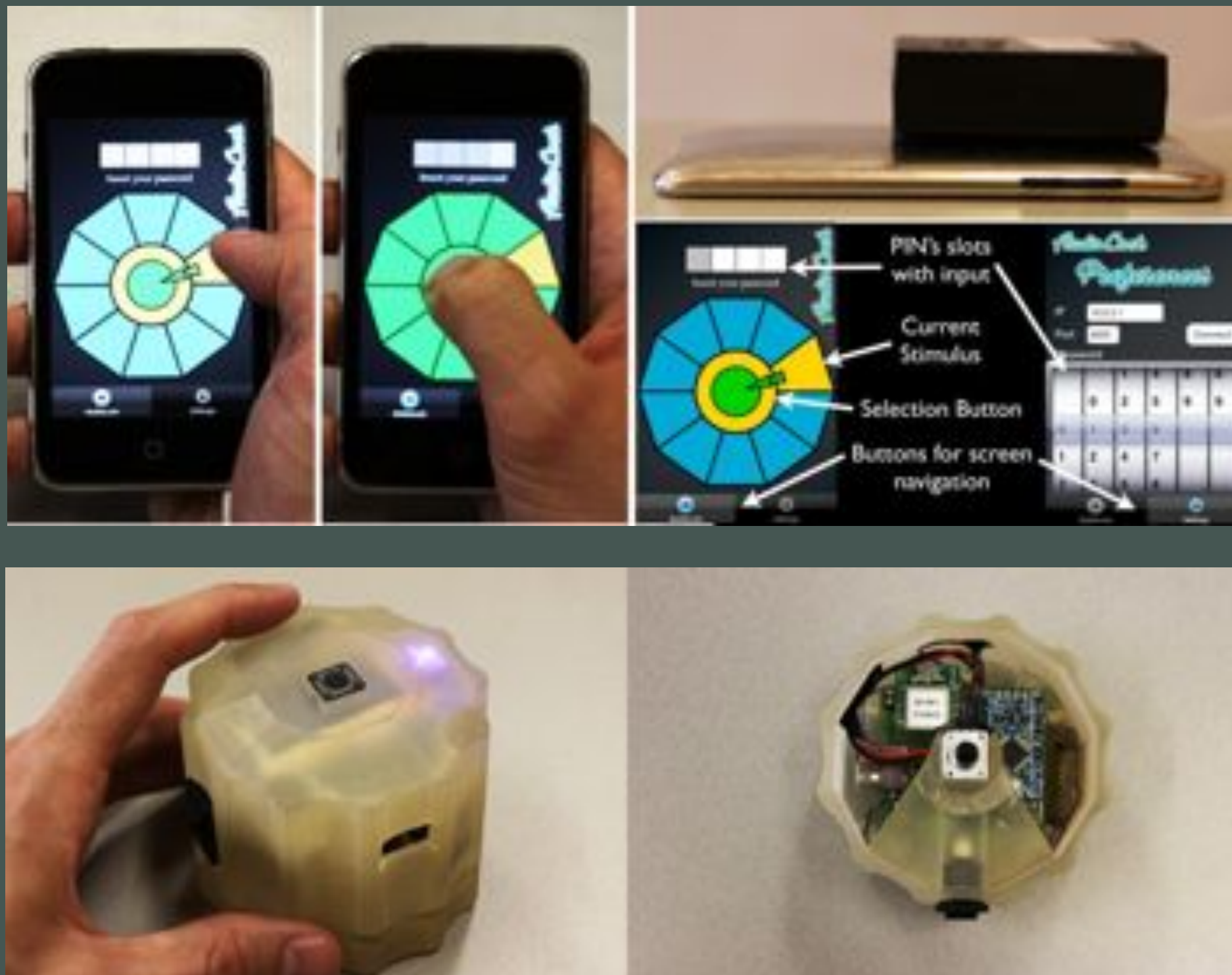


Kostakos, V. and O'Neill, E. (2006). Interacting with mobile and pervasive systems. In I. K. Ibrahim (Ed.), **Handbook of research on mobile multimedia** (pp. 71-85)





Smus, B. and Kostakos, V. (2010). Running Gestures: Hands-free Interaction During Physical Activity. *UbiComp*, pp. 433-434

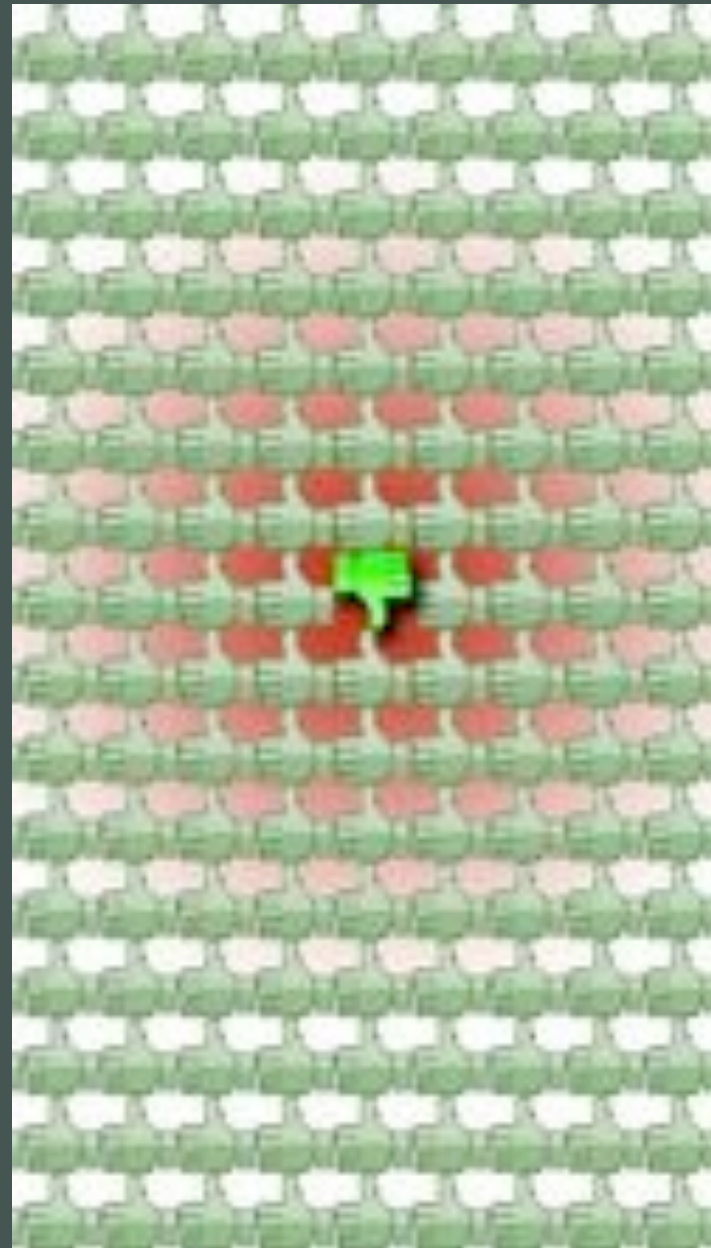


Bianchi, A., Oakley, I., Kostakos, V., Kwon, D.S. (2011). The Phone Lock: Audio and Haptic shoulder-surfing resistant PIN entry methods. **Tangible and Embedded Interaction**, pp. 197-200.
 Bianchi, A., Oakley, I., Lee, J.K., Kwon, D.S., Kostakos, V. (2011). Haptics for Tangible Interaction: A Vibro-Tactile Prototype. **Tangible and Embedded Interaction**, pp. 283-284



		High Quality	Low Quality
Locative	Low Branding		
	High Branding		
Foreign	Low Branding		
	High Branding		

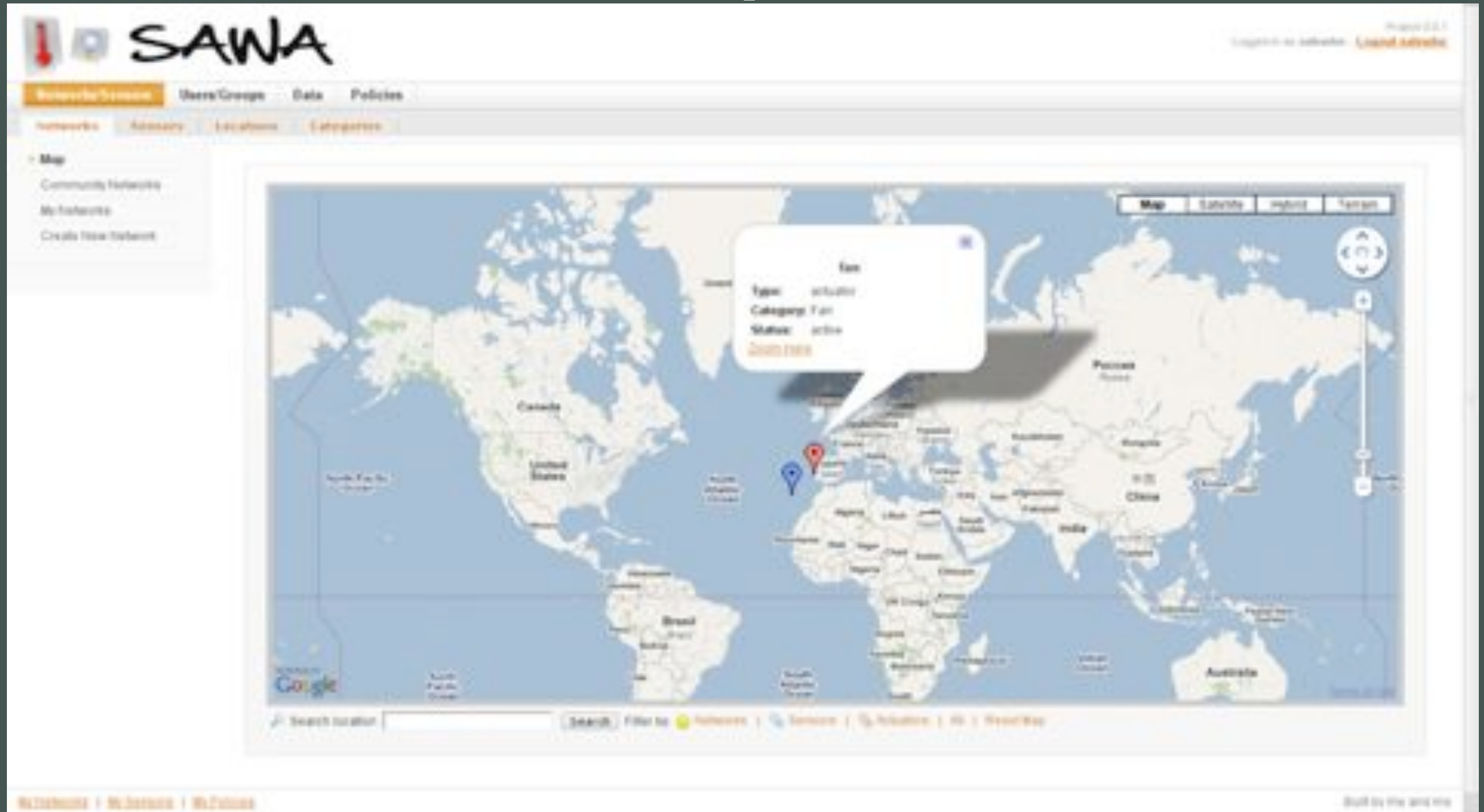
Kindberg, T., O'Neill, E., Bevan, C., Kostakos, V., Stanton Fraser, D.S., Jay, T. (2008). Measuring Trust in Wi-Fi Hotspots. **CHI**, pp. 173-182.
 Kostakos, V. and Oakley, I. (2009). Designing Trustworthy Situated Services: an Implicit and Explicit Assessment of Locative Images' Effect on Trust. **CHI**, pp. 329-332.



Kostakos, V. (2009). Is the crowd's wisdom biased? A quantitative analysis of three online communities. **SocialCom**, 251-255.
MIT Technology Review: Can You Trust Crowd Wisdom? (16/9/2009)

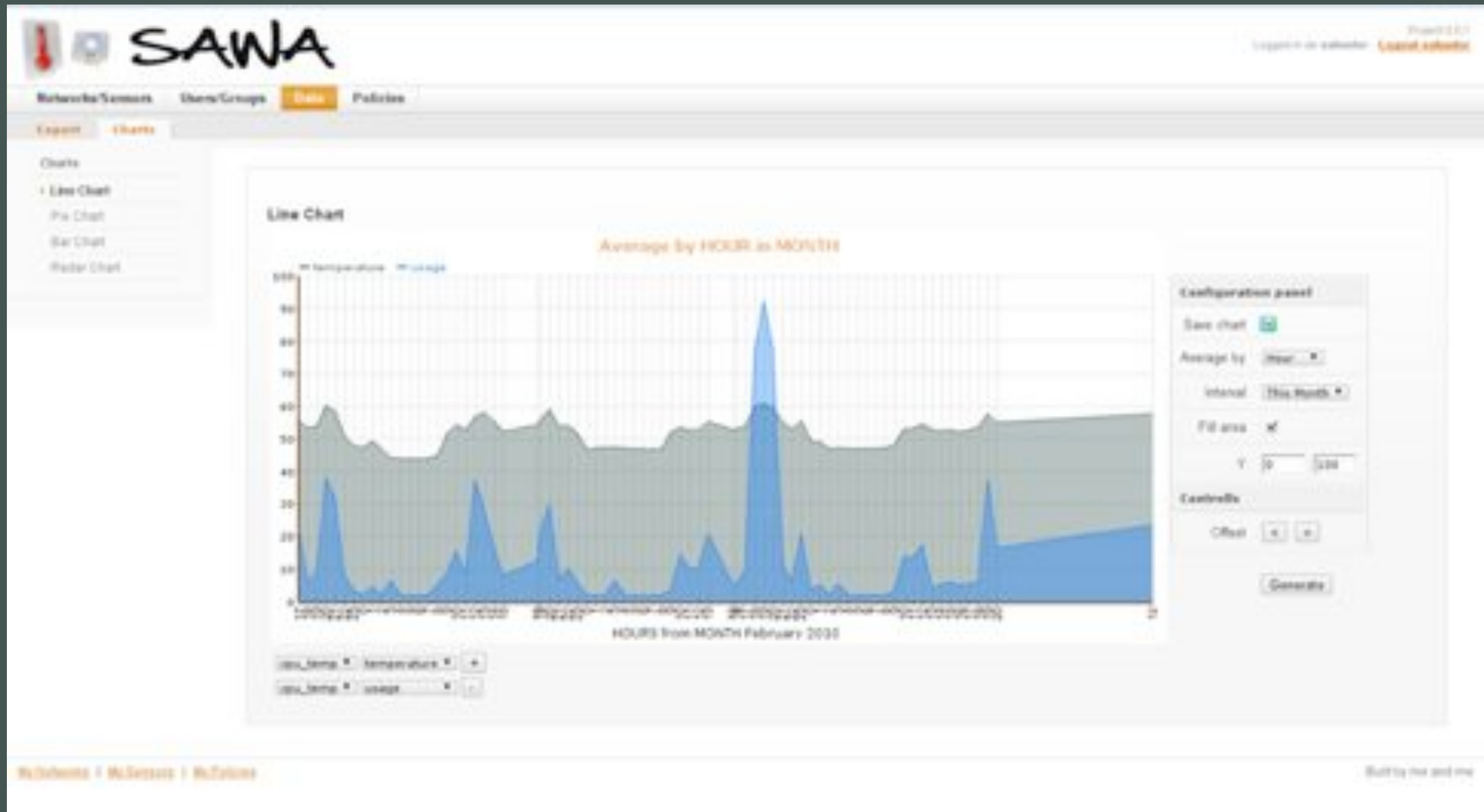
... into the city

Community overview

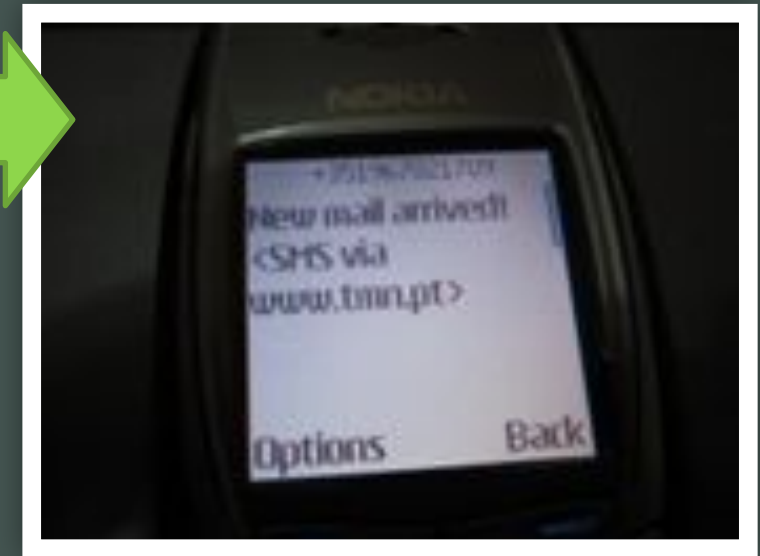


Under review, **edited book on Context Awareness**, Springer.

Overview of collected data



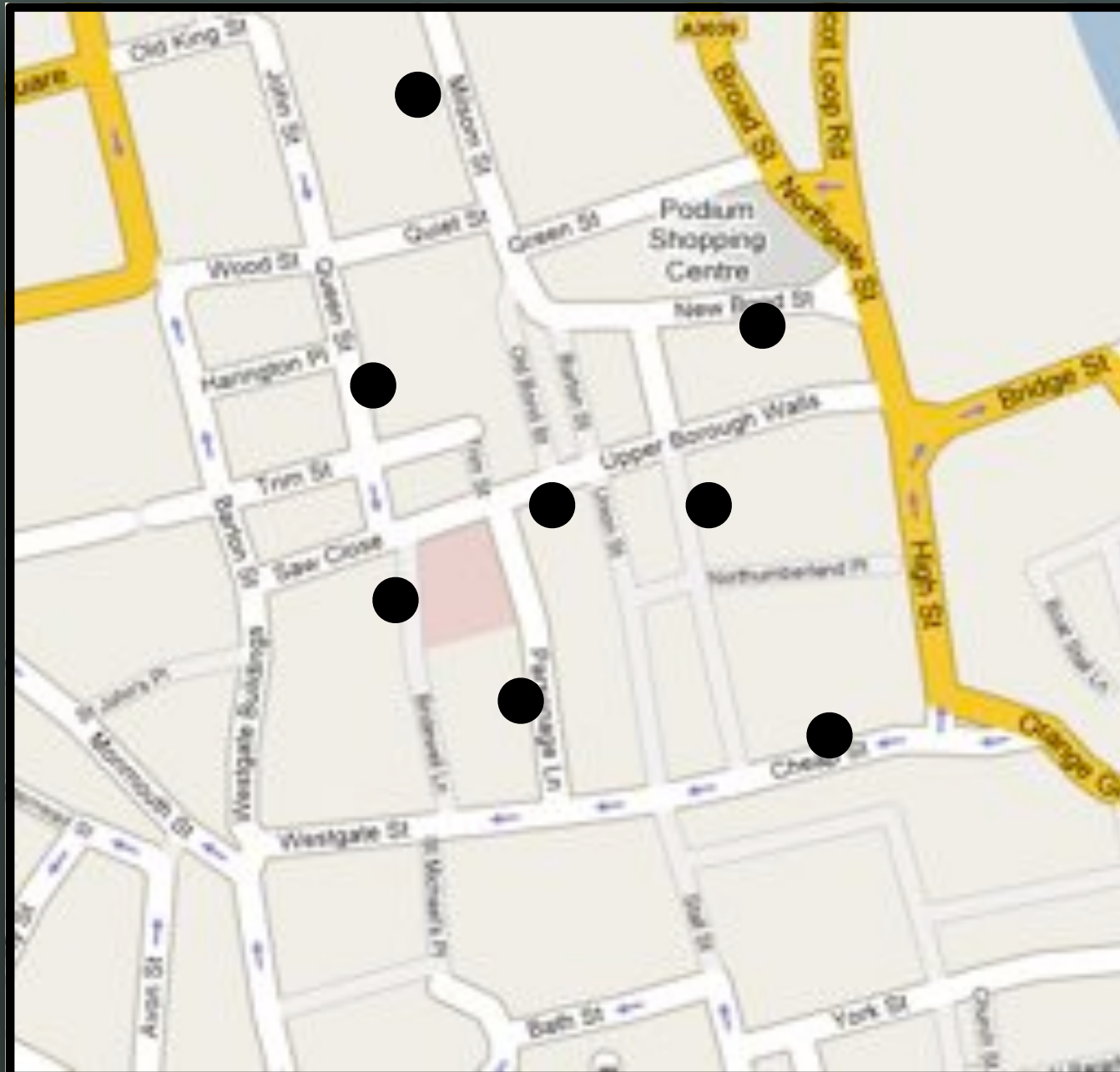
Ferreira, D., Dey, A., Kostakos, V. (2011). Understanding Human-Smartphone Concerns: A Study of Battery Life. **Pervasive**, to appear.

