Academia Sinica, Taipei, Taiwan

SNHCC: Mobile Social Networks

Ephemeral Social Networks

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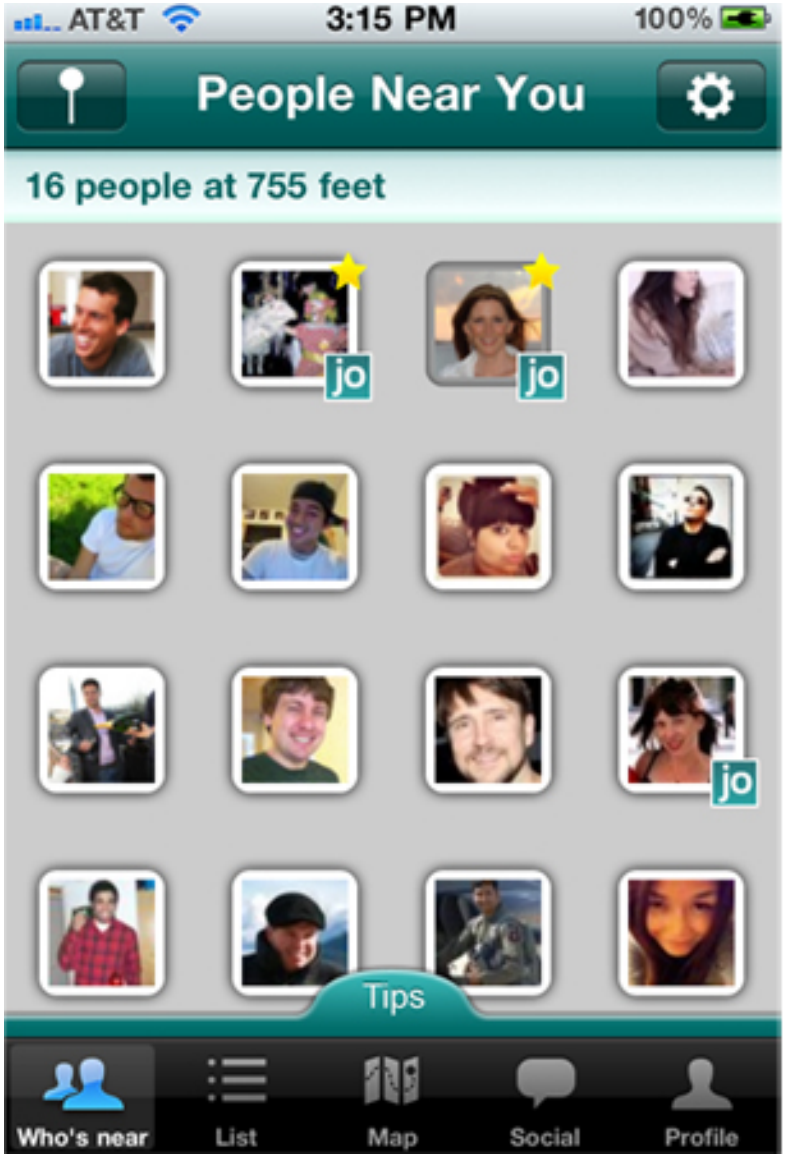
Online and Offline Social Networks

- Online social networks, like Facebook, allow users to manually record their offline social networks
  - Tedious and error-prone
- Some mobile apps try to use location contexts to connect people we know offline (means in physical world)
  - Sensors like, Bluetooth, WiFi, GPS, and accelerometers may be used
- Examples: Bump and Banjo

Bump


1:23 AM
93%
bump
Jane
Kennedy
BUSINESS, INC.
(555) 928-3994
jane@bu.mp
9:56
bump
My Card
Photos
John
McCloud
COMPANY, INC.
(123) 454-4200
john@somebody.com
http://www.somebody.com

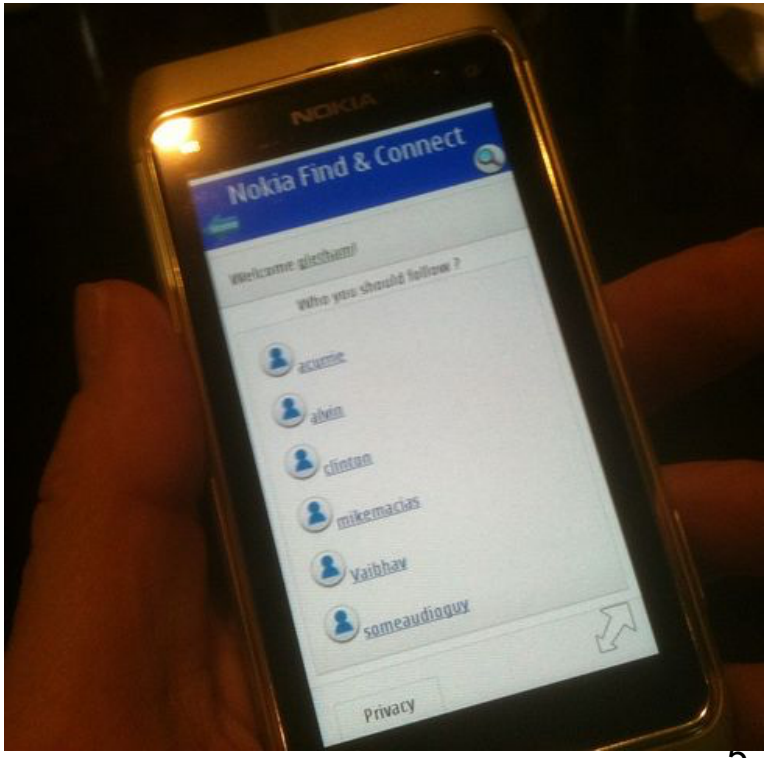
Banjo


AT&T
3:15 PM
100%
People Near You
16 people at 755 feet
Tips
Who's near
List
Map
Social
Profile


