Communities in the Clouds: Support for High-rise Living

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UbiComp '13 Adjunct, September 08 – 12, 2013, Zurich, Switzerland.

http://dx.doi.org/10.1145/2494091.2497324

Abstract
Research into domestic infrastructures has focused upon a user's understanding and control of in-home networking technologies. It has exposed a range of needs that have either lead to the creation of new tools and services, or have triggered a fundamental re-evaluation of the status quo. We consider a class of domestic environment that has largely been neglected: large scale communal living. Urban high-rises, composed of hundreds of apartments and hundreds or thousands of occupants, expose their residents to a set of problems which impose complex requirements upon supporting technologies. We examine the requirements of high-rise communities, through a set of illustrative scenarios, inspired by forums, social media and literature. We consider how commonly appropriated social media tools fail to address these requirements and we discuss the nature of the services required to better support high-rise communities.

Author Keywords
Social Media; Urban Informatics; Home Networks

ACM Classification Keywords
K.4.3: Computers and Society: Organisational Impacts: Computer-supported collaborative work

Introduction

Home network research tends to only consider systems inside the home. In this paper we present a case for considering how the home sits within the community. High-rise properties may be distinguished from other forms of housing by the combination of high-density occupancy, complex infrastructure (lifts, walkways, utility provision etc.), complex management (cleaning, maintenance of buildings and shared spaces etc.) and shared facilities (common areas, gardens, stairs etc.). In spite of the many millions of pounds spent on creating and managing these developments, the social and psychological well-being of the occupant communities is far from assured [1][2]. Moreover it is common (even necessary) for high-rise living to be accompanied by sets of explicit rules; these are characteristically more encompassing and constraining than those associated with other forms of living. Issues in high-rise living are often underpinned by processes whose resolution requires deep knowledge and effective collaboration between multiple stakeholders (owners, tenants, management companies, contractors, on-site staff etc.). An inability to resolve problems can have a profoundly negative effect upon lives of the resident community. People have sought to use a range of social media to serve their needs, but have found them wanting. In this paper we illustrate the nature of residential communities through a set of scenarios. Each scenario has been inspired by online forums, social media and literature. We consider how their requirements are currently mismatched by the use of social media tools.

Motivating Scenarios

We have chosen scenarios as a means of illustrating and grounding needs and requirements within the context of high-rise communities. The scenarios cover three broad themes: *complexity*, *communication* and *management*. They take place in a high-rise composed of six hundred apartments split across three independent blocks. A management company is responsible for running the building and a small concierge team undertakes the daily on-site management.

Scenarios A & B: Complexity

Information, processes and collaboration are all characteristically complex in high-rise living. Many tasks require residents to become knowledgeable in the deep (legal, technical, infrastructural, political) details of their buildings and neighbourhoods. It is common for negotiations to take place where more than one stakeholder is implicated, where discretion is differently negotiated and implicates different people in different ways. The following two scenarios illustrate how residents cannot be entirely divorced from this complexity.

SCENARIO A: COMPLEX COMPARISONS

Ben & Emily receive their first energy bill. It is from a company that they've not heard of: *New Energy Inc*. The bill is so high that Ben suspects a mistake, so he searches his development's Facebook group to discover whether others have the same concern. He discovers that although his energy is provided by a big, well known provider, the *New Energy Inc.* company is responsible for billing. One post explains how many larger developments have a master energy meter which records the energy consumed by the entire building and each apartment has sub-meter that records its share of the overall consumption. Many residents suspect the sub-meter readings are wrong, or are being misread.

In frustration, a few residents decide to log and monitor their meter readings against their usage. They are only able to obtain their readings through the concierge, who in turn must access the sub-meters next to the master meter in the basement. One owner, Julie, proposes that each resident, when leaving an apartment for an extended time, turns everything off to log meter readings upon departure and return. She notes: "I appear to have consumed 7% of my total energy over a weekend when I was not there and nothing was left on". Several weeks later, Julie presents her case along with data from ten residents to the management company. A month later, all residents are notified that the contract with *New Energy Inc*. has been terminated and that alternative options are being explored. In an adjacent development, run by the same management company, residents have begun to question the bills they are receiving from *New Energy Inc.*

SCENARIO B: COMPLEX PROCESSES

Ben and Emily are required to pay a monthly service charge to their development's management company. The charges cover insurance, maintenance, staff costs and the company's fee. When they receive their first invoice, they discover the yearly charges have increased by over 50%. Ben attempts to compare last year's statement against the latest one to determine where costs have increased, but the different structure of the two documents makes it an almost impossible task. It appears Ben's only option is to request an audit from the management company (at the expense of all owners). He knows that owners will only agree if they receive assurances that the likely outcome will show costs to be unreasonable. Without being able to compare increases or overall charges against similar developments (with the same and different management companies) he cannot build a persuasive enough case. Ben considers switching management companies. Due to the UK's property laws his only option is to invoke the "Right to Manage (RTM)", which transfers the responsibility for management to the residents [3]. He first has to establish that his building meets the necessary criteria for RTM. He must then persuade at least half of the owners in his block of the benefits of RTM (a minimum of 50% of residents are required by law). He must then form a company and appoint directors and a secretary and invite the residents to join the company. He can then serve notice to the management company. Finally, with no background in managing a property, he must be sure that at the end of the whole process, his new resident-owned company would be able to reduce costs. Ben decides, eventually, to simply pay the increase.