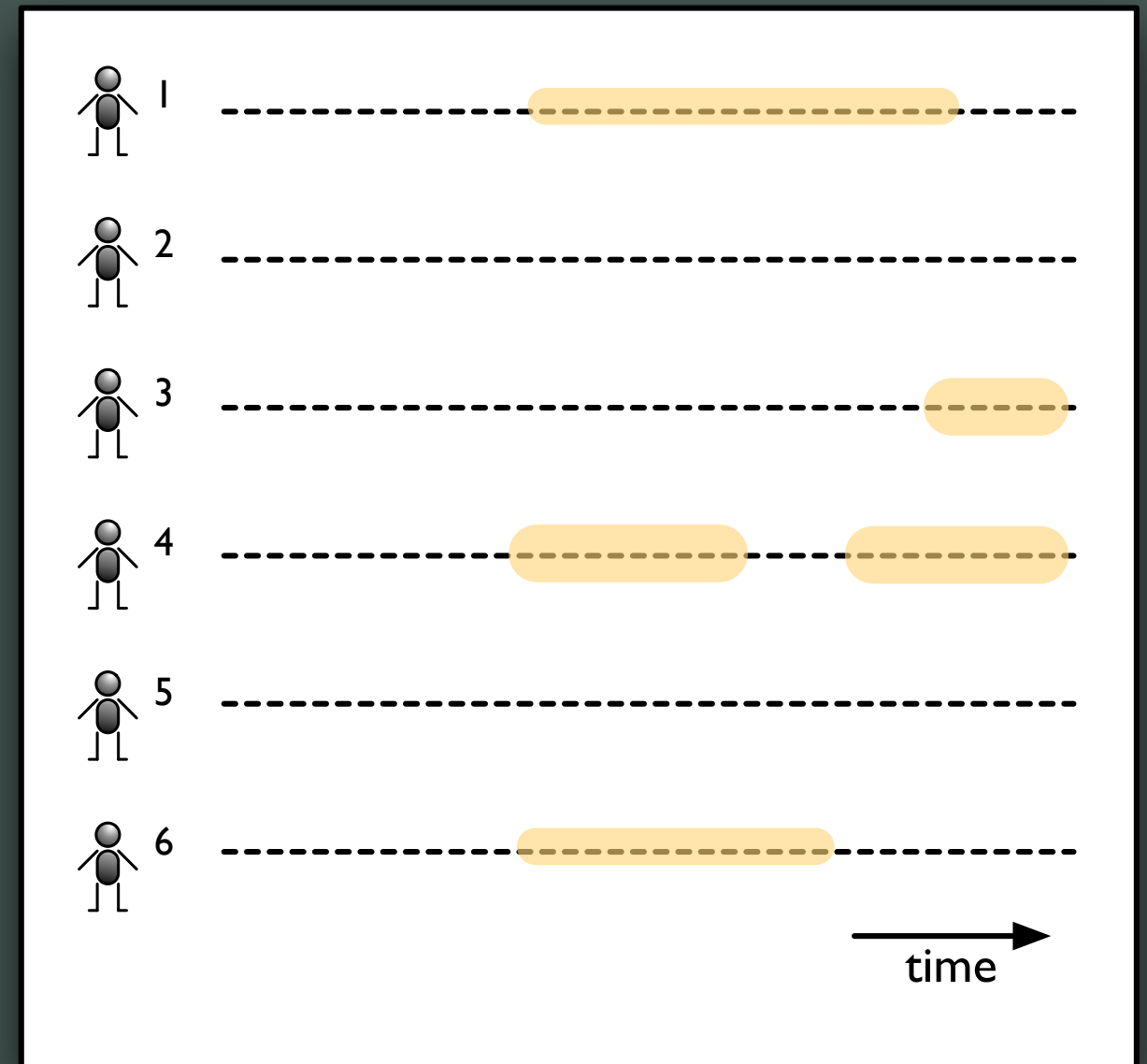
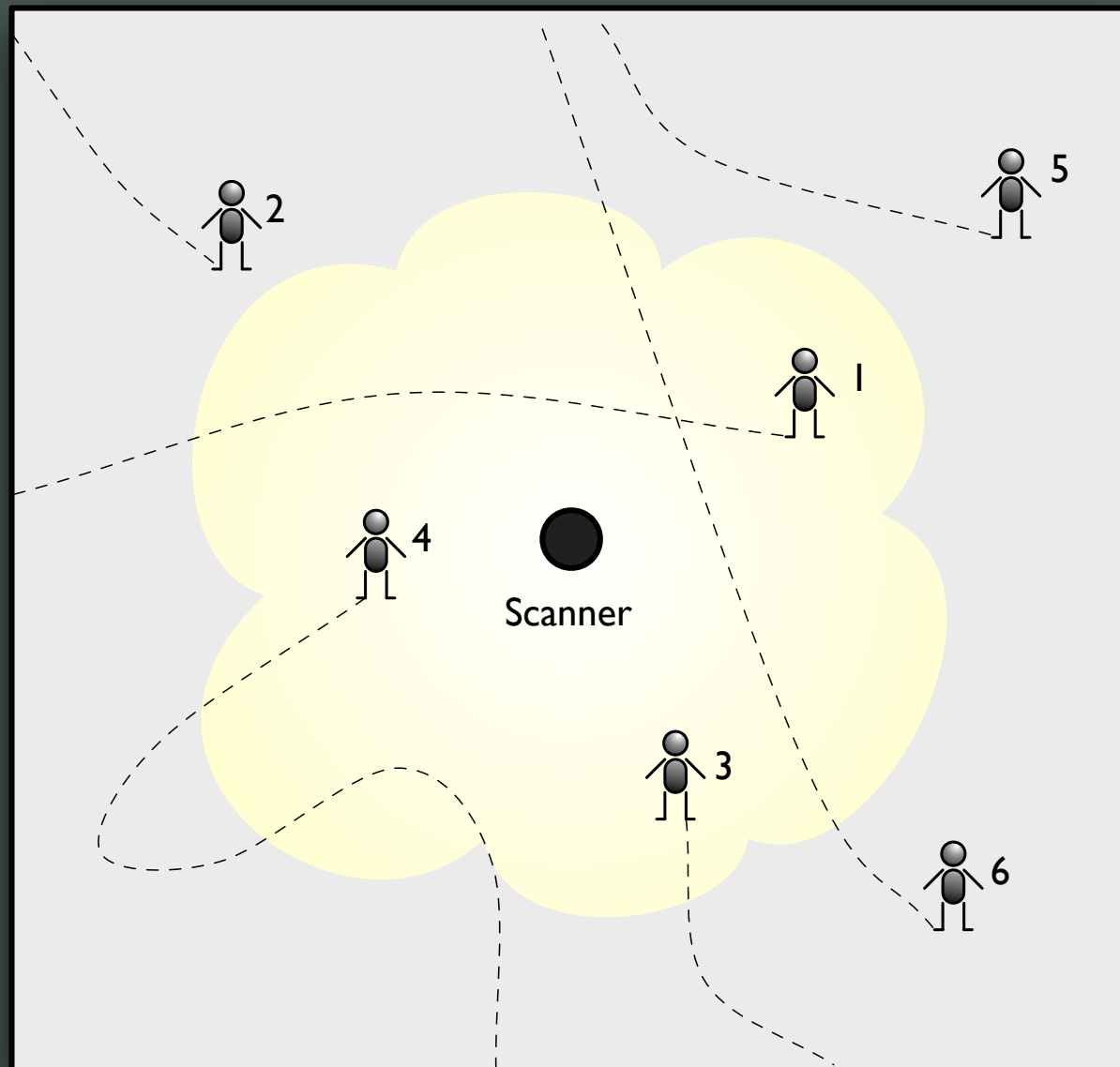


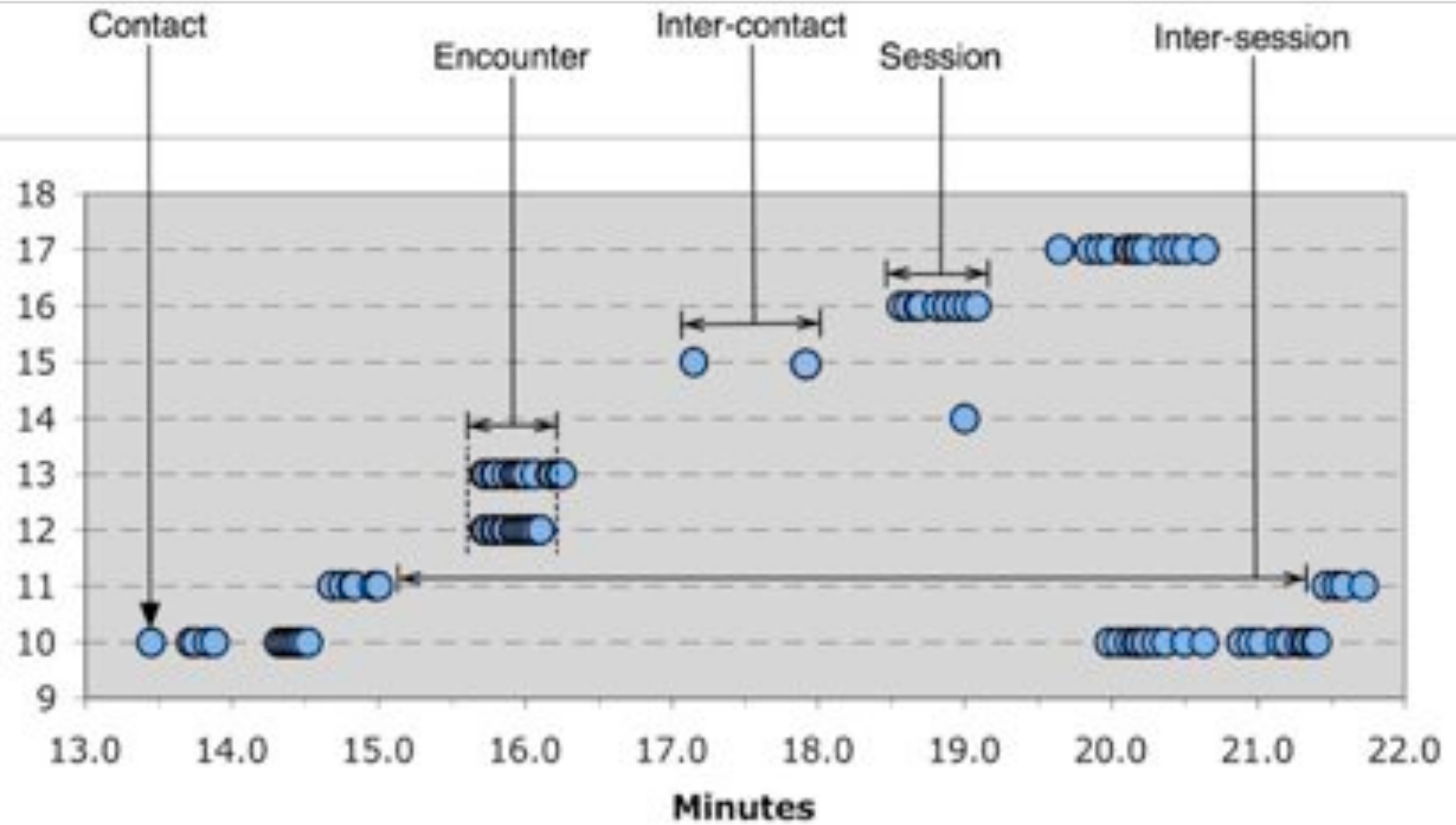


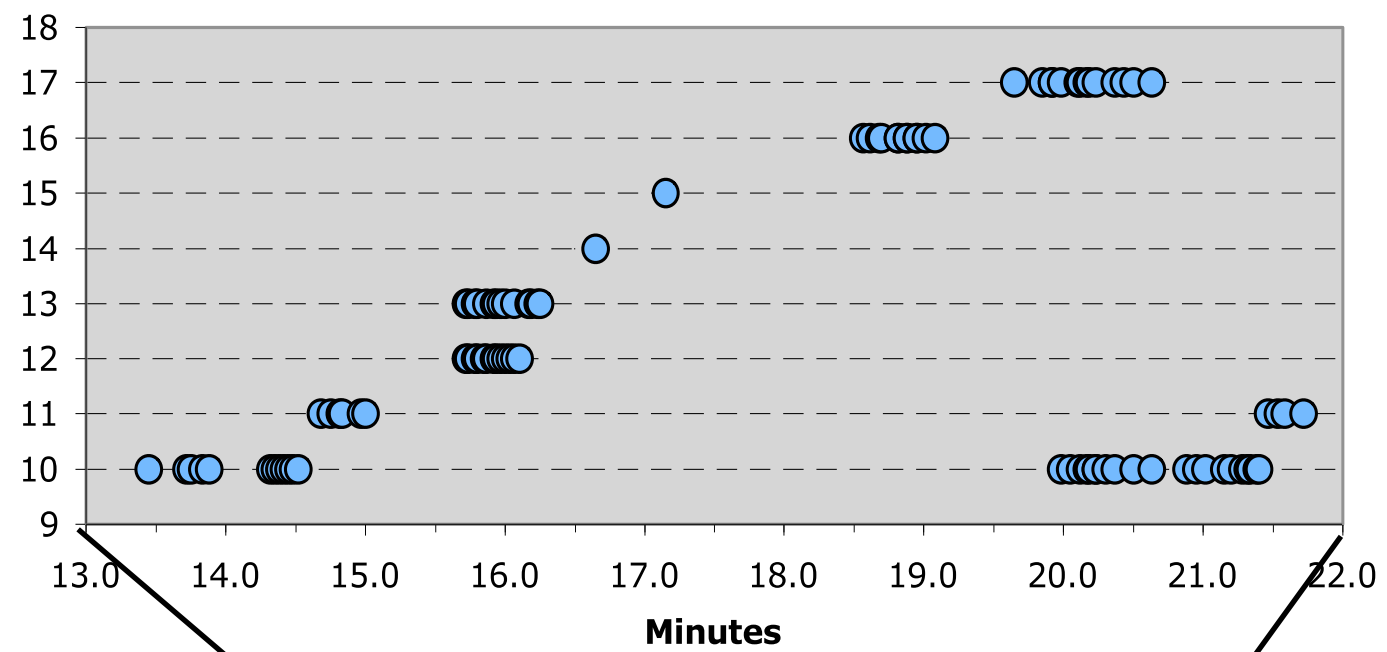
Under review, INTERACT 2011.