AT&T
5:10 PM
77%
San Francisco
Bush St
Sutter St
Stockton St
Grant Ave
Kearny St
Post St
Geary St
Market St
Powell St
O'Farrell St
Stevenson St
Trinity Pl
Google
Jewish Contemporary Museum
Who's near
List
Map
Social
Profile

Using Conferences as Case Studies

- Each conference has a series of social events and an organized program
- Hard for new conference attendees to locate people in the same research area and exchange contacts.
- In this chapter, we will study how to use a mobile app, called Find & Connect, to help attendees to meet the right persons!
- Attendees form ephemeral social networks at conferences

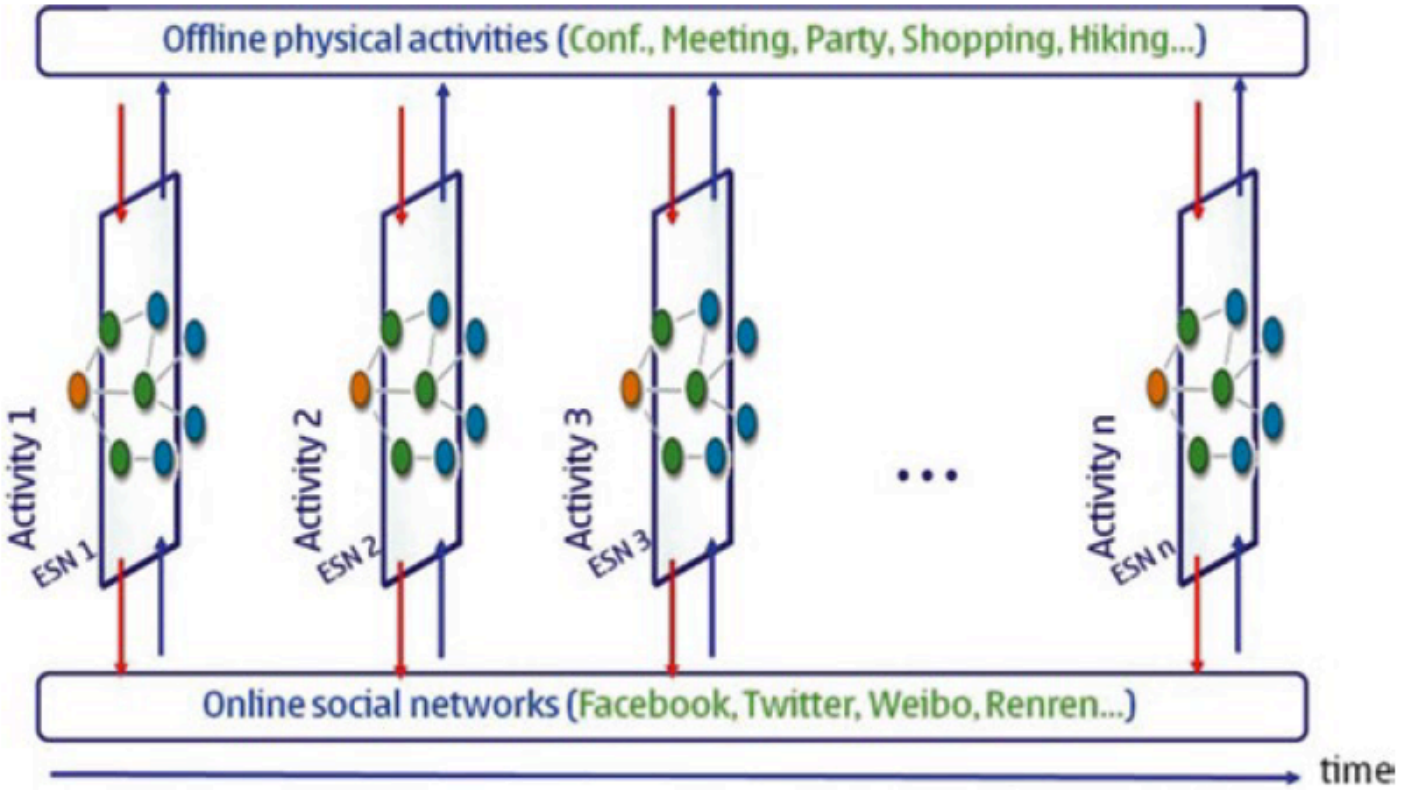


What is Ephemeral Social Network?

- In online social networks, our own social network consists of micro-social networks where we physically interact with and are surrounded by social networks as ephemeral social networks
- These network connections among people are spontaneous (not planned) and temporary (not persistent), which occur at a place or event in groups
- Example: conference attendees attending the same talk may form an ephemeral social community
  - They likely either share the same interests or both know the speaker

Otherwise, Many Opportunities Will be Missed

- Social interactions are often not recorded ← attendees are busy with social events
- Ephemeral can help to record social events → organize future conference activity



Three Elements of Activities

1. Contact
2. Content
3. Context

Contact

- People exchange business cards, so that they can contact each other in the future
  - Offline contacts
- People may also exchange Facebook or Twitter messages ← tedious
  - Online contacts

- Challenge: Hard to meet everyone, how to recommend people that an attendee should meet and add to his/her social network

Content

- Multimedia content, such as text, photos, and videos are captured for attendees to remember the event
- For example, these contents are poplar on Facebook, Instagram, and Path.
  - Most are captured by mobile devices
- Not too much meta data are associated, most common one is location information
  - More meta data help to search for particular activities
- Challenge: collecting more sensory data for meta data