People-sensors

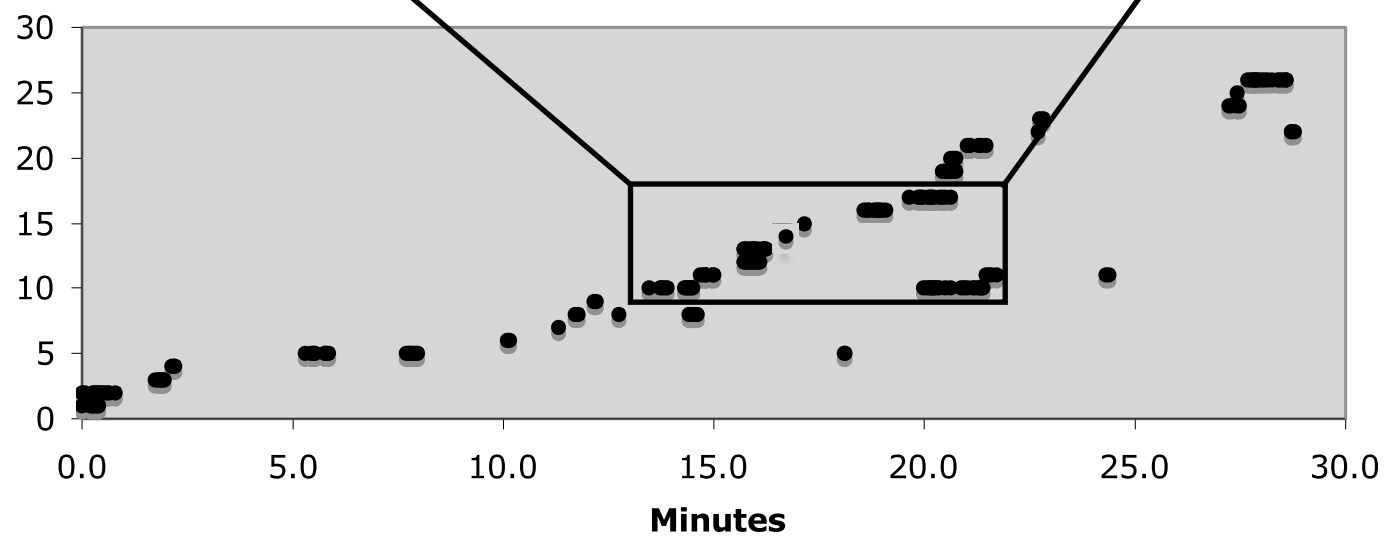


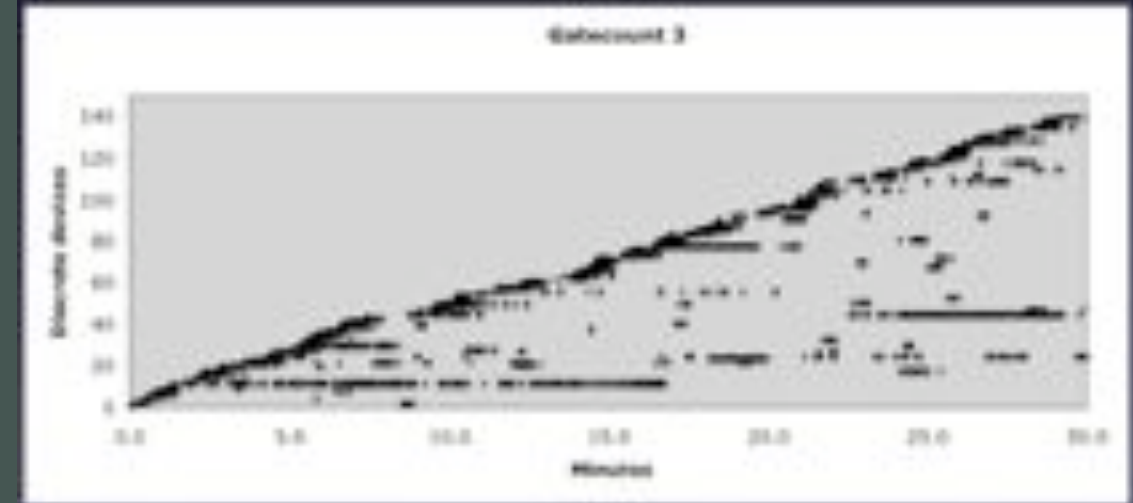
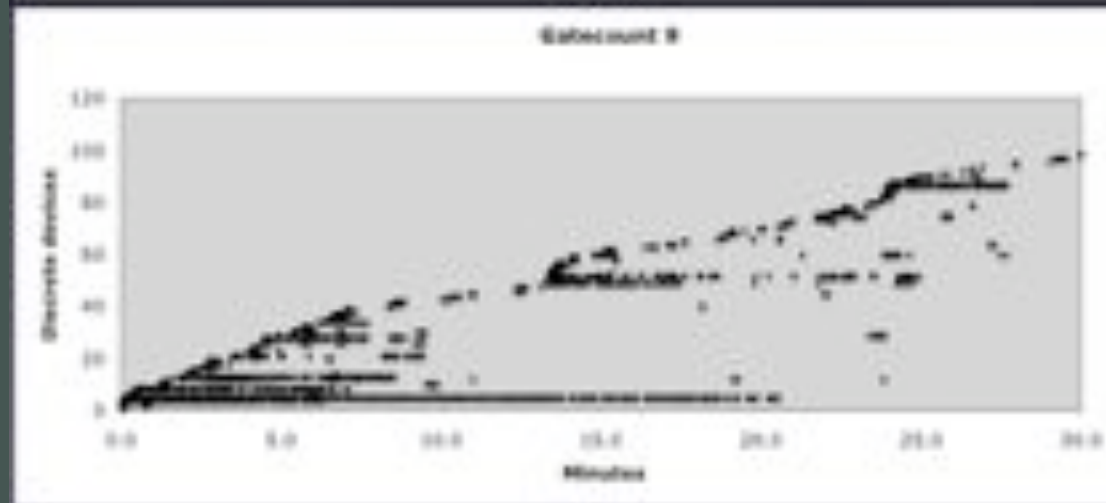
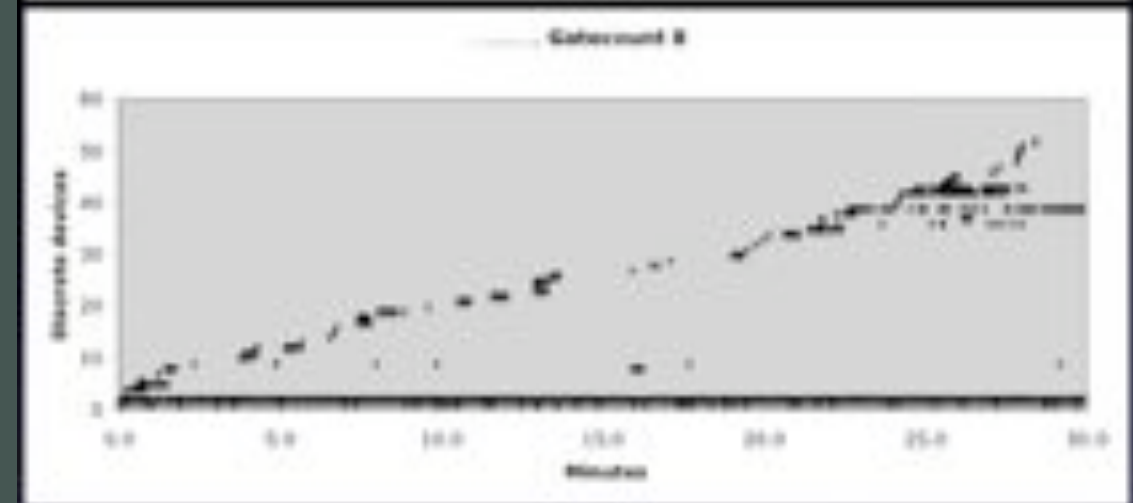
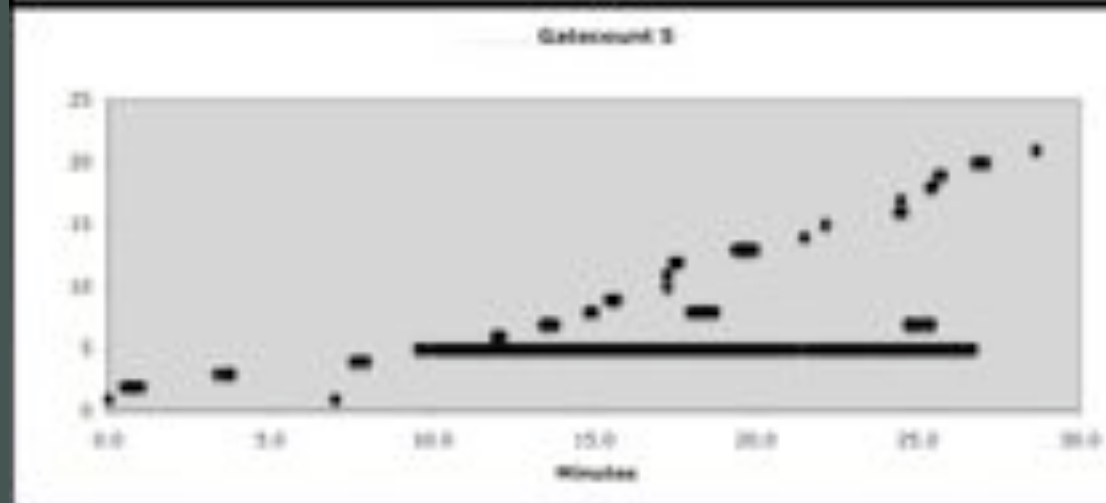
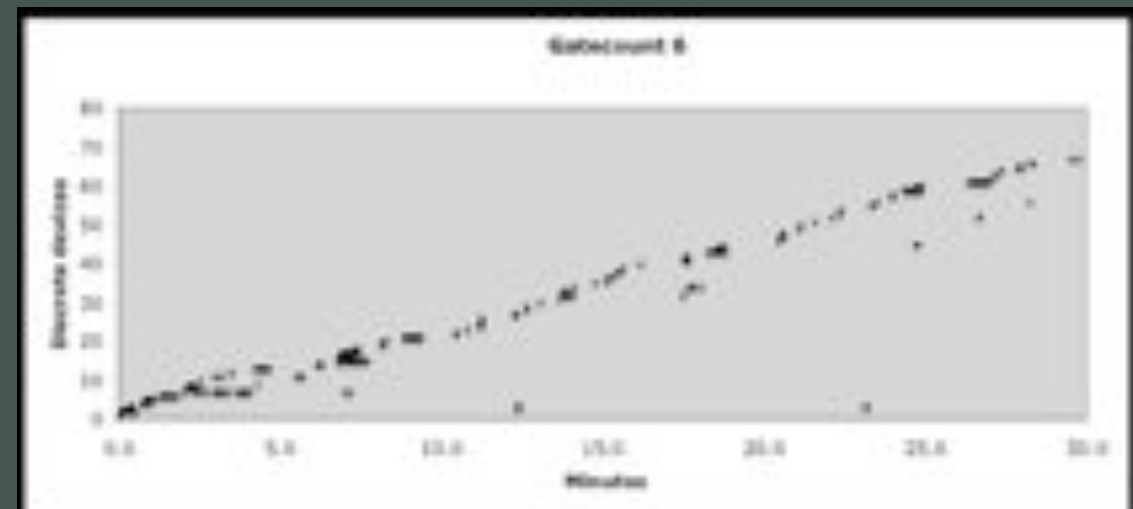
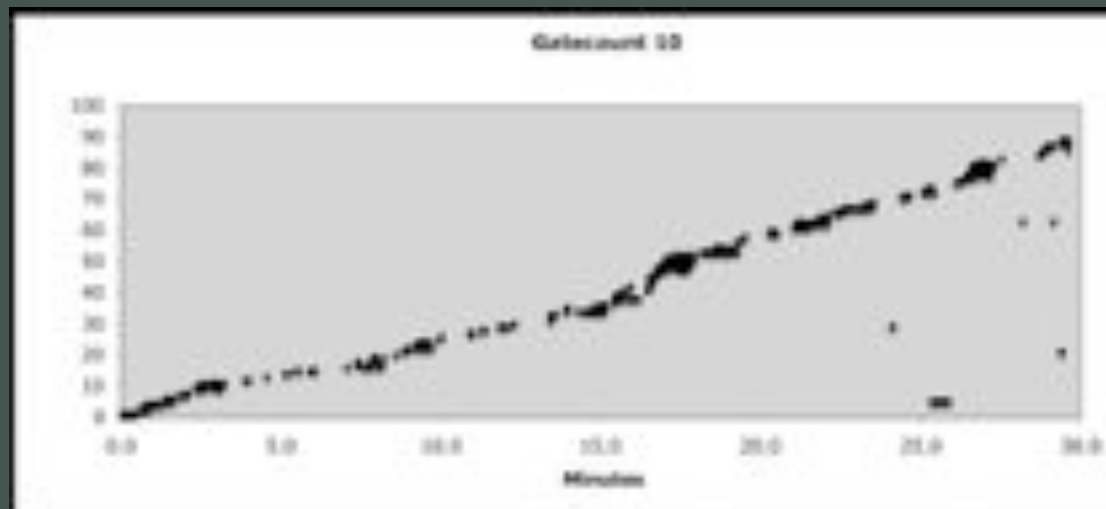






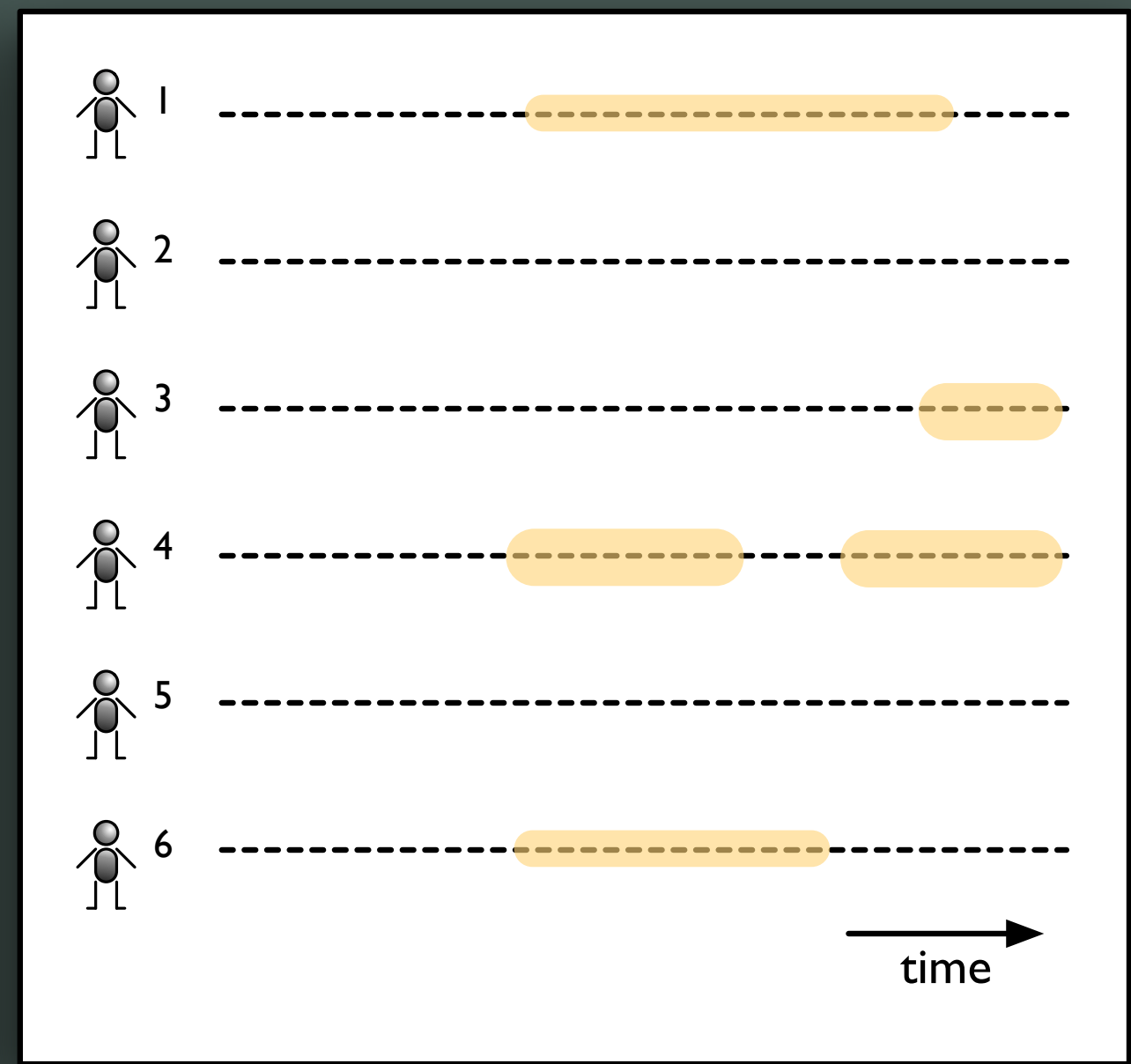
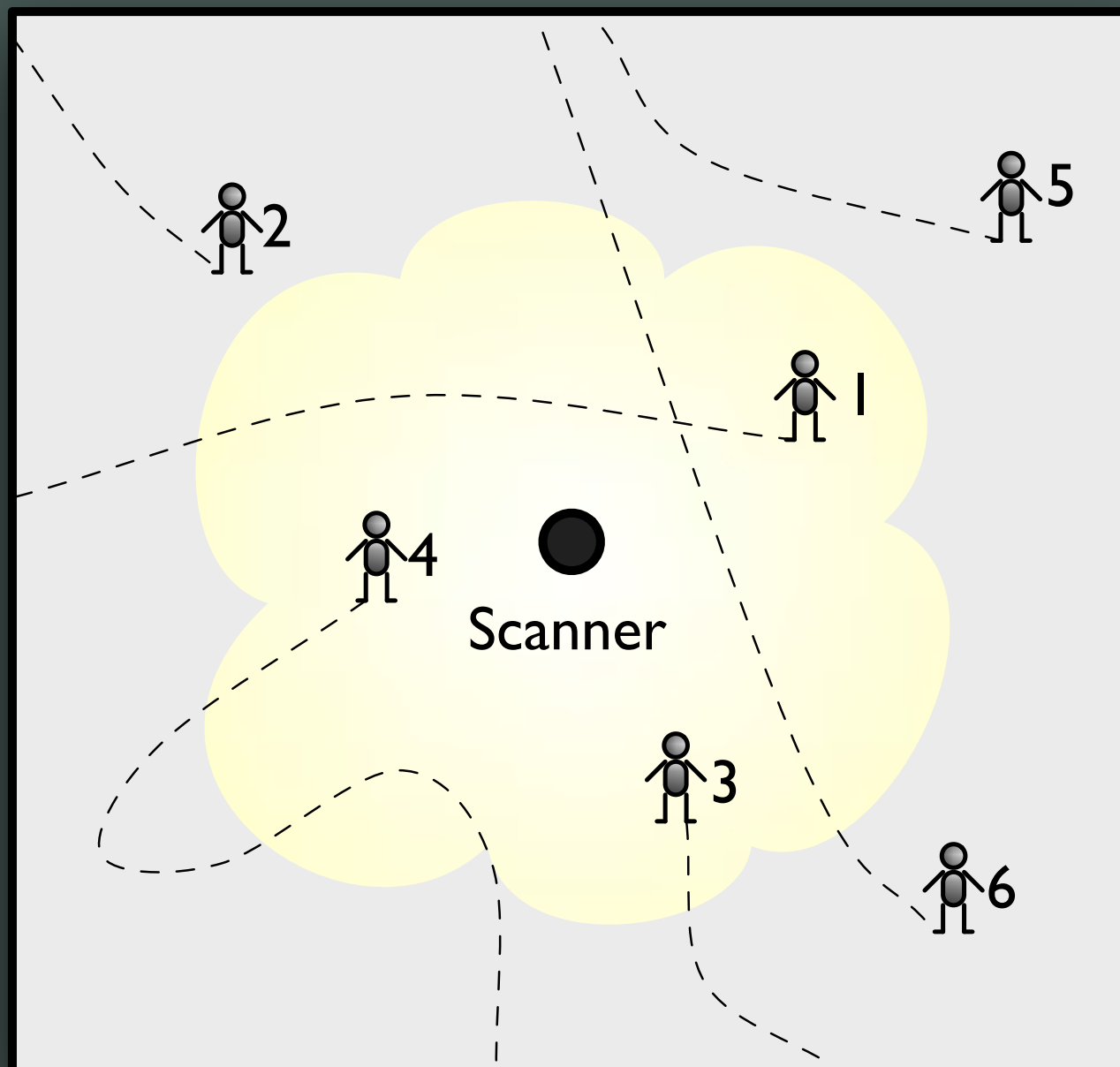
Mobile Gatecount 1