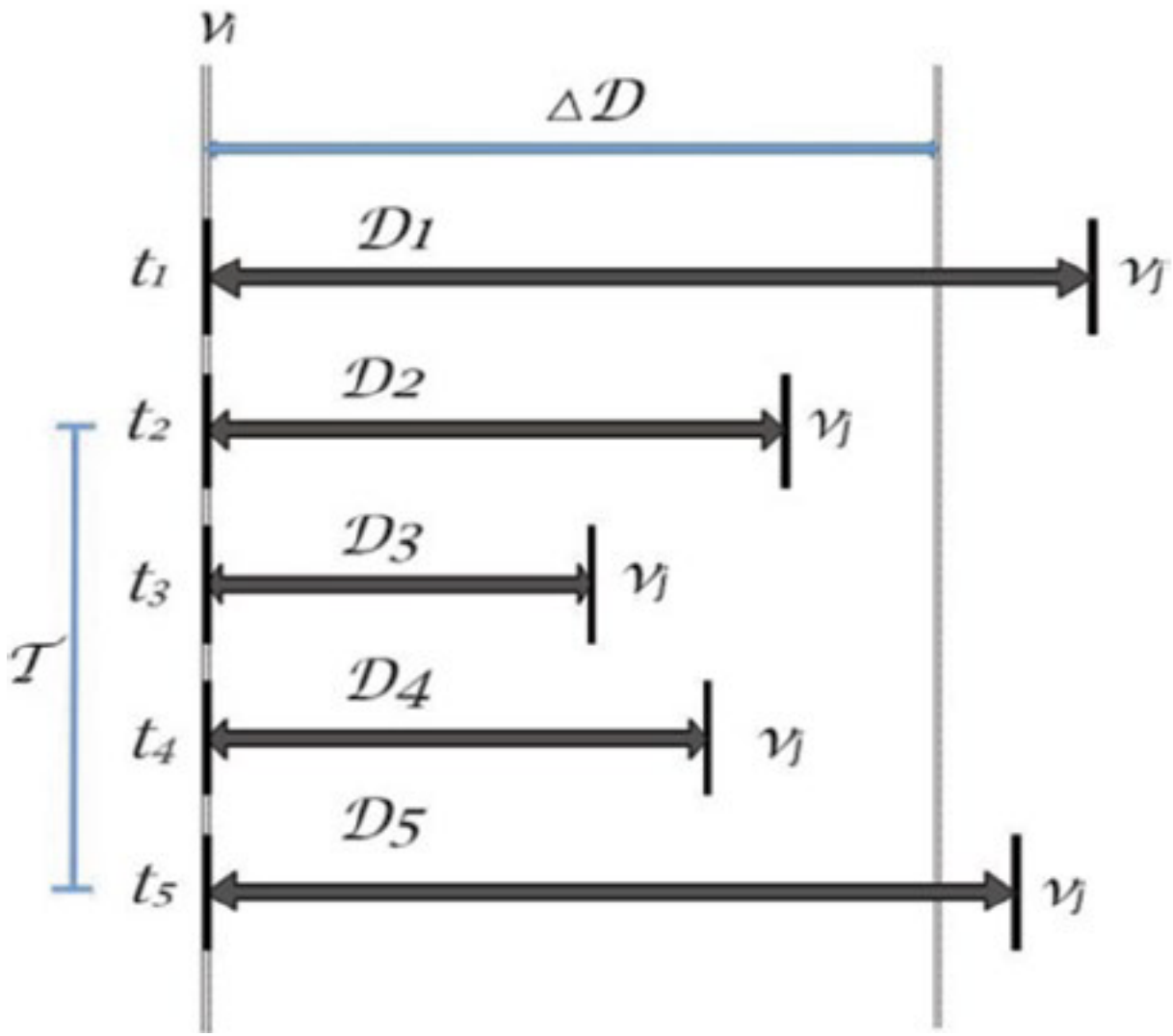
Context

- Each activity occurs at a specific time, at a location, for a fixed duration
  - The data capturing the situation and environment is called context
- Classifications:
  - Physical context
  - Social context
  - Situation context
- Challenge: How to record the contexts, such as encounters and interactions among people
  - This is because the contact, content, and context associated with an activity/event are not integrated