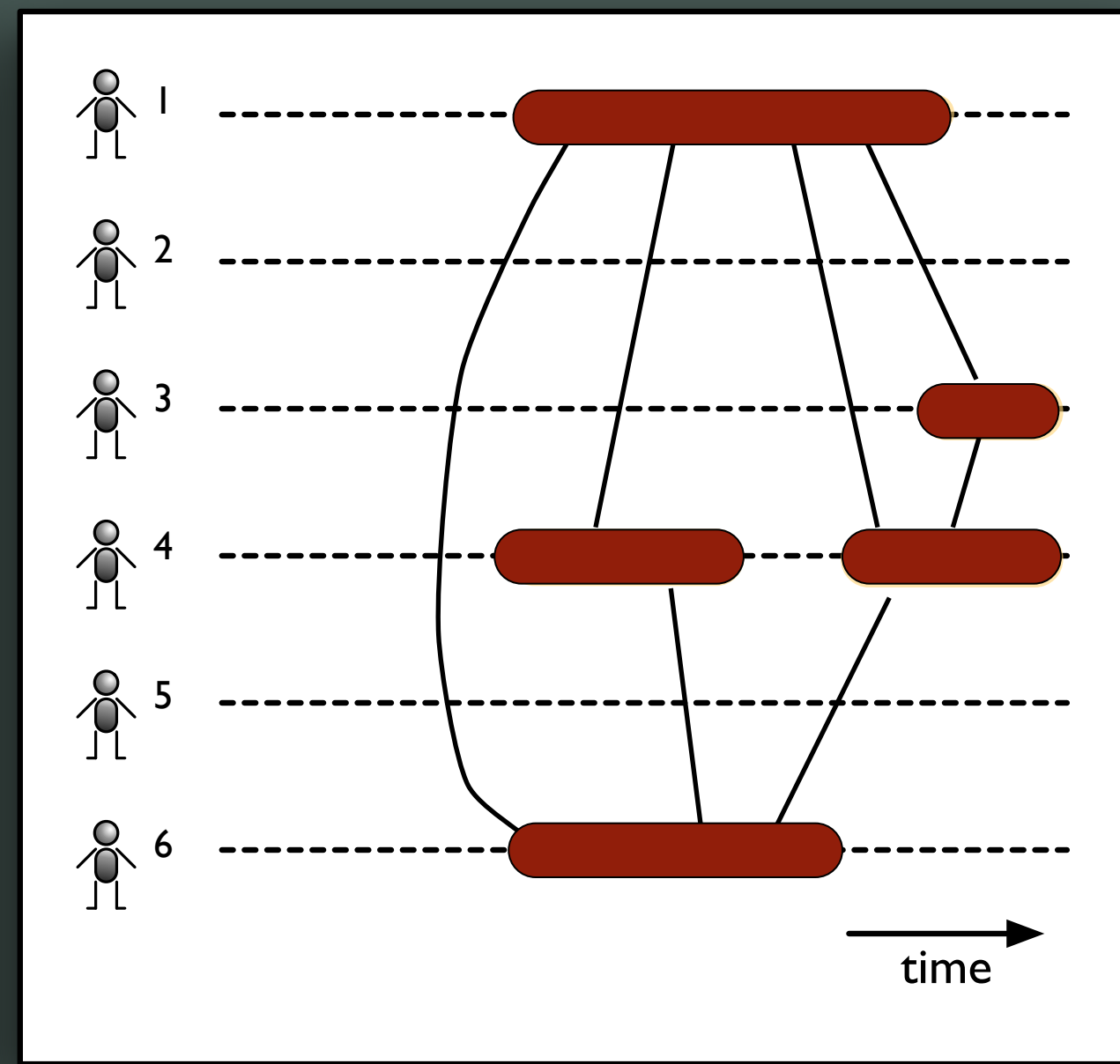
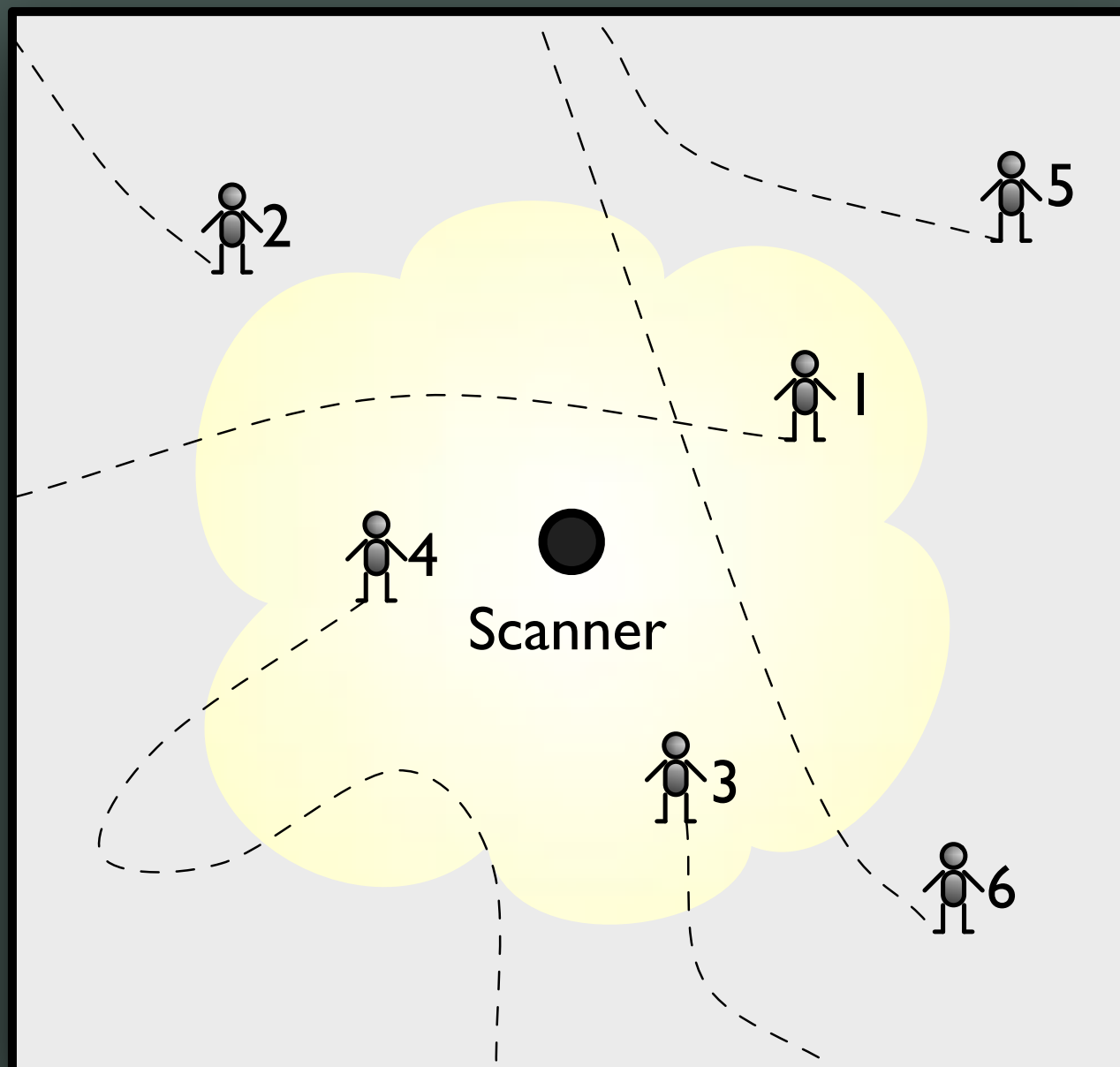


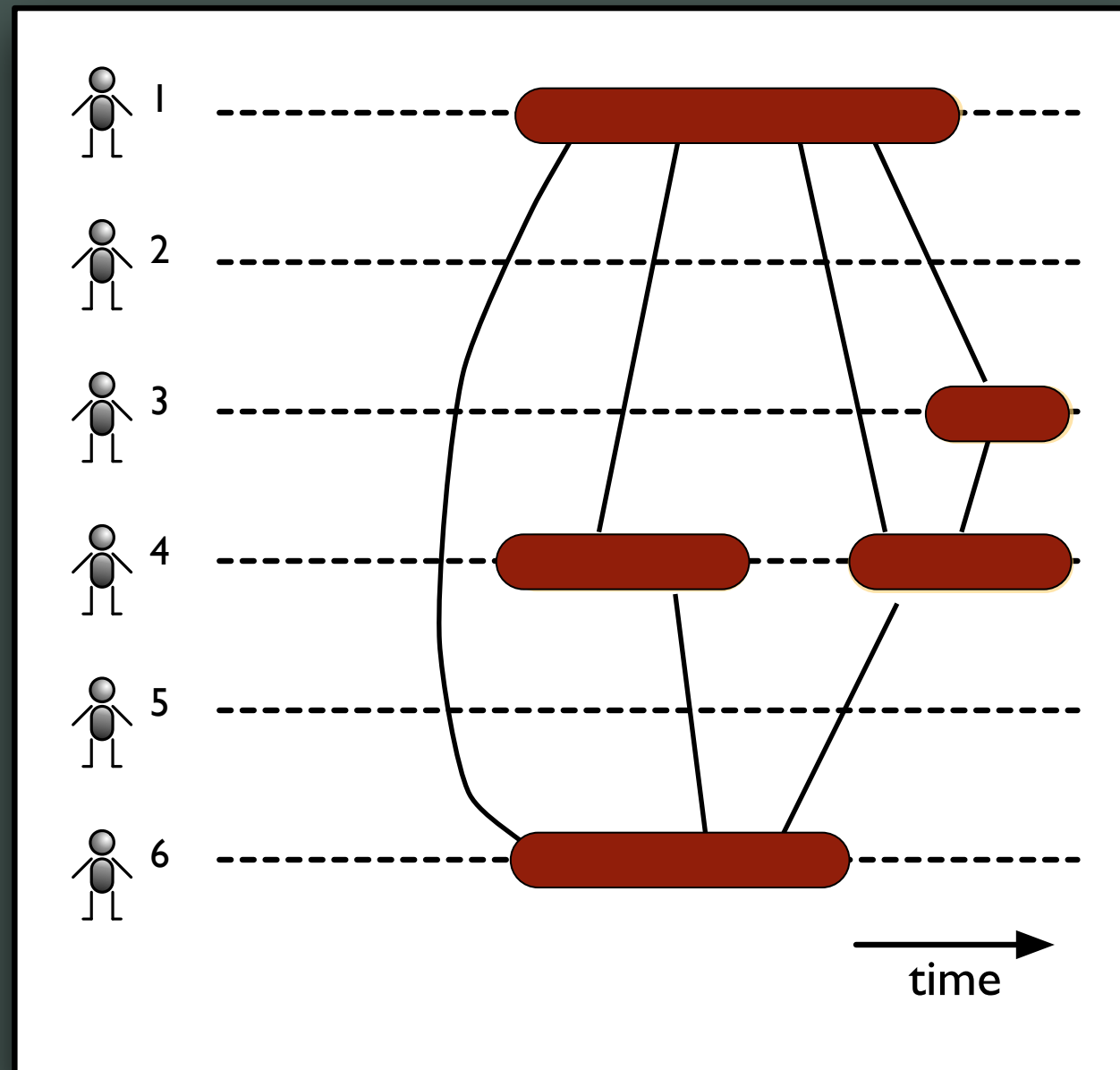


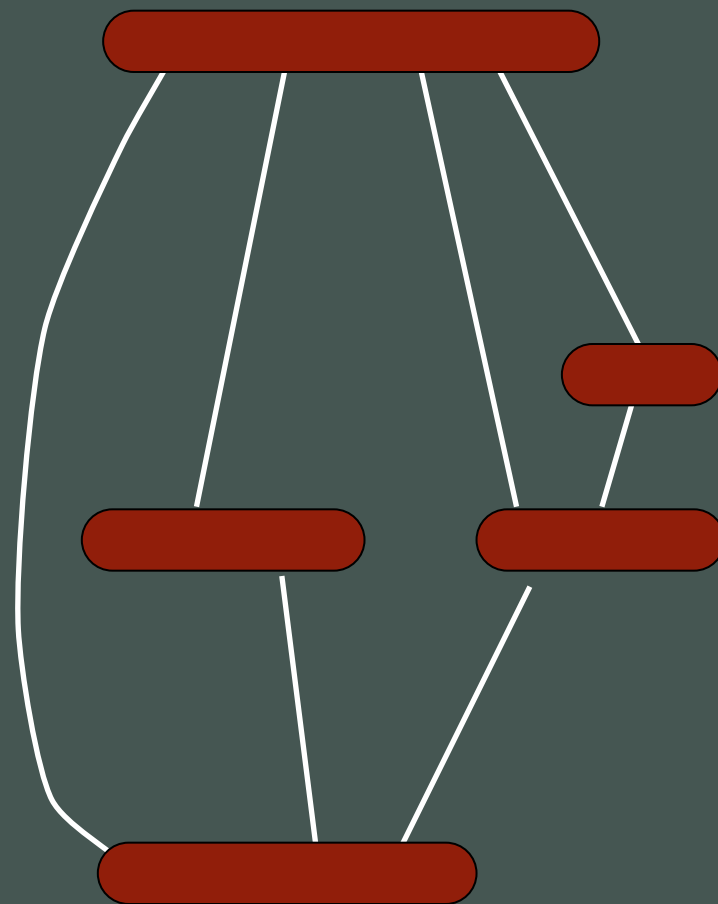
O'Neill, E., Kostakos, V., Kindberg, T., Fatah gen. Schiek, A., Penn, A., Stanton Fraser, D. and Jones, T. (2006). Instrumenting the city: developing methods for observing and understanding the digital cityscape. **UbiComp**, pp. 315-332.