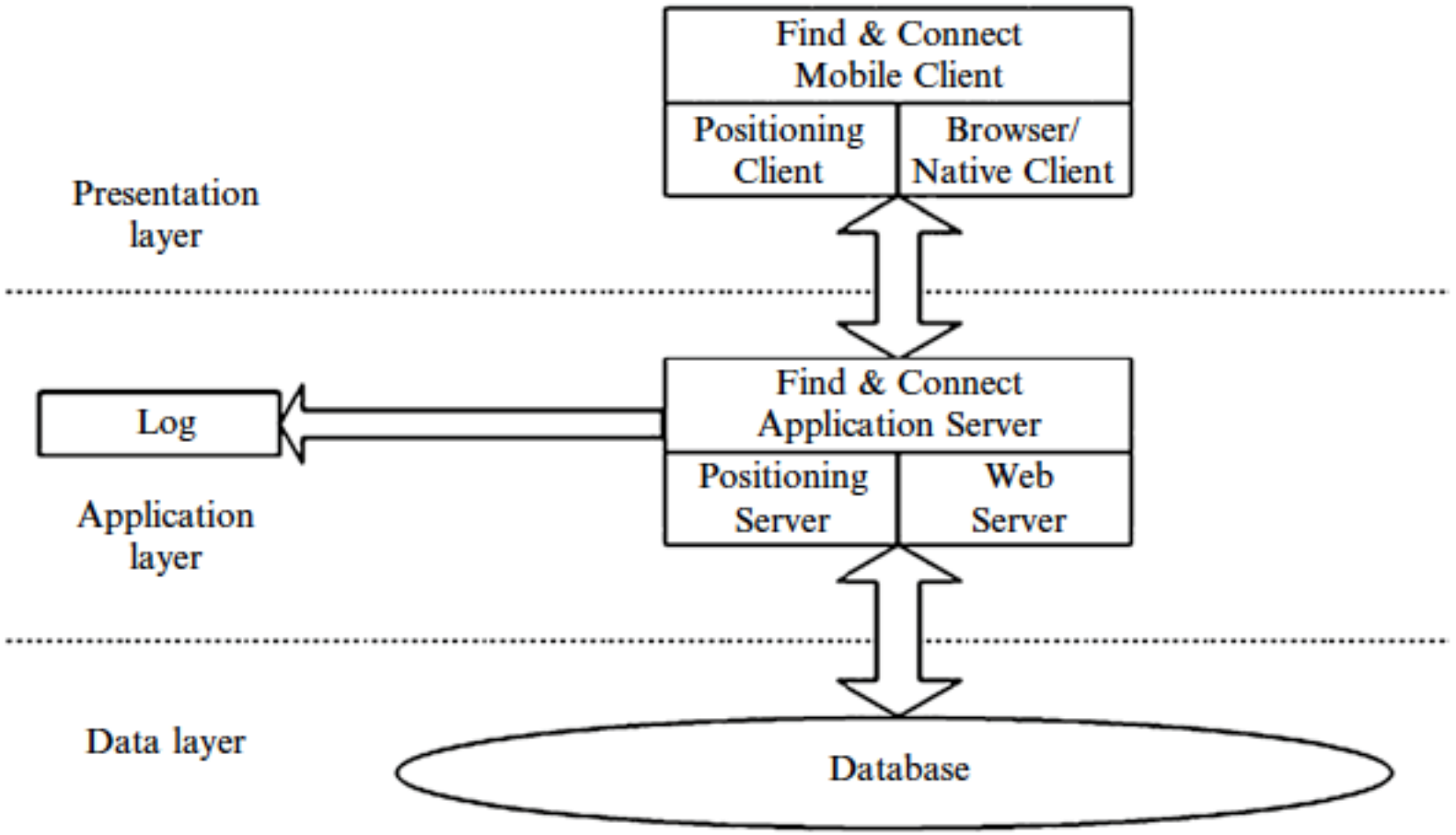
Recording Encounters

- Proximity can be measured by WiFi, Bluetooth, RFID, and GPS
- Encounters define proximity interactions!
- But how to formally define it?
  - Encounter happens if: (i) the distance between two people is less than the encounter distance threshold and (ii) for at least the encounter duration threshold
- Once we have the encounters, we can plot an encounter graph, where each edge is associated with the start and end time of each encounter
- Encounter graphs allow various analysis

Sample Encounter

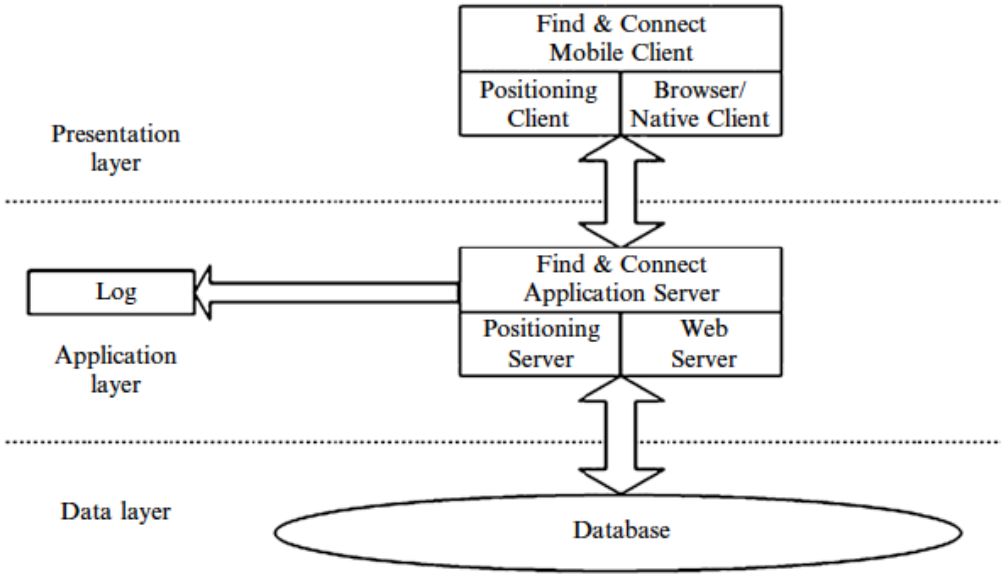


System Architecture

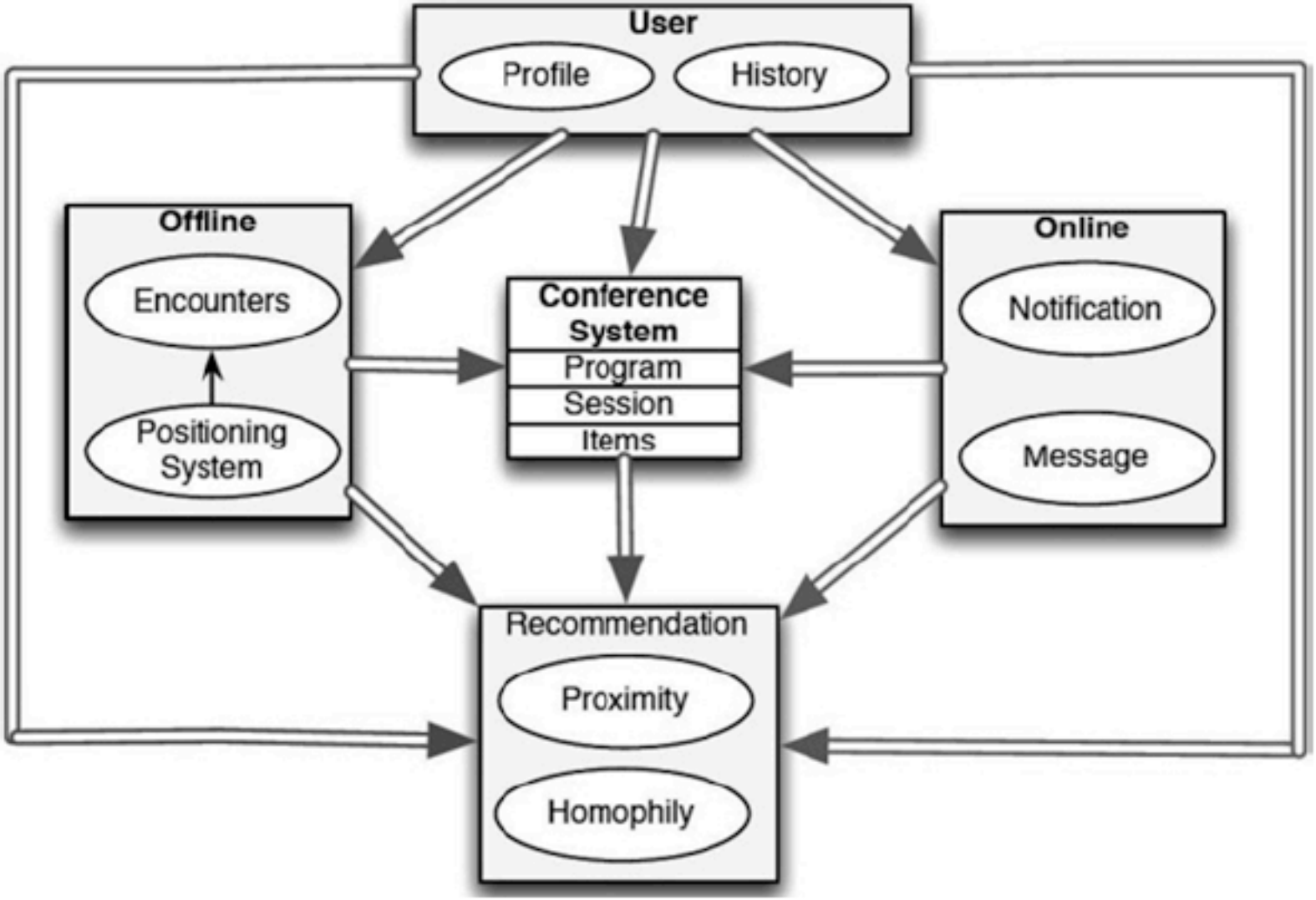


System Architecture (cont.)

- Browser/native client: provides location-based social network services
- Application server: backend
- Positioning client/server: adopt positioning model to approximate the position of a user
  - E.g., WiFi, cellular networks, and GPS



Functional Architecture

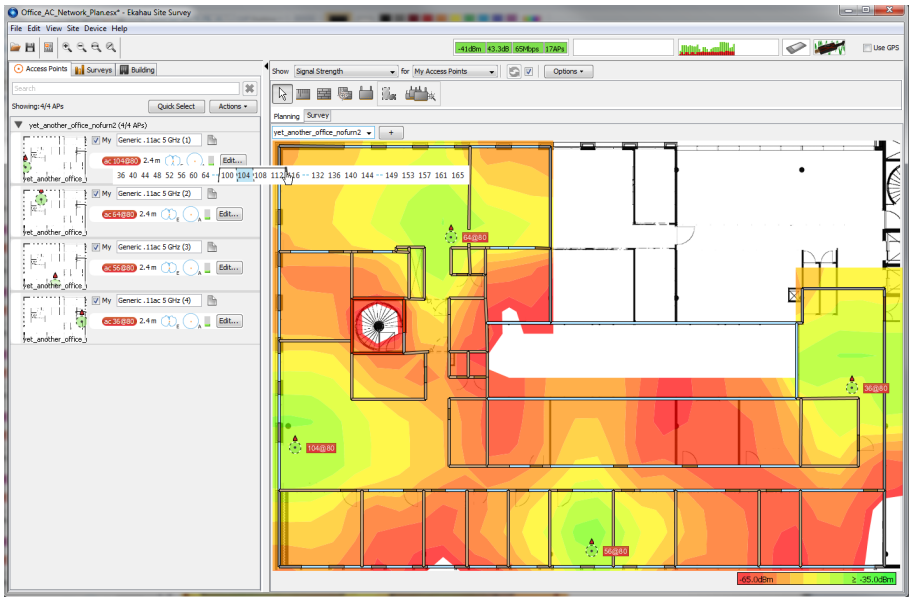


Five Components

- Offline system: positioning → encounters
- Online system: prolong ephemeral offline relations to permanent online connections
- Conference system: program, sessions, items (presentations, demos, and so on)
- Recommendation: based on proximity and homophily to recommend attendees to connect to strangers
  - Proximity: proximity, same session, offline encounters
  - Homophily: research interests, messages, common friends
- Users: record profile and history data

Connecting Offline and Online

- Three conferences are considered
  - UIC: research conference, multiple tracks
  - GCJK: business meeting, no formal presentations
  - UbiComp: research conference, single track
- Offline information: off-the-shelf solutions are used for localization, such as Ekahau (WiFi) and LANDMARC (RFID)
  - Location determines sessions
- Online information is the social network related data within the Find & Connect app



Find & Connect at UIC 2010

- My Agenda our plan
- Program: papers, presentations, and so on
- Map: find other people
- Social Network: similar to Facebook
- Buzz: send messages to: (i) ind. attendees, (ii) folks at the same location, and (iii) individual sessions

Find & Connect at GCJK 2011 and UbiComp 2011

- Some changes for each conferences, e.g., no Program and My Agenda pages for GCJK 2011, and Web-based app for UbiComp 2011

Analysis Metrics

- Density: number of encounters over the total number of possibilities
- Average shortest path: average shortest number of steps between any two pairs of users
- Diameter: maximum length of all shortest paths between two users
- Clustering coefficient: degree of the users to cluster together