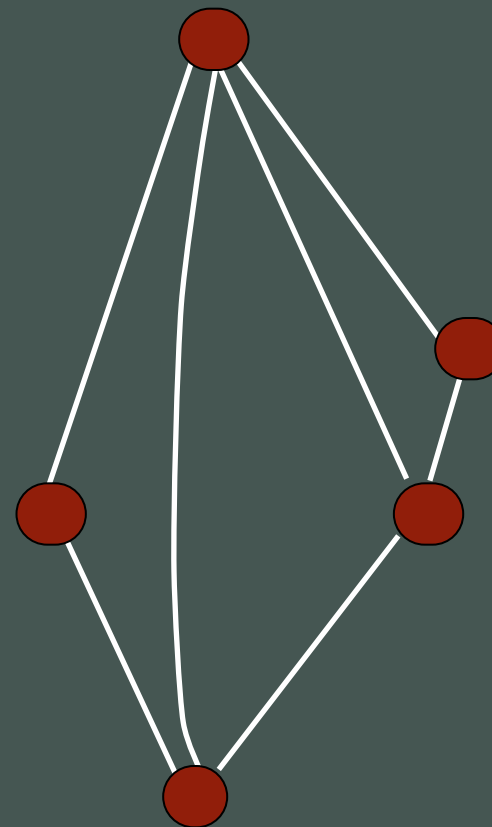


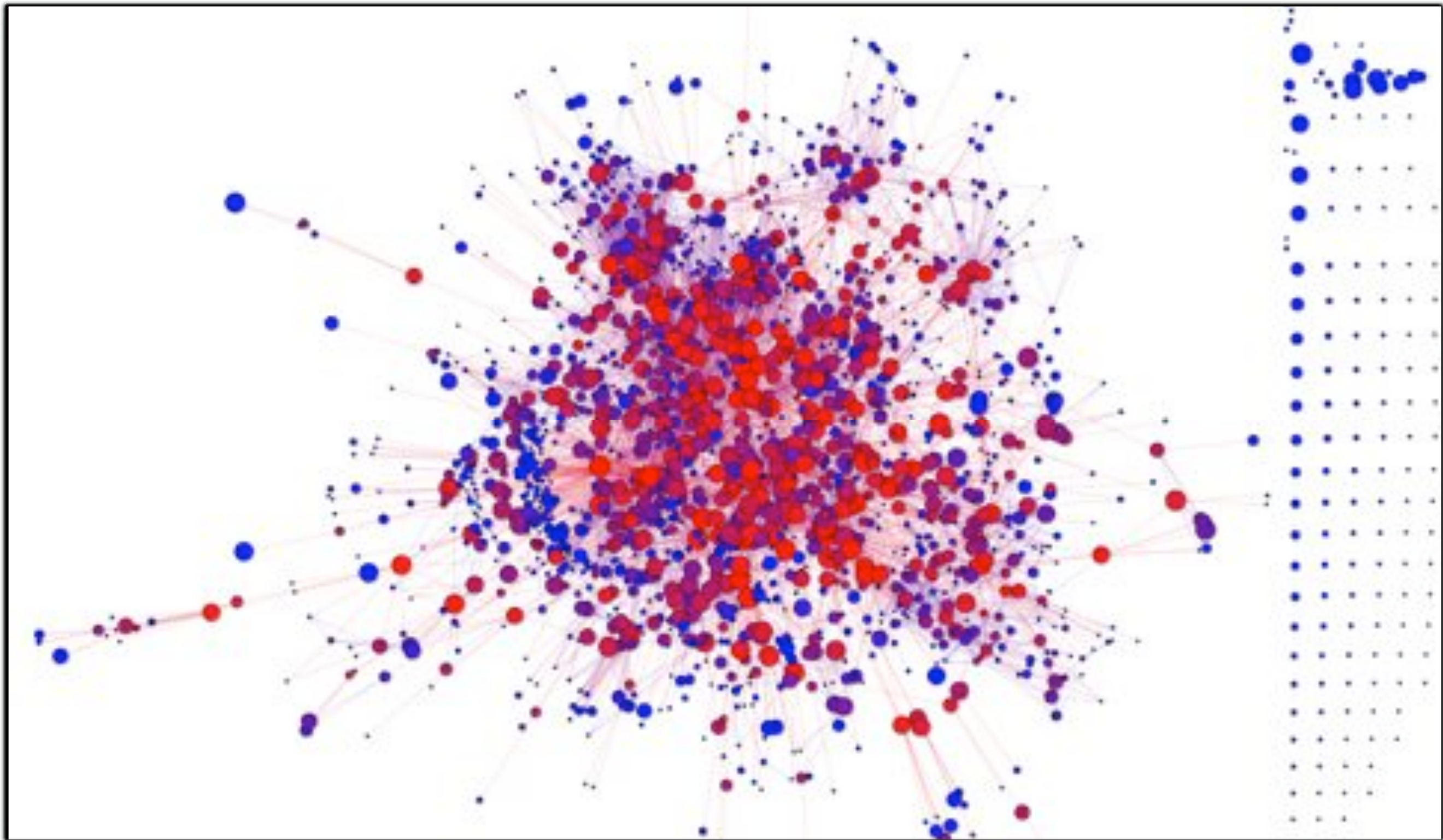




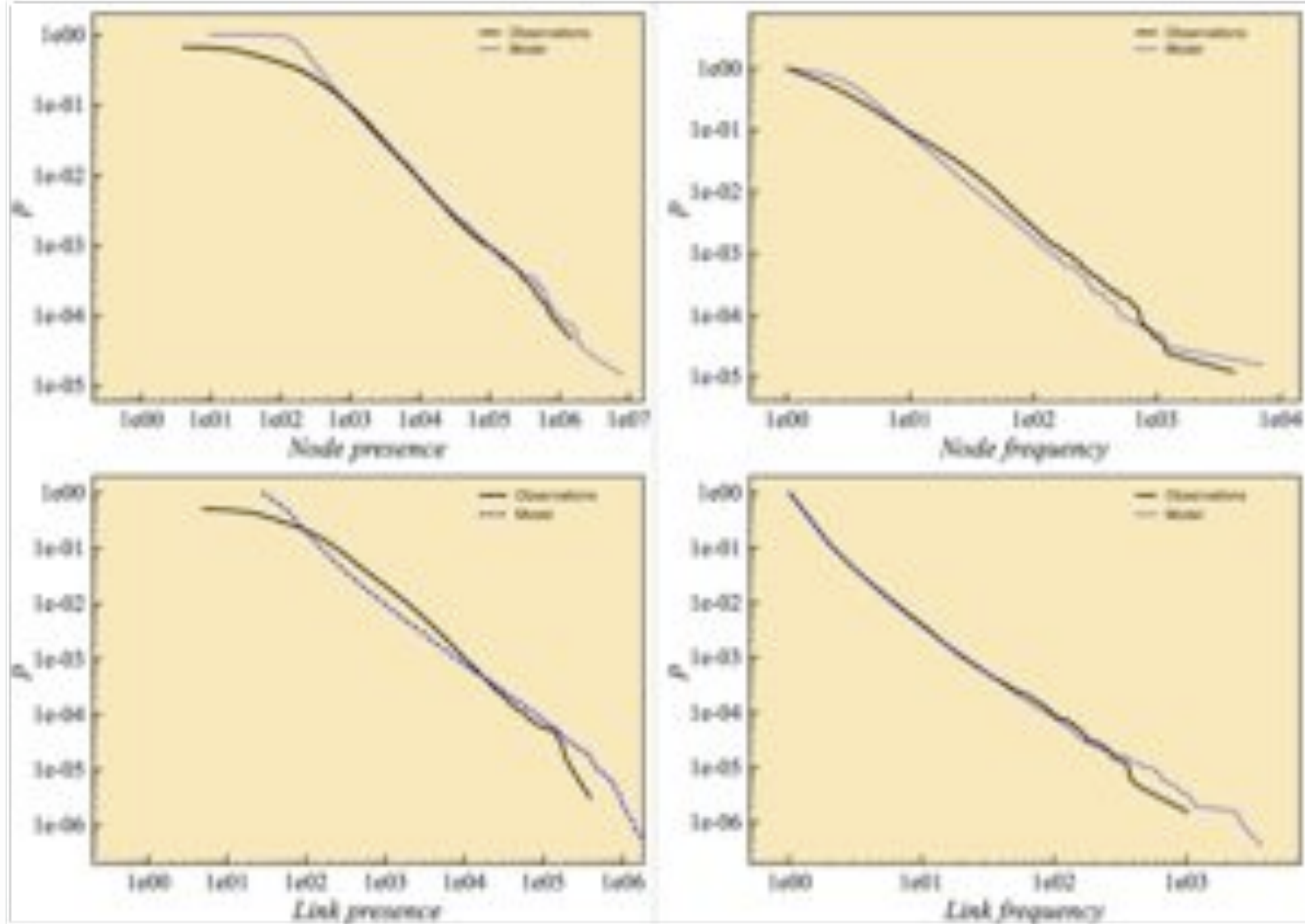




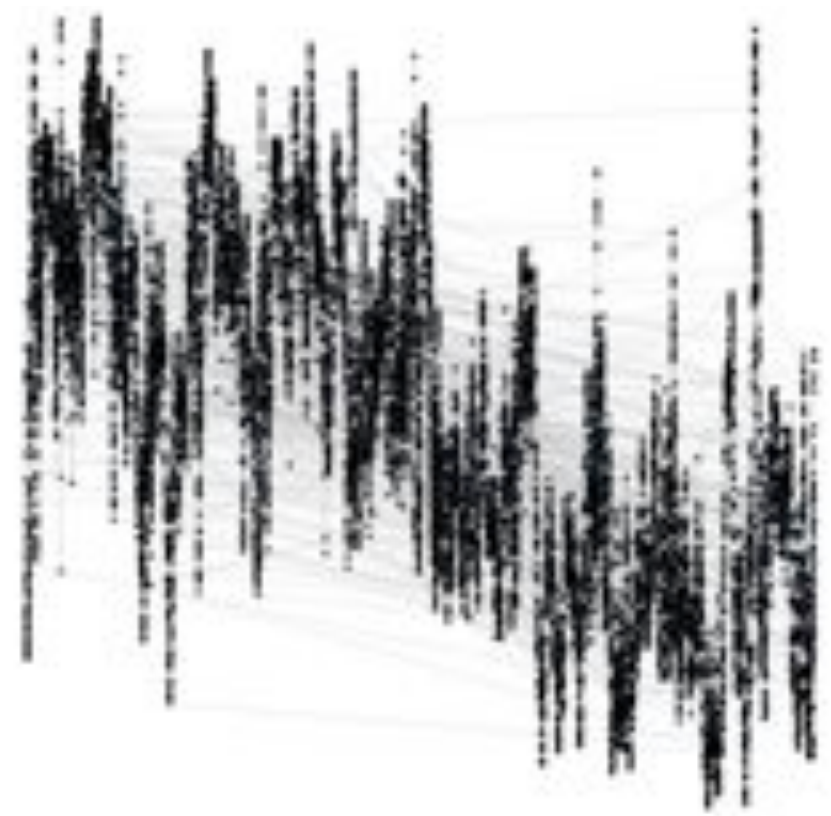
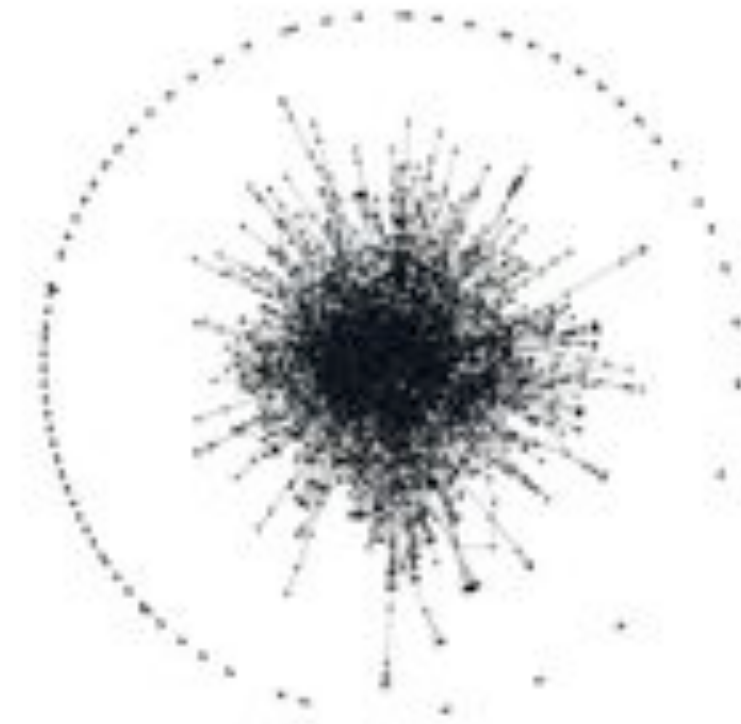
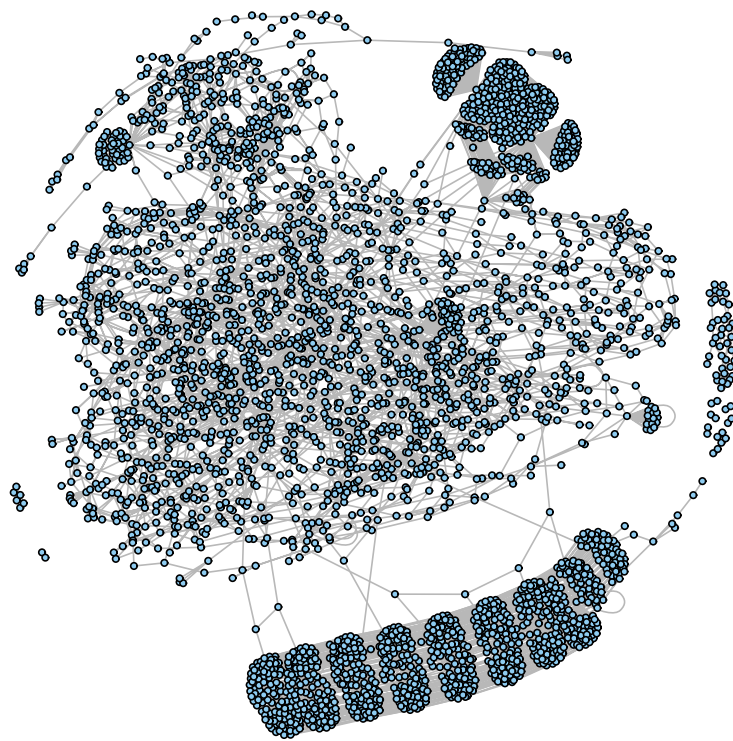
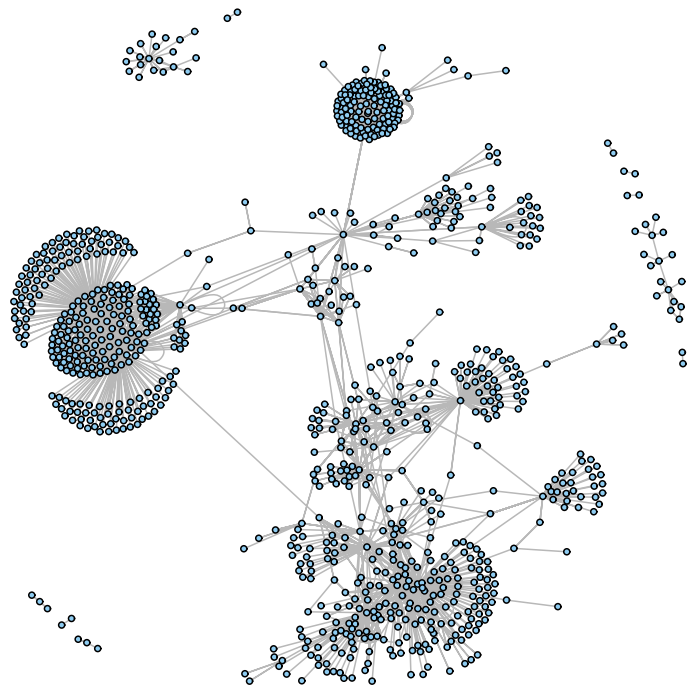




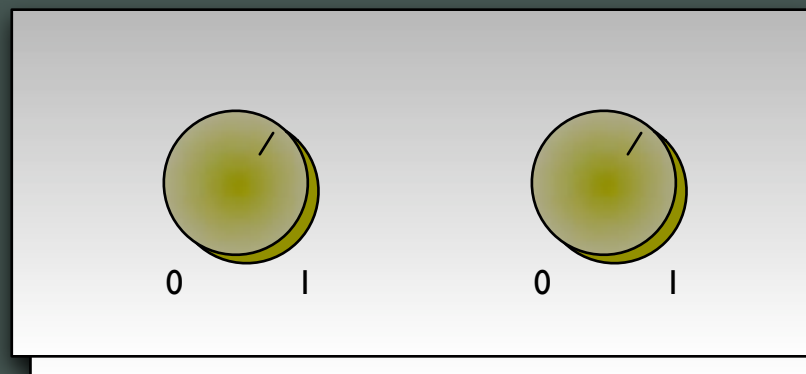
Kostakos, V., Nicolai, T., Yoneki, E., O'Neill, E., Kenn, H. and Crowcroft, J. (2009). Understanding and measuring the urban pervasive infrastructure. **Personal and Ubiquitous Computing**, 13(5):355-364.



Kostakos, V., O'Neill, E., Penn, A., Roussos, G., Papadongonas, D. (2010). Brief encounters: sensing, modelling and visualizing urban mobility and copresence networks. *Transactions on Computer Human Interaction*, 17(1):1-38



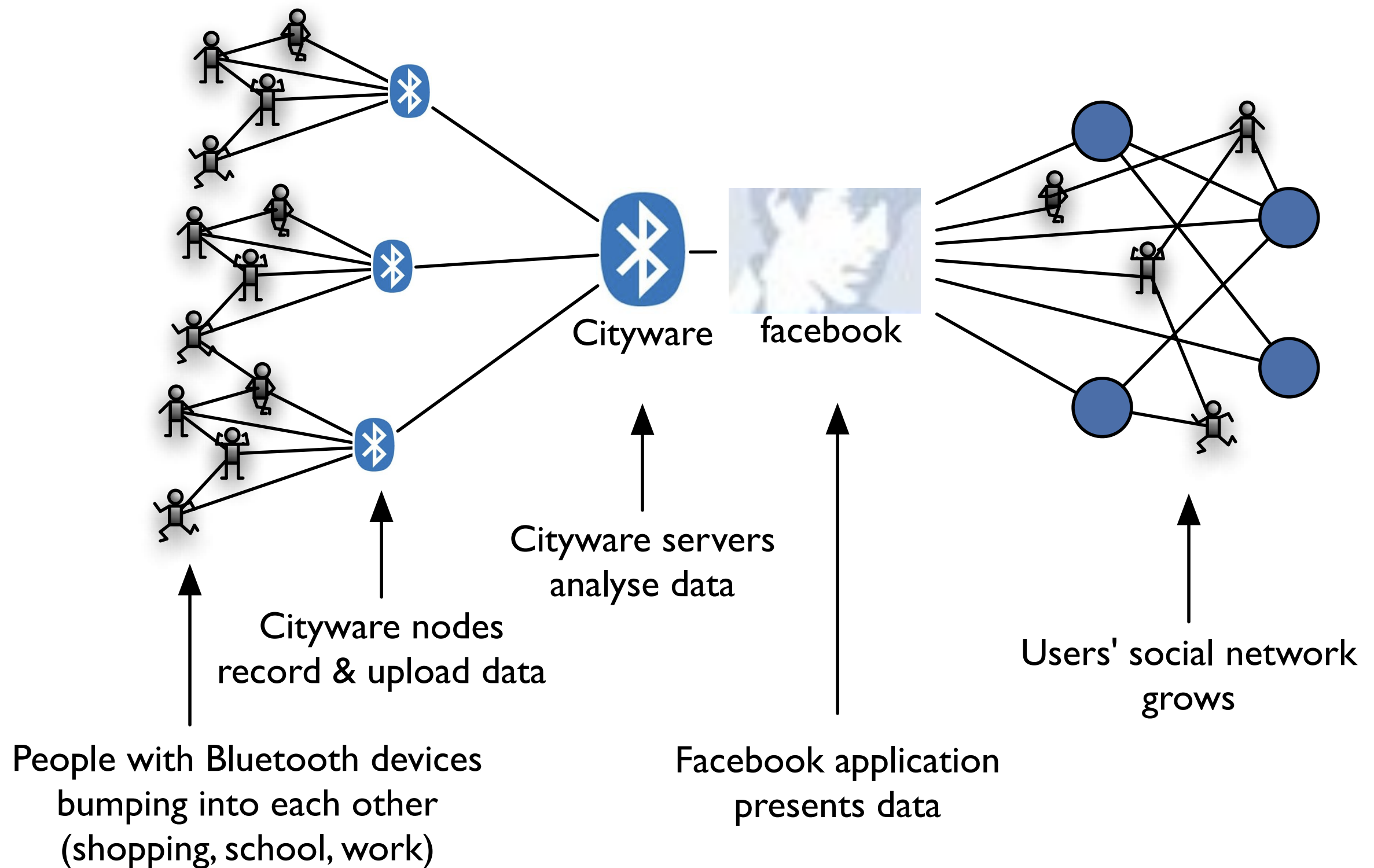
Kostakos, V. (2009). Temporal graphs. *Physica A: Statistical Mechanics and its Applications*, 388(6):1007-1023.

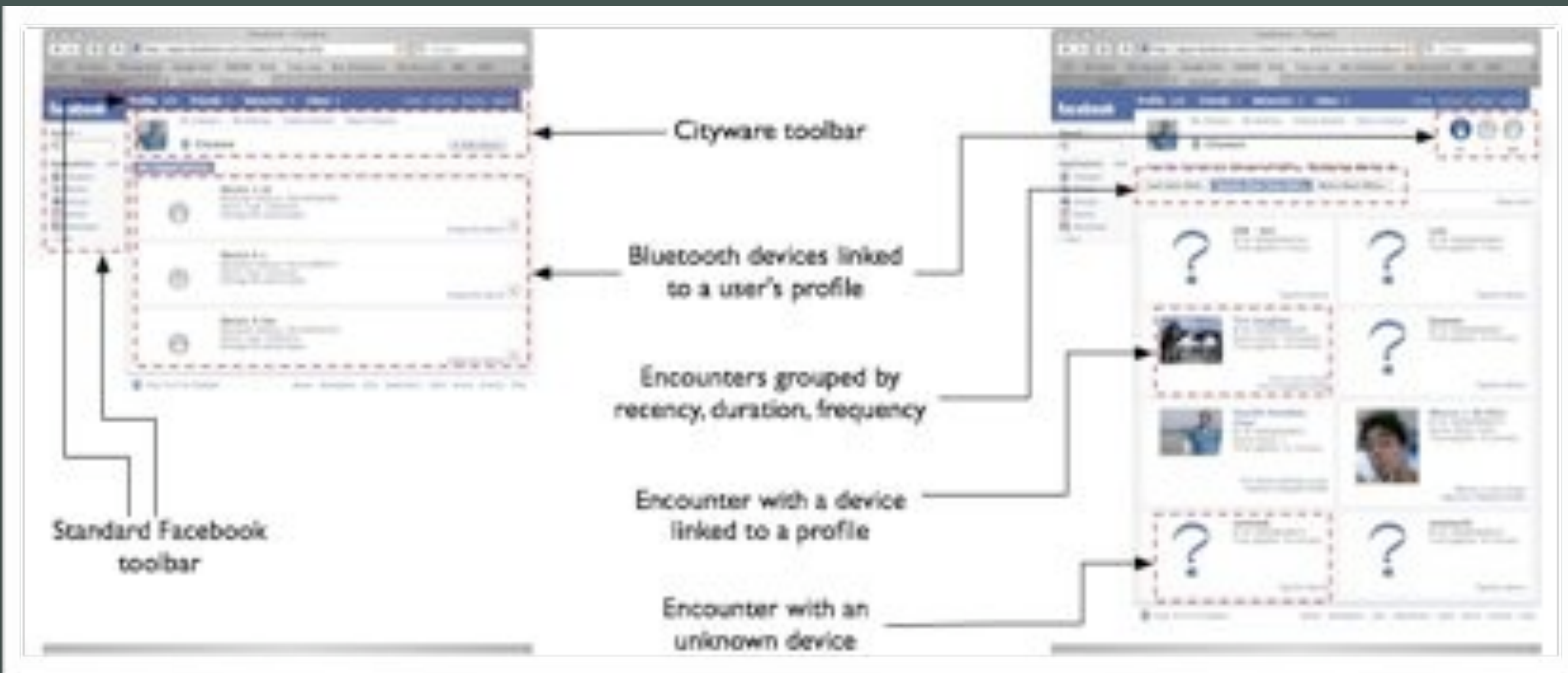


Kostakos, V., O'Neill, E., Penn, A., Roussos, G., Papadongonas, D. (2010). Brief encounters: sensing, modelling and visualizing urban mobility and copresence networks. **Transactions on Computer Human Interaction**, 17(1):1-38

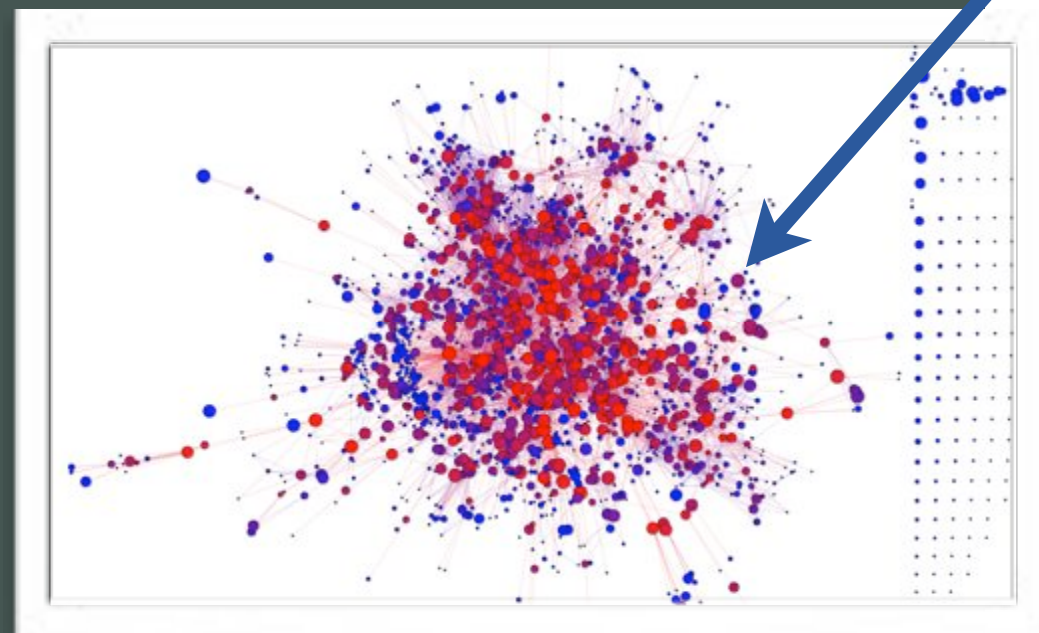








Kostakos, V. and O'Neill E. (2008). Cityware: Urban Computing to Bridge Online and Real-world Social Networks. In M. Foth (Ed.), **Handbook of Research on Urban Informatics: The Practice and Promise of the Real-Time City** (pp. 195-204). Hershey, PA: Information Science Reference, IGI Global



Facebook | Cityware

http://apps.facebook.com/cityware/index.php?active=duration&use Google

VK Home Photography Google docs ODEON - Bath Tube map Mac Wallpapers MacResearch NBG ACM 30

Google Facebook | Cityware

facebook Profile edit Friends + Networks + Inbox + home account privacy logout

Search + Q=

Applications edit Cityware Photos Group Events Developer

Cityware | My Settings | Getting Started | About Cityware

Cityware

Vassilis Kostakos's Cityware Profile - Displaying device: vk

Last Seen With... Spends Most Time With... Meets Most Often...

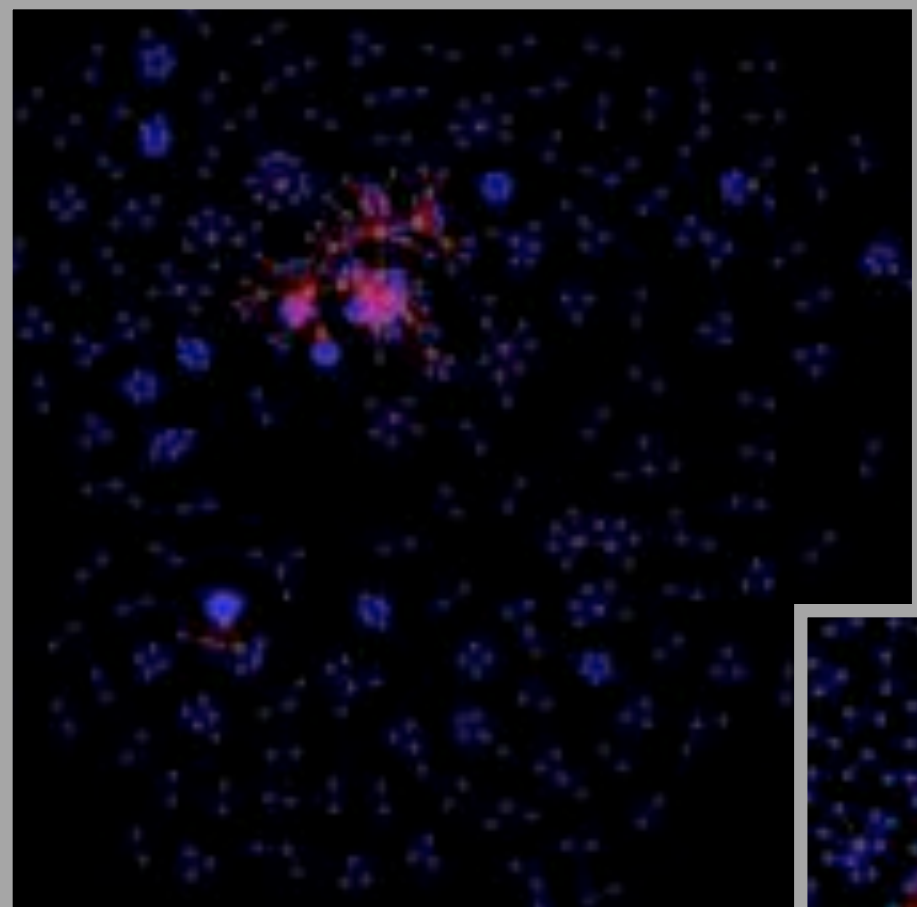
Show more

CSR - bc4 BT ID: 30000000007A4 Time together: 2 hours Tag this device	Lulu BT ID: 300000000082A Time together: 1 hour Tag this device
Tim Coughlan BT ID: 3000000000288 Device Name: TimsLaptop Time together: 54 minutes Tim is your friend Tim's Cityware Profile	Eamonn BT ID: 3000000000837 Time together: 53 minutes Tag this device
Vassilis Kostakos (You) BT ID: 3000000000FC1 Device Name: v Time together: 51 minutes This device belongs to you Vassilis's Cityware Profile	Marcus L. Da Silva BT ID: 30000000002C9 Device Name: Vicky Time together: 45 minutes Marcus is your friend Marcus's Cityware Profile
minime9 BT ID: 3000000000E73 Time together: 44 minutes Tag this device	minime10 BT ID: 3000000000D1E Time together: 44 minutes Tag this device

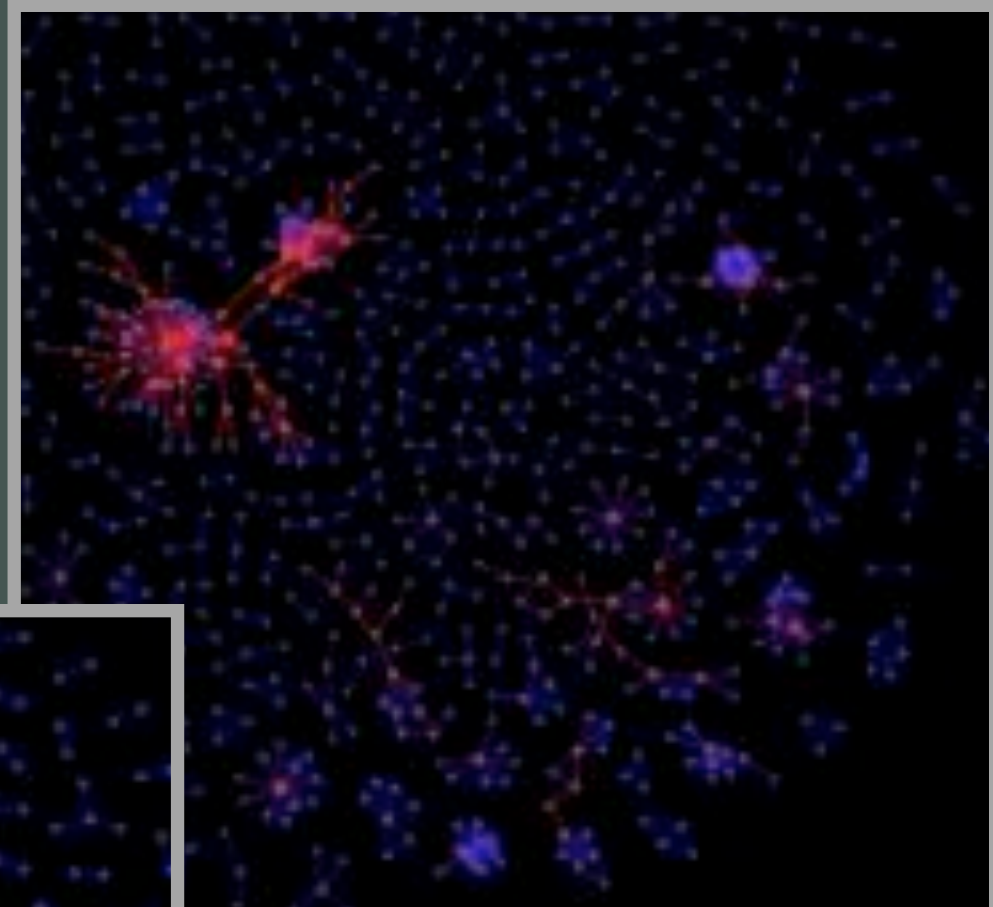
Page built by Cityware about developers jobs advertisers polls terms privacy help

Kostakos, V. and O'Neill E. (2008). Cityware: Urban Computing to Bridge Online and Real-world Social Networks. In M. Foth (Ed.), **Handbook of Research on Urban Informatics: The Practice and Promise of the Real-Time City** (pp. 195-204). Hershey, PA: Information Science Reference, IGI Global