Social Network Properties

Table 3.1 Social network properties of the social connection and encounter networks formed in the UIC 2010, GCJK, and UbiComp 2011 conferences from Find & Connect

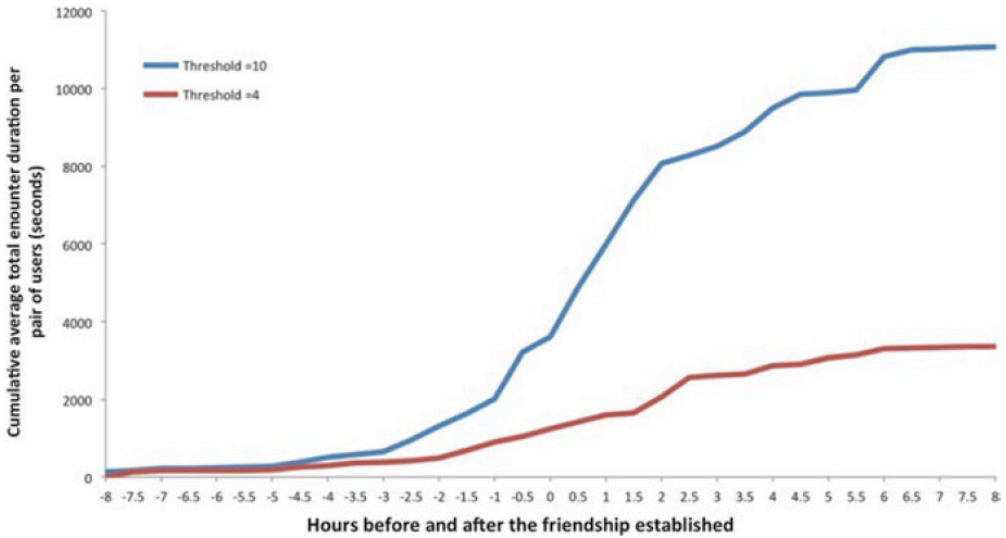
	Contact (UIC)	Friend (UIC)	Follow (UIC)	Encounter (UIC)	Contact (GCJK)	Follow (GCJK)	Encounter (GCJK)	Contact (UbiComp)	Encounter (UbiComp)
# of users	55	59	62	83	41	72	70	244	234
# of links	217	221	184	1,000	51	123	592	595	15,960
Average degree	7.89	7.49	2.97	24.1	2.5	1.71	8.46	2.44	68.2
Density	0.146	0.129	0.049	0.294	0.062	0.024	0.246	0.01	0.586
Diameter	4	4	6	3	6	6	4	8	3
Average clustering coefficient	0.505	0.462	0.387	0.711	0.195	0.221	0.683	0.174	0.876
Average shortest path length	2.12	2.12	2.68	1.69	2.62	2.78	2.02	3.30	1.414

Analysis at UIC 2010, Network Properties

- Comparing the networks of friend, follow, and exchanged contacts
- Users follow fewer people (on average 3) than adding friends (on average 7.5) and exchanging contacts (7.9)
- The friend and contact networks are much denser than the follow network (0.146, 0.129 versus 0.049)
- Etc.
- Observation #1: people want to establish stronger social connections, but follow is only a one-way connection
- Observation #2: most activities happened in the large meeting room and corridors outside

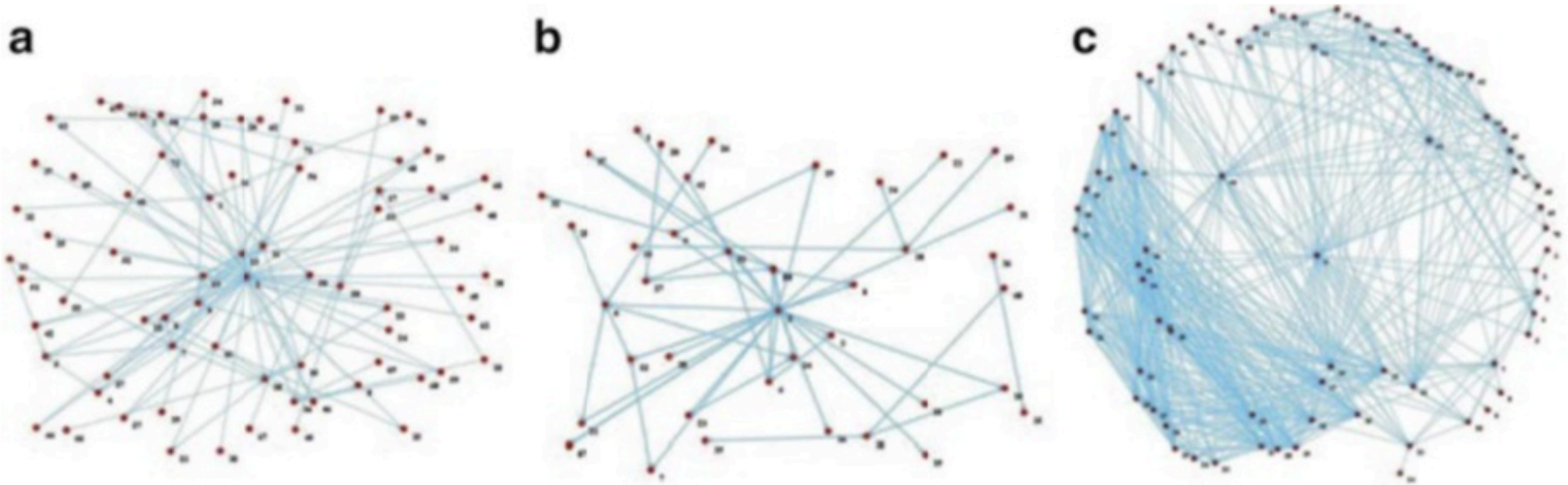
Analysis at UIC 2010, Offline Encounters versus Online Connections