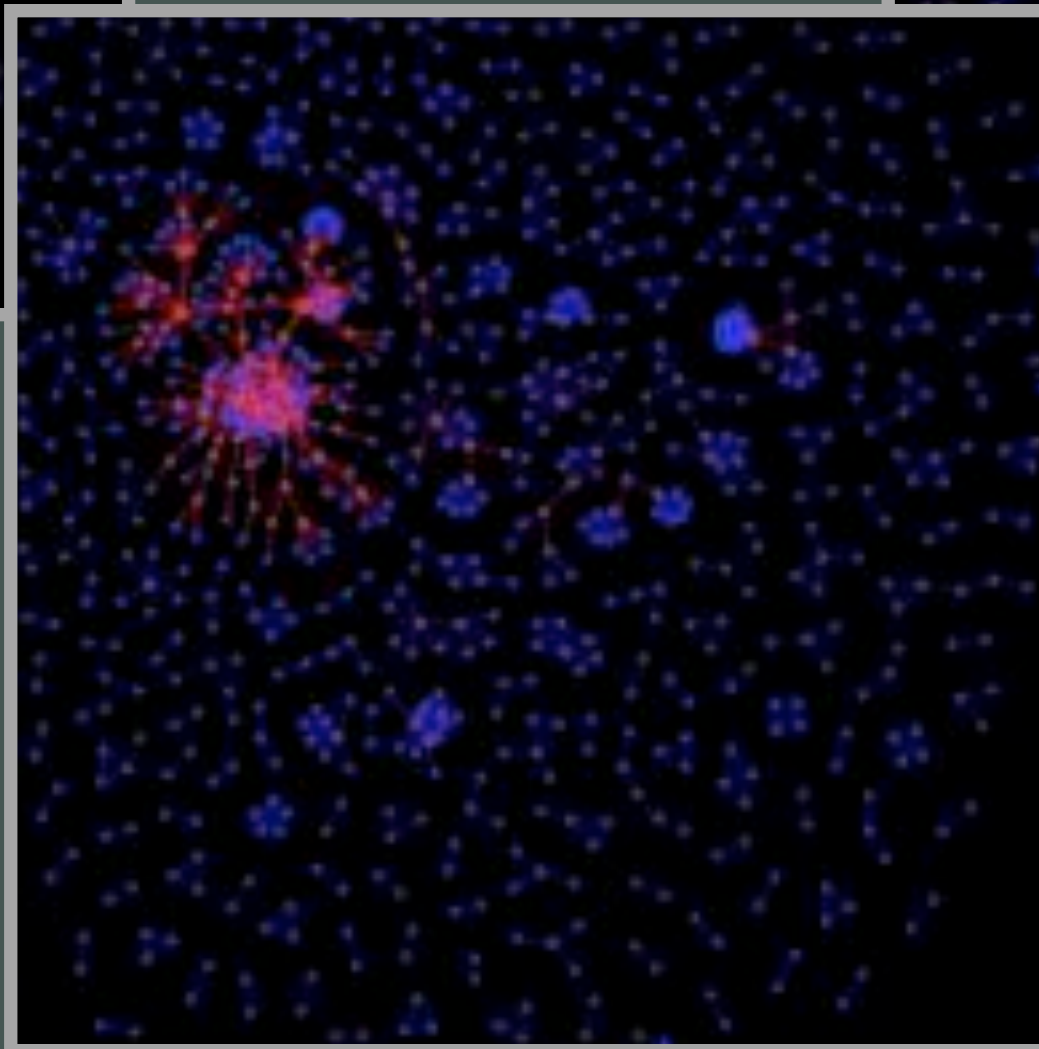
Facebook

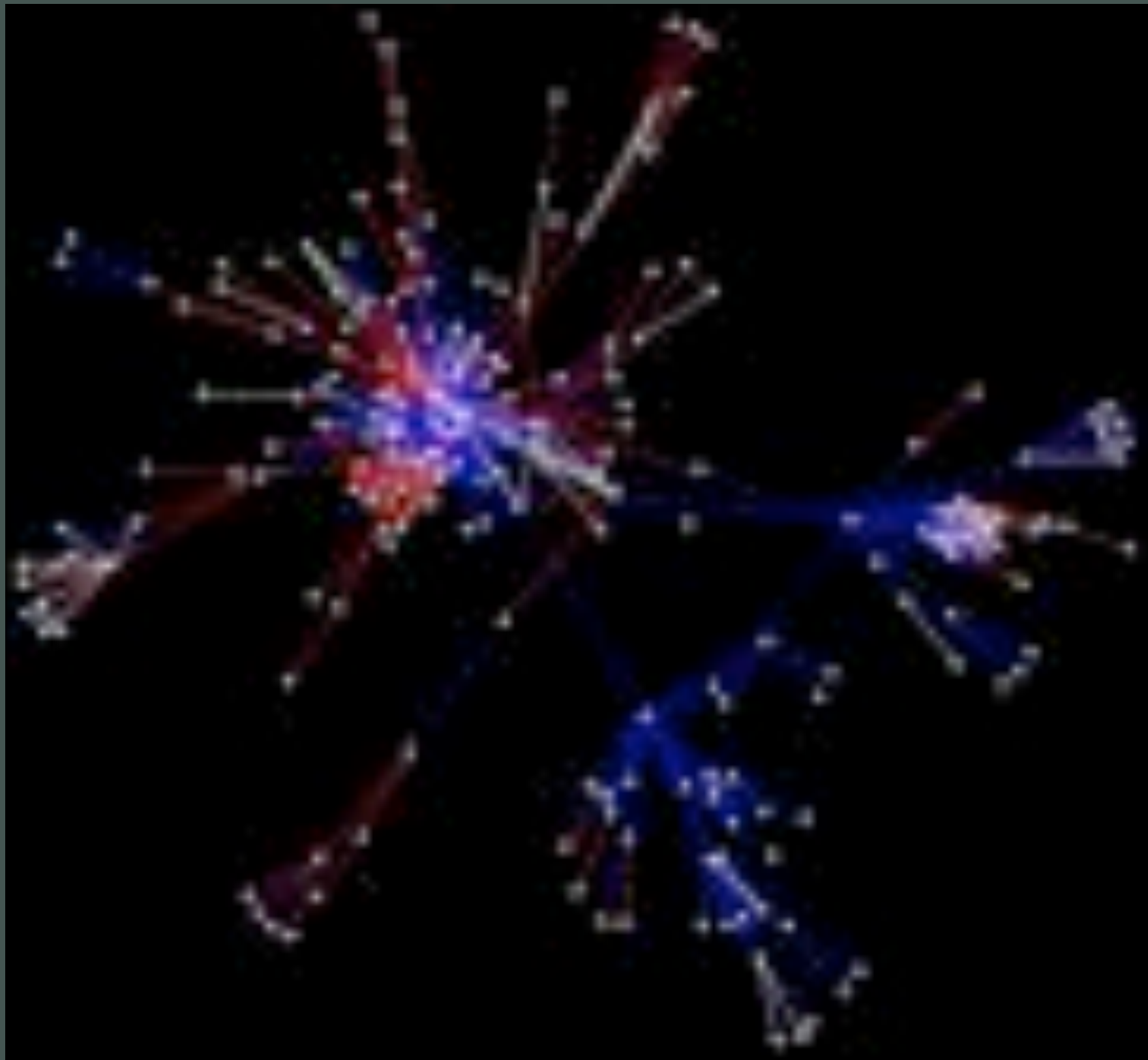


Encounter

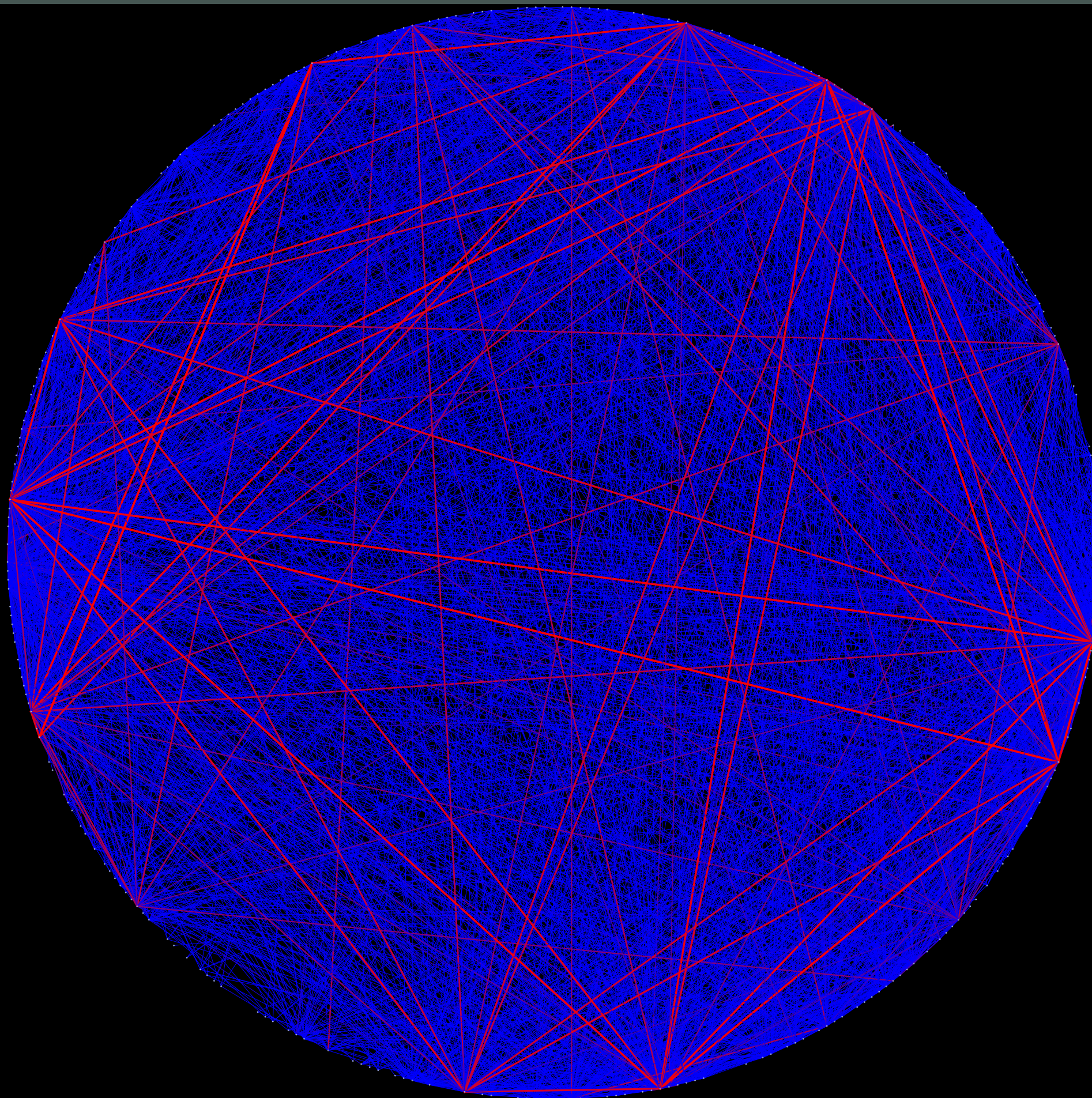


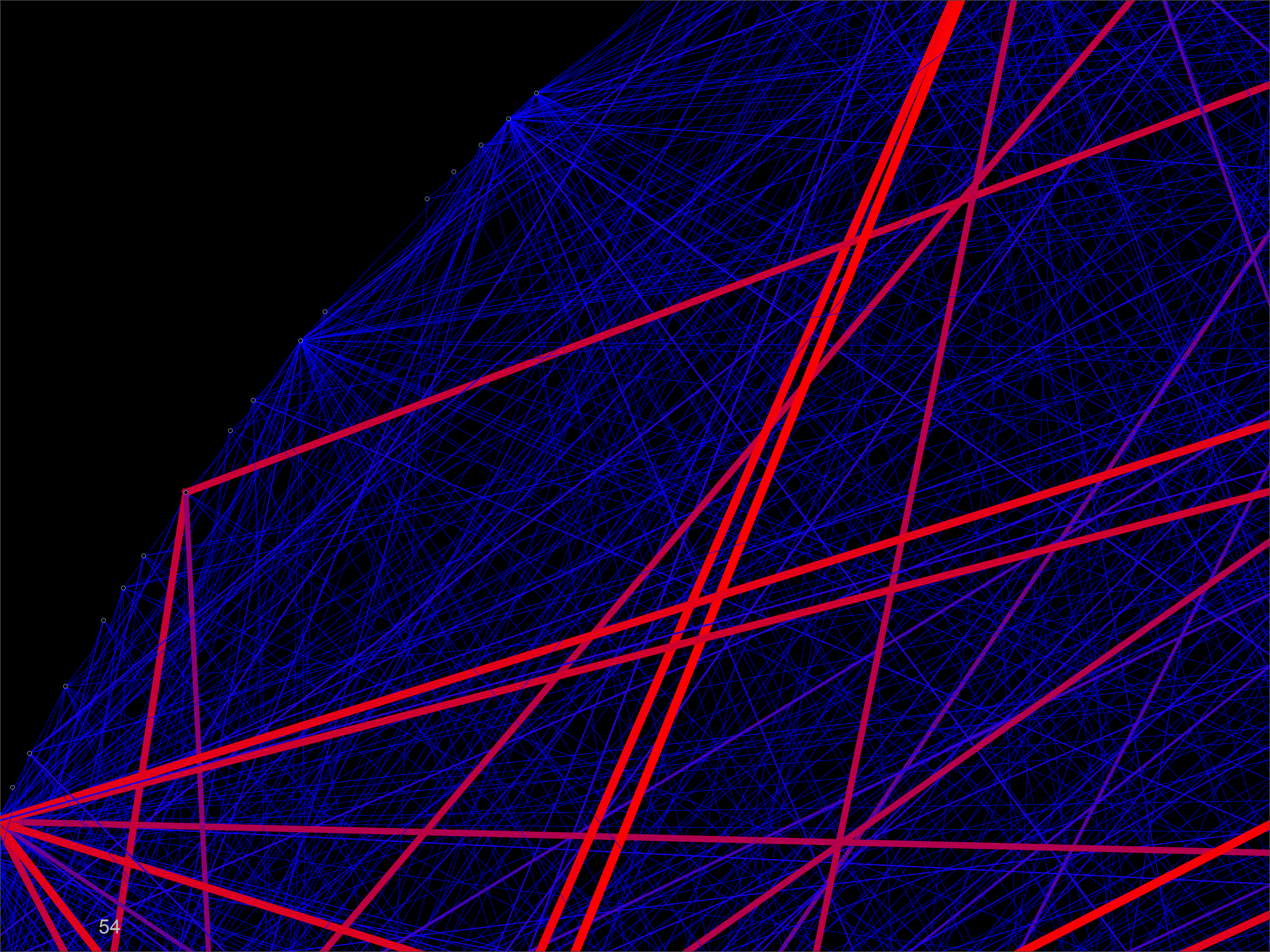
Fused

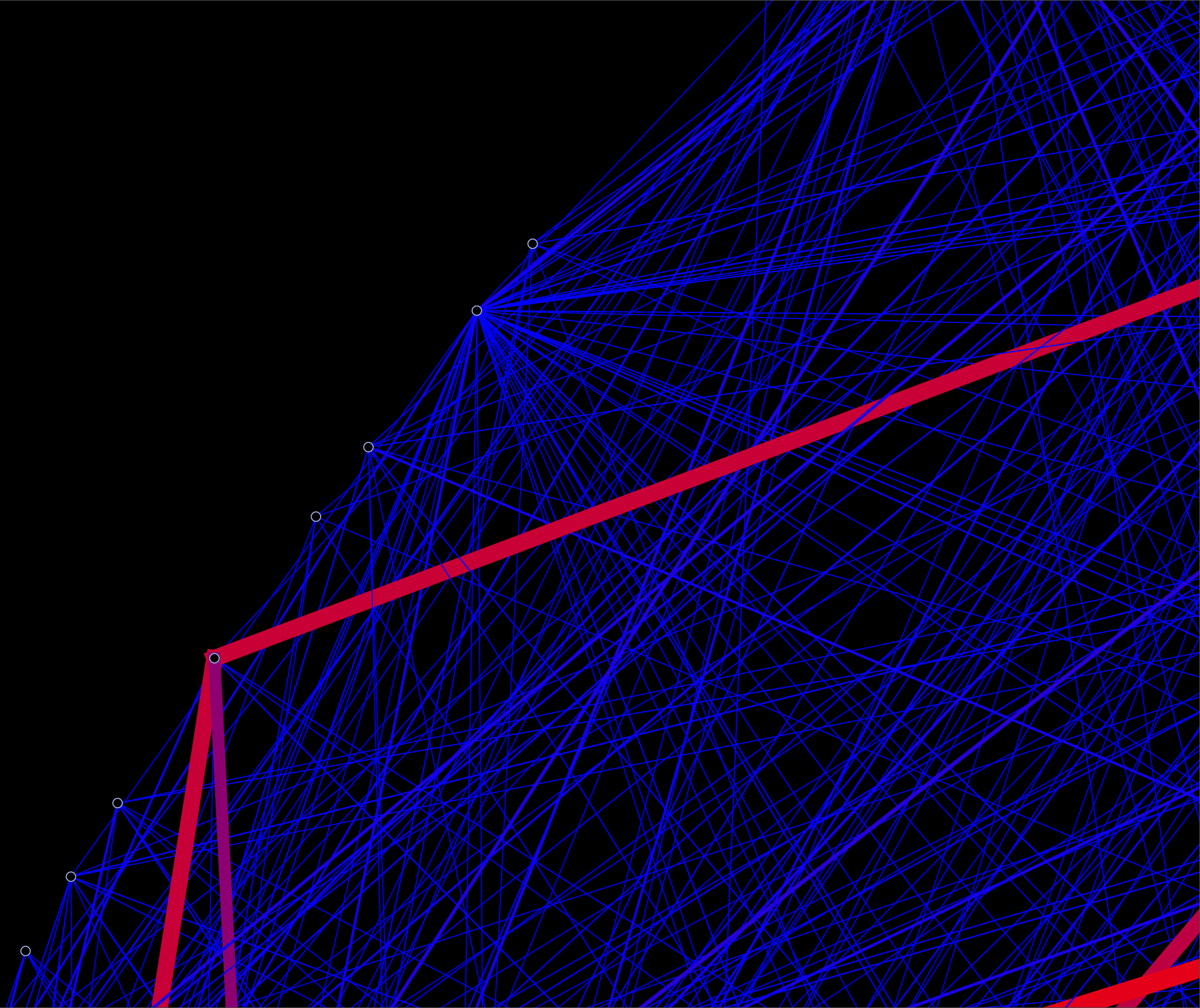




Kostakos, V. and Venkatanathan, J. (2010). Making friends in life and online: Equivalence, micro-correlation and value in spatial and transpatial social networks. **SocialCom**, 587-594.







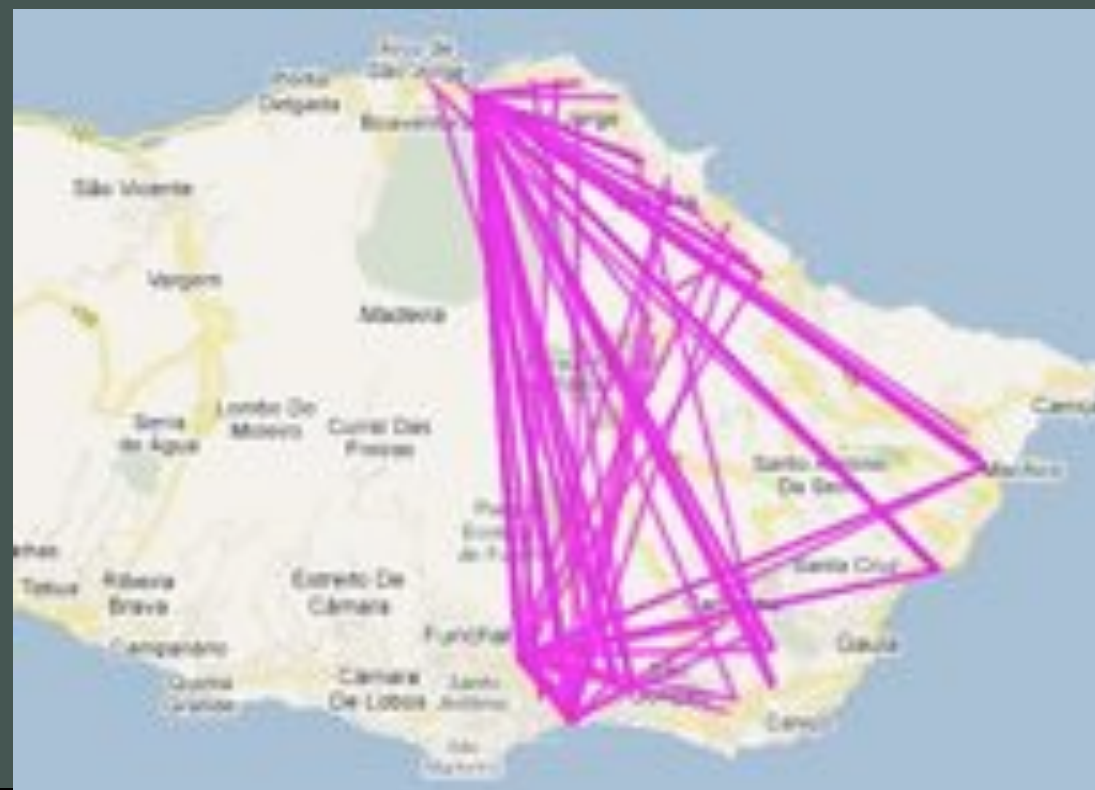
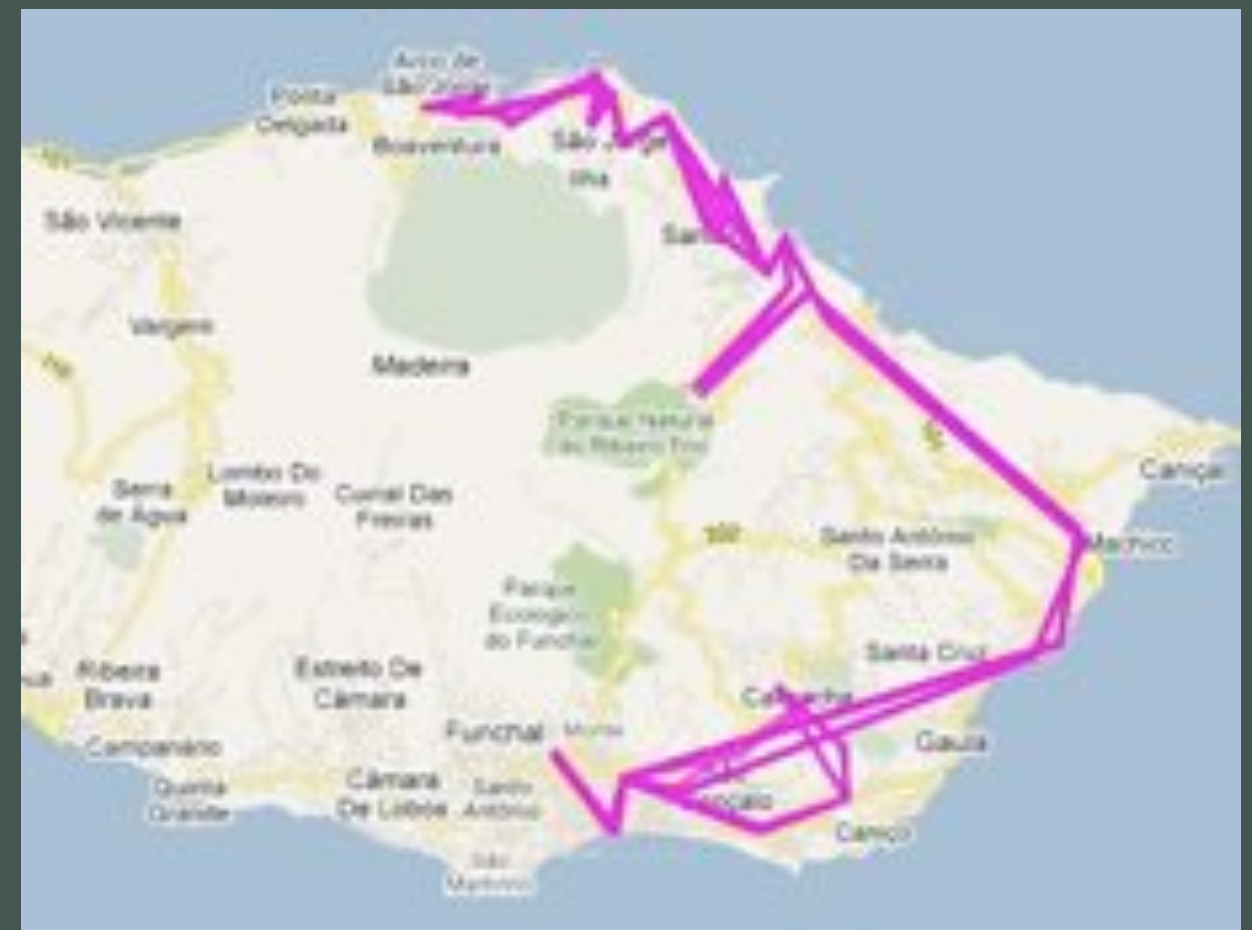
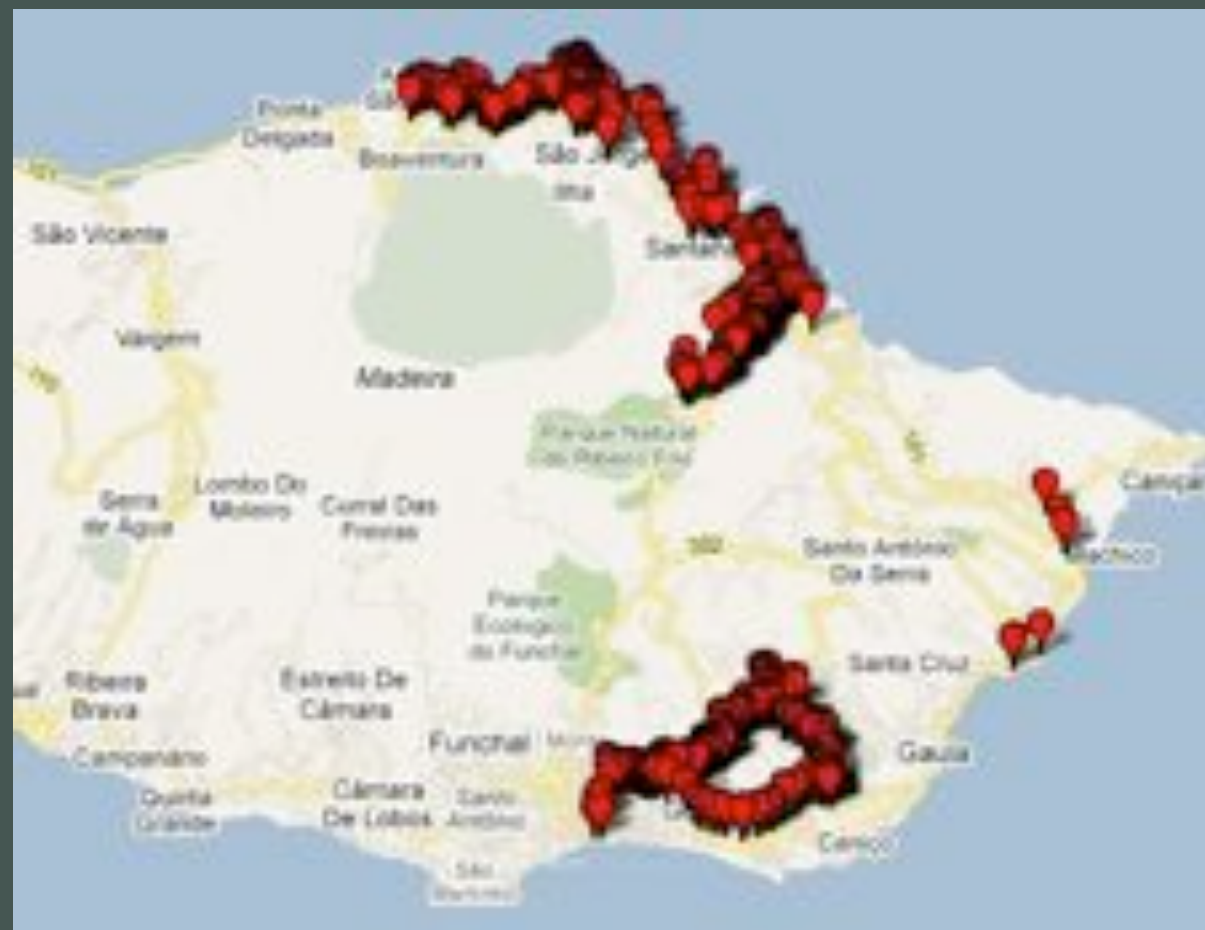
It's a small world!



Intelligent sensing for public transport



Kostakos, V., Camacho, T. and Mantero, C. (2010). Wireless detection of end-to-end passenger trips on public transport buses. **IEEE Conference on Intelligent Transportation Systems**, pp. 1795-1800.



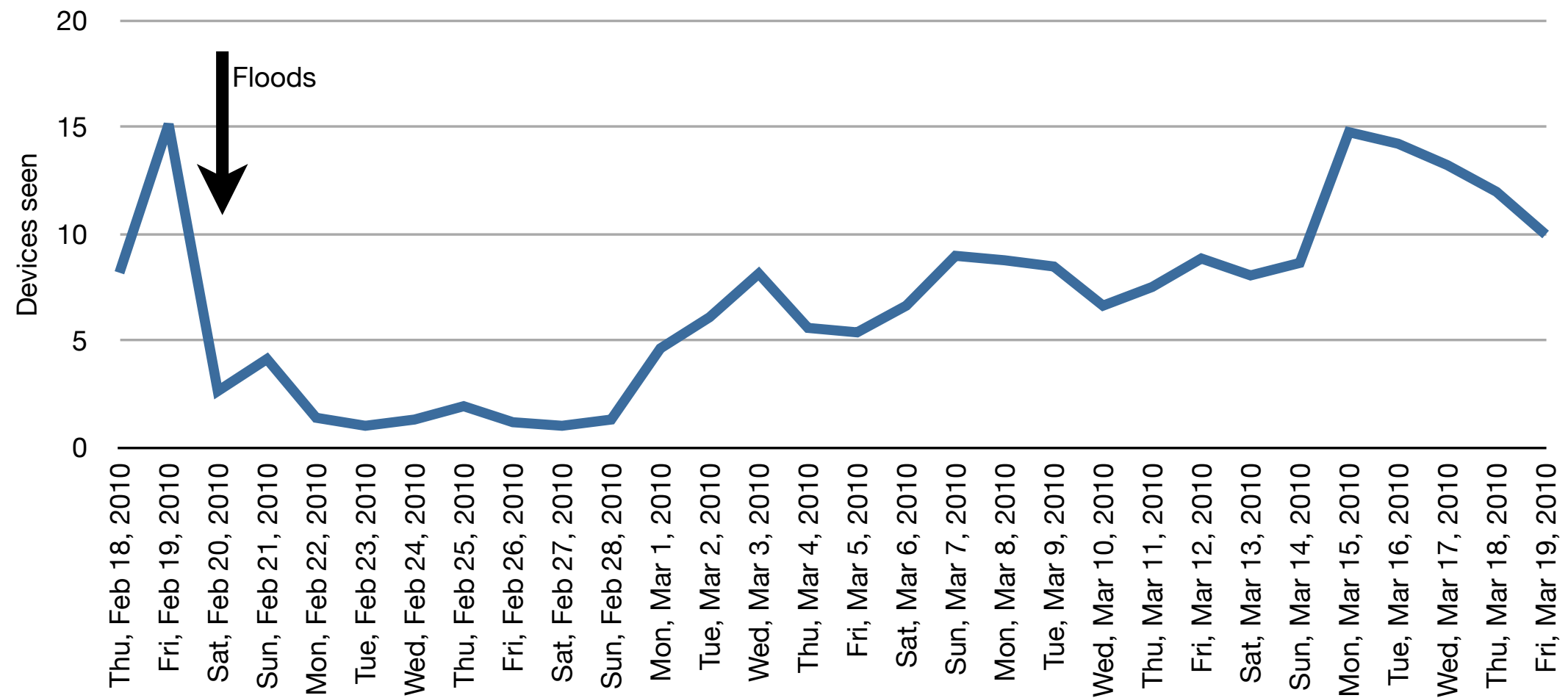






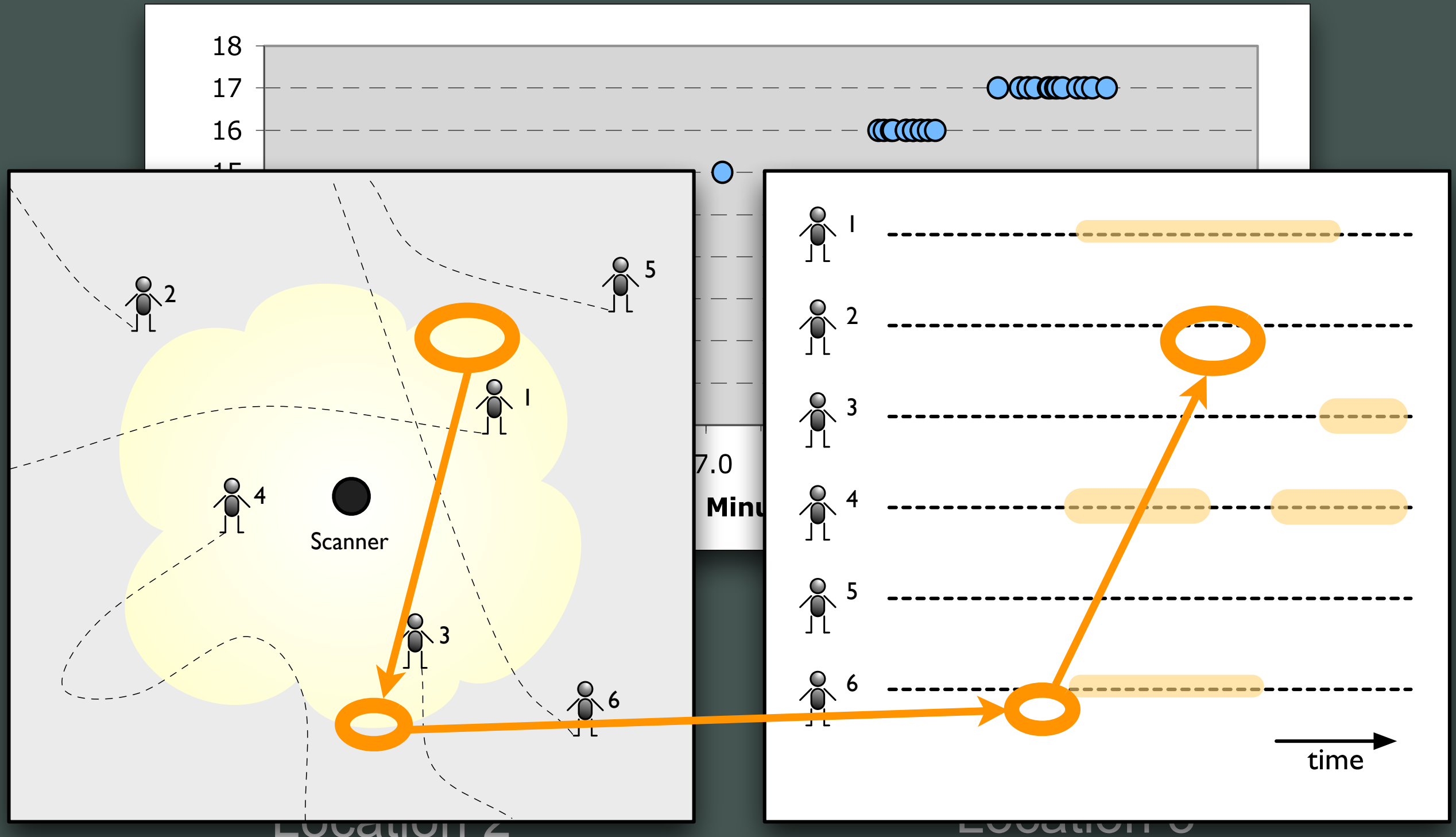


Avenida - Recovery



Camacho, T., Kostakos, V., and Mantero, C. (2010). A Wireless Infrastructure for Delivering Contextual Services and Studying Transport Behavior. **IEEE Conference on Intelligent Transportation Systems**, pp. 943-948.