- Encounter distance is between 4 and 10 m
- Increases of encounter durations are time dependent
  - Phase I: 2 hours before being friends, the accumulated number of encounter duration is very small
  - Phase II: around 2 hours before being friends, attendees start to meet people, leading to more and longer encounters
  - Phase III: around 2 hours after being friends, even more encounters
  - Phase IV: 2 hours after being friends, fewer and shorter encounters → they already connect on online social networks



Analysis at GCJK 2011, Network Properties

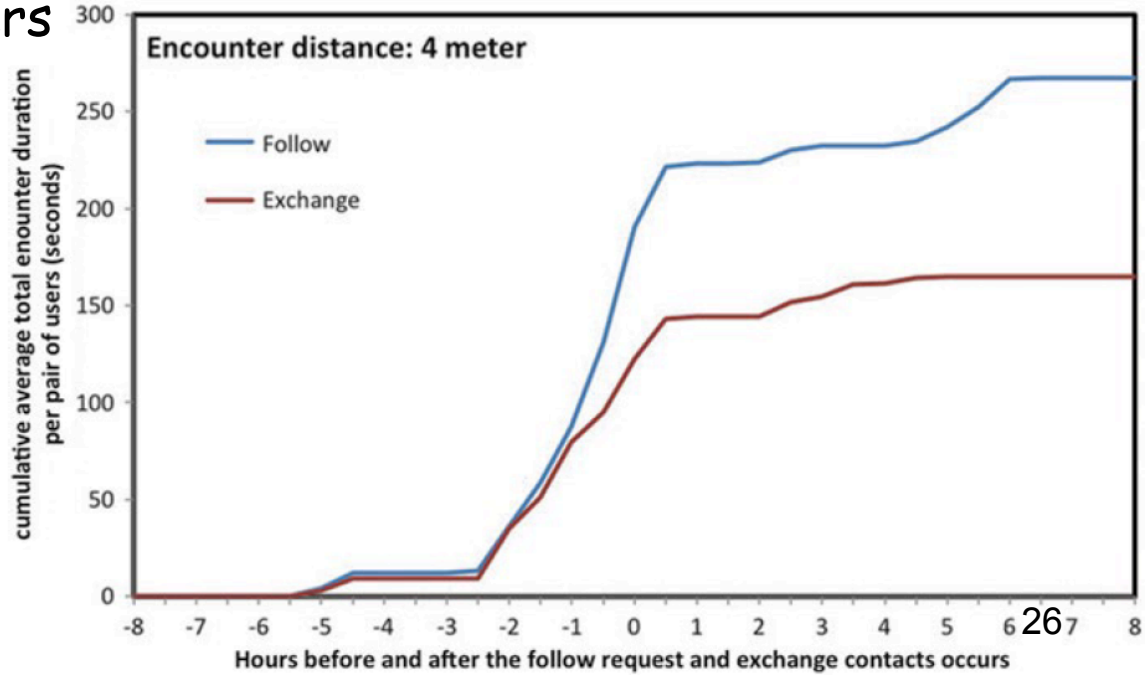
- Observation #1: Encounter network is better connected and more cohesive
- Observation #2: Follow network is larger than exchanged contact network, but they have similar levels of connection ties



The (a) follow network, (b) exchanged contact network, and (c) encounter network.

Analysis at GCJK 2011, Offline Encounters versus Online Connections

- Encounter distance is 4 m
- Compared to UIC, no phase IV
  - Phase I: 2 hours before any social interaction, the accumulated number of encounter duration is very small
  - Phase II: around 2 hours before any social interaction, attendees start to meet people, leading to many more and much longer encounters
  - Phase III: right after any social interaction, fewer and shorter encounters → they want to know other attendees, due to the shorter meeting time



Analysis at UbiComp 2011, Usage Analysis

- Unique settings: RFID badges, web app
- Use Google Analytics to track the usage of their web-based app
- Based on page views
  - Finding people nearby: 12%
  - Connecting to others: 10%
  - Login: 6%
  - View conference program: 5%
  - Finding people farther away: 3%

Analysis at UbiComp 2011, Network Properties

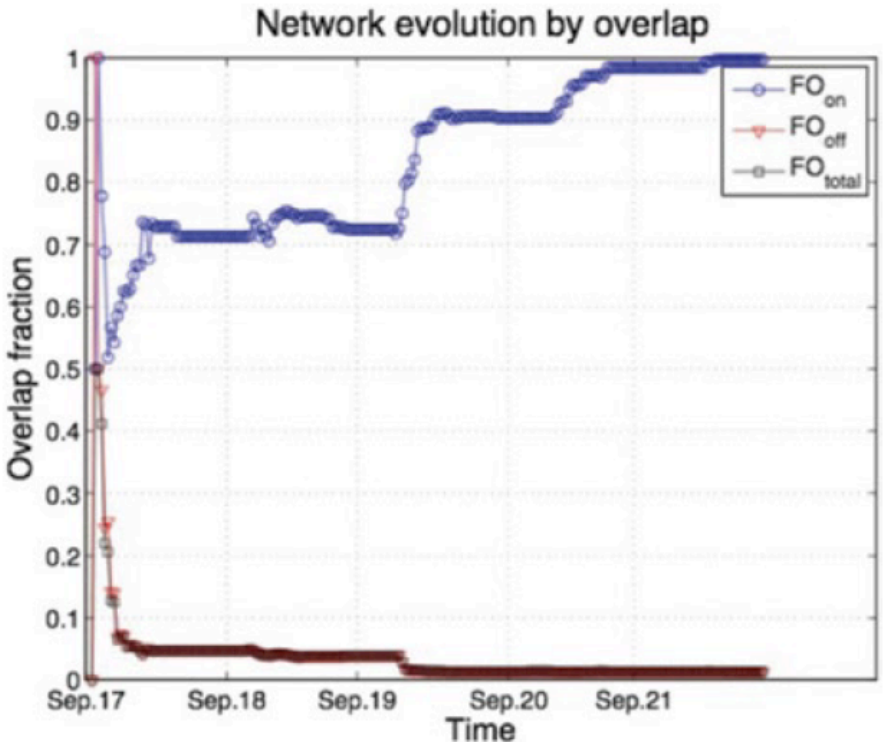
- Contact: 571 contact requests, 40% are accepted
  - 309 of them come from the contact recommendation algorithm, which produces 15252 contact recommendation, leading to 2% success rate
  - 93% of paper authors exchange contacts at least once
- Why people add contacts? ← homophily principle
  - Common contacts
  - Common research interests
- Most people have only one or two contacts, why?
- Encounter network has a smaller diameter than contact network → attendees can directly connect to others