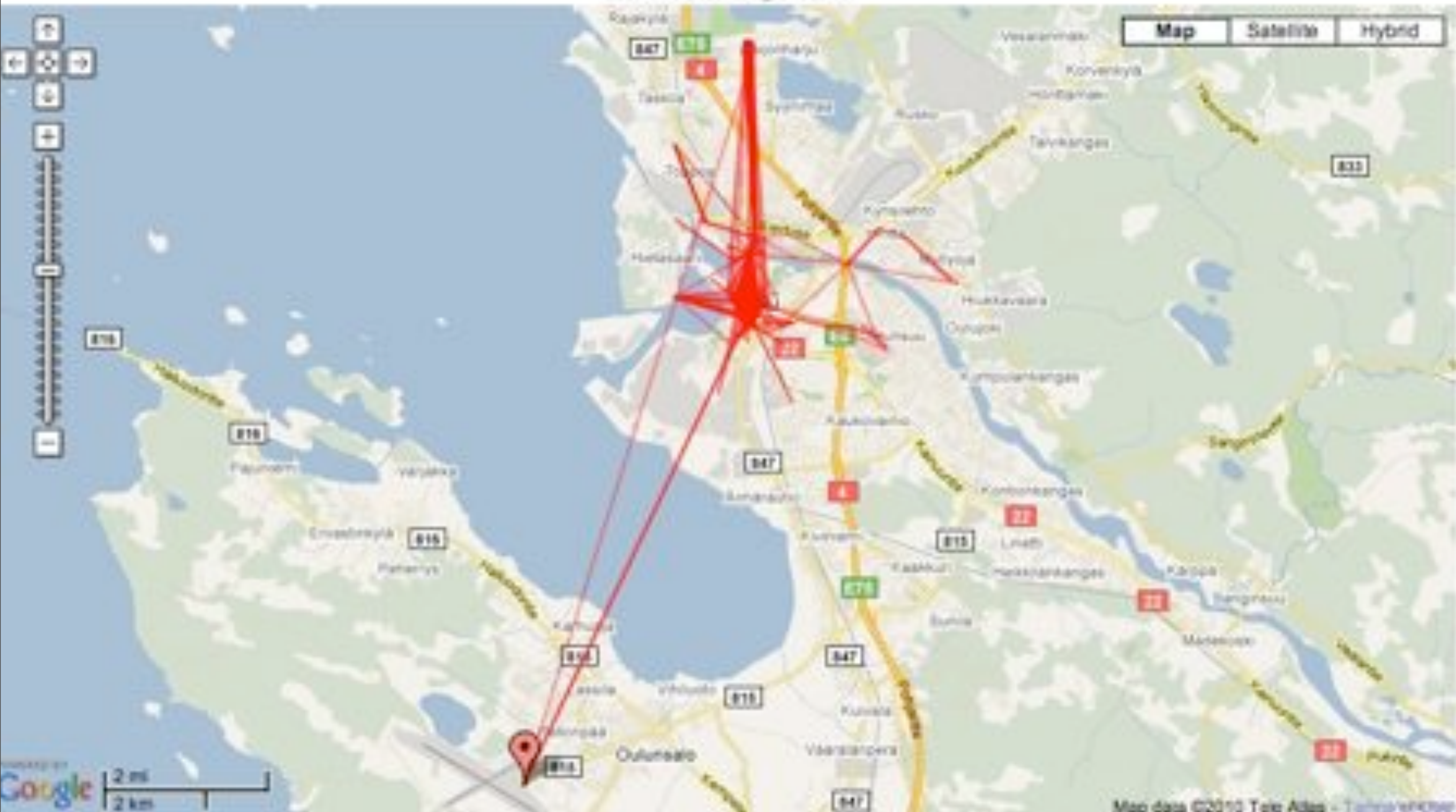
Location 1



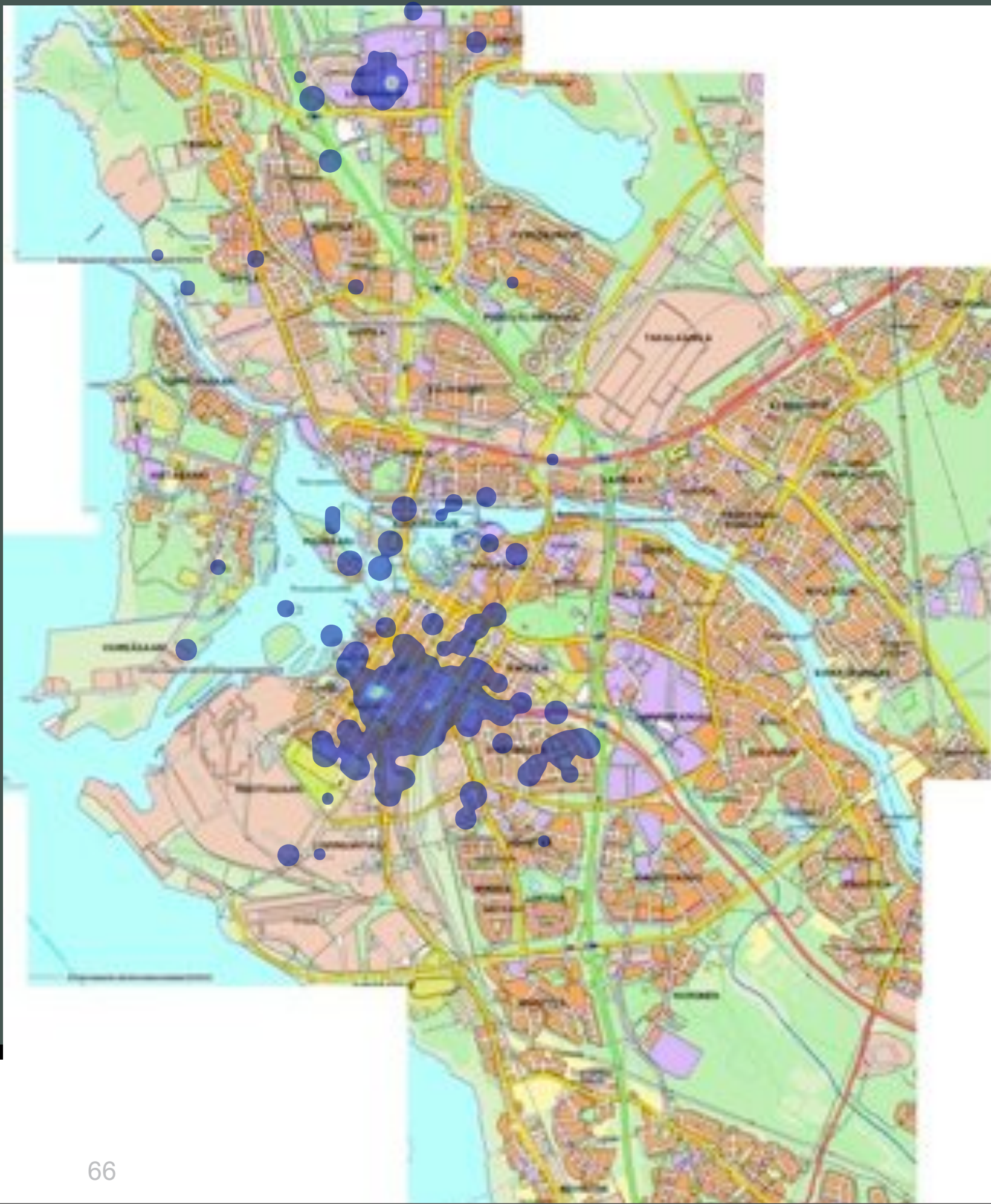
StartDate: EndDate: 2010-07-28 22:00:04

Maximum gap between segments	36000
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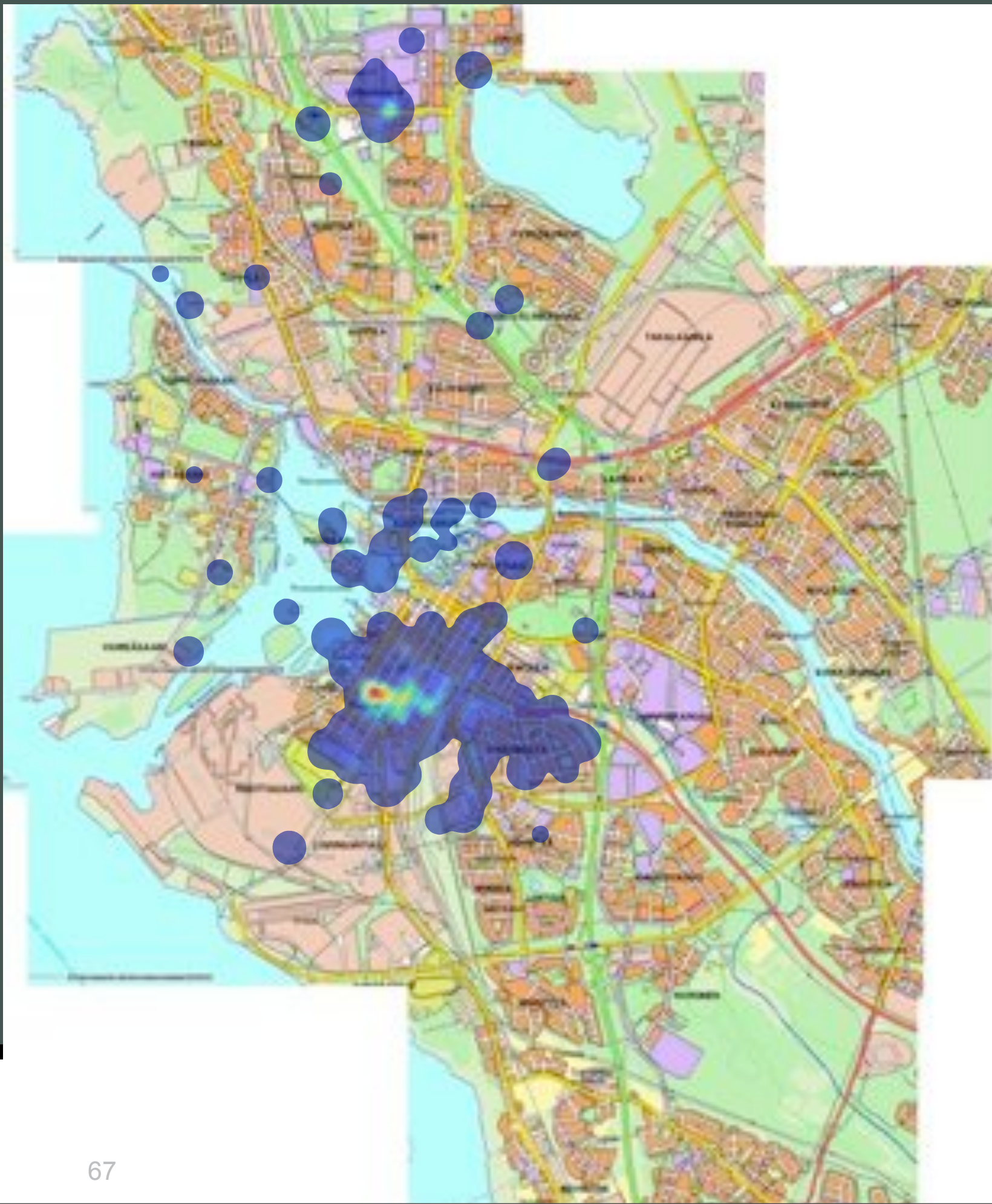
Map	Satellite	Hybrid
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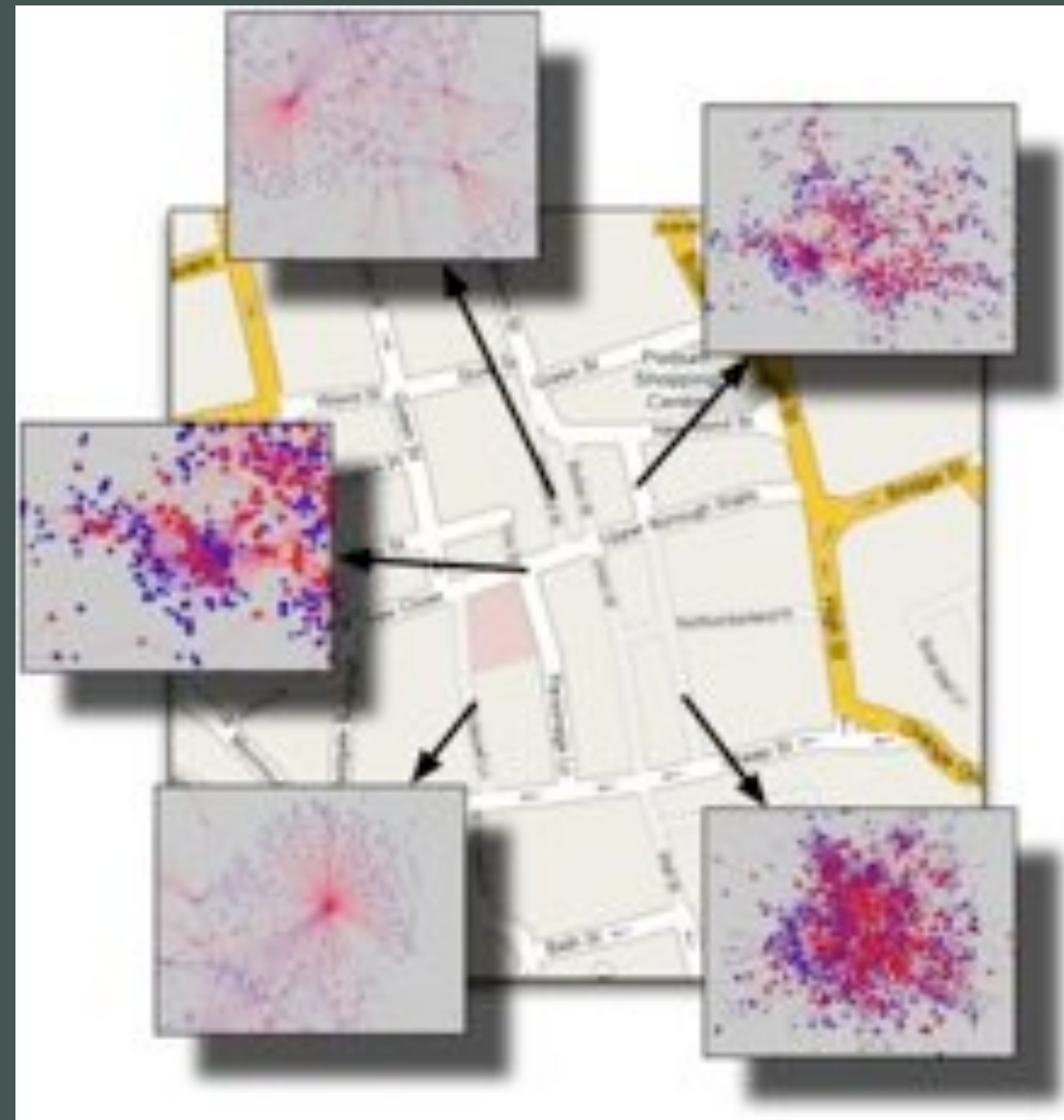
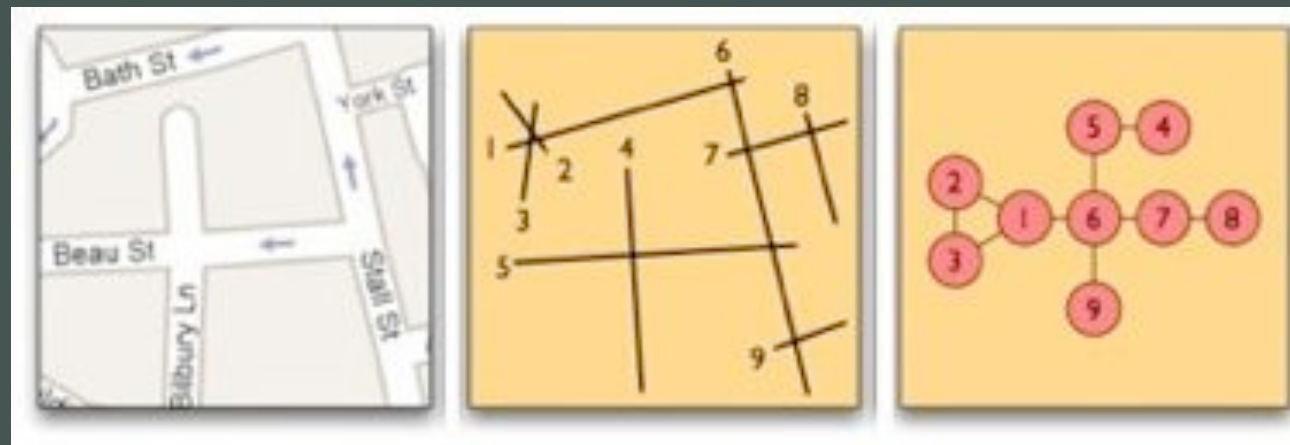
Wednesday
1 Sep, 10pm-4am



Friday
3 Sep, 10pm-4am







Kostakos, V. (2010). Space Syntax and pervasive systems. In B. Jiang and X. A. Yao (Eds.), **Geospatial Analysis and Modeling of Urban Structure and Dynamics** (pp. 31-52), Springer.

Privacy

- Bluetooth can be turned off
 - Should be turned on if there exist potential benefits
 - Build systems that provide such benefits
- Each Bluetooth device has a unique hexadecimal ID
 - Associate this ID with a person's identity
 - VISA, RFID ticket, IMEI : stored in a database
 - Bluetooth: not stored centrally

Conclusion

- HCI & Ubicomp is a challenging and exciting field
- Research agenda
 - Moving interaction beyond the desktop...
 - tangible interaction techniques
 - feedback
 - security, trust
 - ...and into cities
 - sensing
 - mobility
 - urban social networks