Analysis at UbiComp 2011, Offline Encounters versus Online Connections

- How many offline encounter lead to online contact requests?
- Define three overlapping metrics

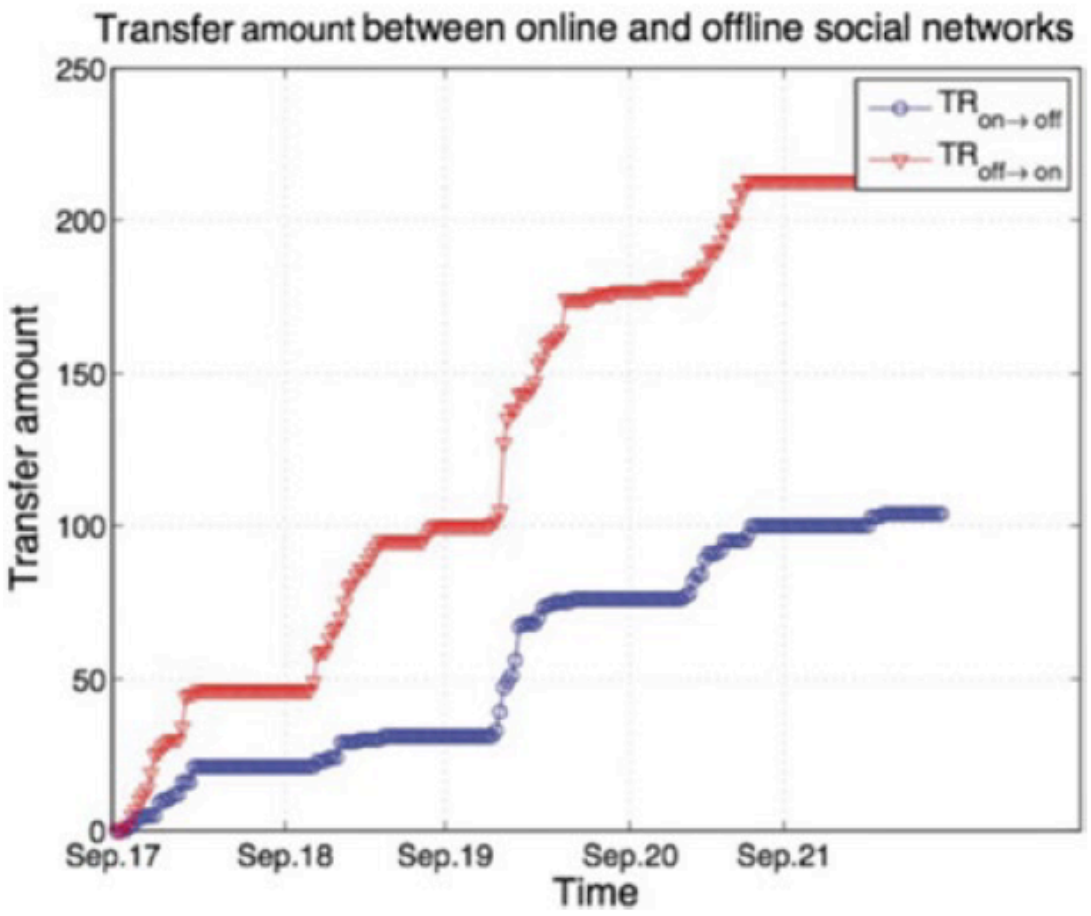
$$FO_{on} = |E_{on} \cap E_{off}| / |E_{on}|,$$
$$FO_{off} = |E_{on} \cap E_{off}| / |E_{off}|,$$
$$FO_{total} = |E_{on} \cap E_{off}| / |E_{on} \cup E_{off}|$$

- FO_{on} is much higher → majority people with online contacts also have offline encounter
- Not surprising as UbiComp is a single track conference



Analysis at UbiComp 2011, Offline Encounters versus Online Connections (cont.)

- Online and offline transfer amount ← depending on which occurs earlier
- Offline→online is much higher, steep increase in the evening and after the first conference day
  - Showing effectiveness of the Find & Connect app



Discussion

- UbiComp has the most participants ← mandatory badge system and cross platform Web app
- UbiComp has the densest encounter network with highest degree and short average path length ← single track conference
  - CCJK is an internal business meeting, so the encounter network is the least dense one
- At UCI 2010, people don't use the messaging features too much ← why? Nokia? China?
- Generally, offline encounters lead to online contacts ← but how can we make this even more immersive

Takeaways and Brainstorming

- The three experiments are insightful, although conducting them requires a lot of efforts
- Find & Connect seems to (i) ease the burden and (ii) increase the change to (permanently) connect with new colleagues
- However, only location and program info is used, which is only part of the user context! → location, time, activity
- Many things can be done beyond Find & Connect
  - Across conferences and even more general usage scenarios for our daily life
  - More sensors and better integration with online social networks
  - …….

Questions?

Contact me at chsu@cs.nthu.edu.tw anytime