Implications of Scenarios A & B

Residents in high-rises will often find themselves needing to champion causes or undertake nuanced, technical discussions with groups of people that they do not know or necessarily trust [4]. There are many more examples of complex processes: taking a dispute to tribunal, improving common parts of a building, building new structures (e.g. gates, bike storage), installing new utilities (fibre optic broadband, energy metering, CCTV), extending a lease, dealing with antisocial behaviour and crime or obtaining consent.

There is a dual-edged nature to the use of social media in this context; it has the potential both to empower and undermine. Many collaborators can be implicated in resolving a problem and if discussions become divisive or rely upon flawed information, the outcomes

for current and future issues may be severely jeopardised. This can be at the cost of living standards and property values [5].

Social media tools are able to partially meet residents' requirements by providing facilities for users to debate, discuss and collect information. Yet, broadly, the tools are designed with a notion of being sociable and the motives thus map poorly onto the needs of high-rise communities. Their unstructured nature provides poor scaffolding for information retrieval, negotiation and navigation through complex processes. Where forum-style discussions are the principle method of knowledge sharing, it can be hard for residents to discover which sets of questions and answers are relevant to their current circumstance.

Scenarios C & D: Communication

The communication channels available to residents in high-rise buildings are typically limited. In the absence of technology, a resident can access neighbours by knocking on doors, posting letters or relaying messages through on-site management. To get a message out more widely they may hold meetings or pin notes on a noticeboard. Whilst technological approaches such as email lists, forums, Twitter and groups (e.g. Facebook, Yahoo) provide additional facilities for residents to reach out to their community, the following scenarios demonstrate their shortfalls.

SCENARIO C: OVERFLOWING TAPS

Over winter, water to the entire development is switched off for a half a day to allow contractors to fix a leak in the main supply. When the supply is resumed, the taps in a property on the third floor start running, having been left on by the tenant. Not long after, water seeps into the two properties beneath. One of the properties is Ben's. He immediately bangs on the leaking apartment's door, with no success. He runs down to the concierge to explain the emergency. They contact the management company to ask them to contact the tenant, and call their emergency maintenance contractor to have him turn off the supply to the entire building. The management company has the contact details for the landlord, but not the tenant. The landlord has keys, but lives several hundred miles away. It takes half an hour for the maintenance man to arrive and turn off the supply. It takes a further three hours before they are able to contact the tenant. The concierge cannot be certain that this problem hasn't occurred elsewhere in the building as most apartments are left unoccupied during the day. He leaves the water off for the remainder of the day and turns it back on in the evening, when he hopes any other running taps will be noticed.

SCENARIO D: BAG SNATCH

When walking home, Emily has her bag snatched by a man. Shocked, she watches him run off into a nearby development. A man sitting on a nearby balcony shouts down to ask if she is ok. Fortunately, her phone is in her pocket and she calls Ben to come and escort her home. When she later reports the incident to the police, she is told that similar crimes have occurred in the area in the last month. She mentions the witness, but cannot remember his apartment, only that it was three floors up. It is too late to warn residents in the development that the man ran into. The police do not try to find the witness; the crime is too minor. Emily posts a message on the Facebook group, but there are three similar incidents over the next two months.

Implications of Scenarios C & D

Communication abstractions that support notions of role and place can more naturally support high-rise communities. With regard to *role*: communication primitives should distinguish between the many stakeholders associated with a development e.g. tenants, owners, on-site staff or residents' committee members. With regard to *place*: support for messaging oriented around buildings, apartments, blocks and floors will more effectively support commonly required modes of interaction. In scenario *C*, Ben would have benefitted from sending a message directly to the landlord and tenant of the flat above him. The concierge would have benefitted from broadcasting an emergency warning to all tenants in the entire building. In scenario *D*, it would have been useful for Emily to send a message warning residents in the development the man ran off into, to the floor of the building that the witness was in, and all buildings along the path where the crimes had taken place. Although crime is by no means exclusive to high-rise developments, there are a set of common features that make high-rises particularly vulnerable: multiple escape routes, many semi-private areas and a large, dynamic occupancy [1].

Scenarios E & F: Management

Social media tools such as Facebook provide management functionality for access control, content moderation and information disclosure that generalize to meet the needs of a wide range of online communities. However they map poorly to the needs of high-rise communities who must provide sustainable management in the face of a continual ebb and flow of owners, tenants and staff. The longer-term effects of a poorly managed site can be serious, and can have emotional and financial implications upon residents.

SCENARIO E: FOUNDER POWER

Ben and Emily have decided to rent out their apartment and go travelling for a year. Of the three visitors that view it, one is very keen and immediately agrees to rent it. The following morning, Ben receives a call from his estate agent informing him the visitor has changed his mind. Ben is confused and phones the visitor to find out if there has been a misunderstanding. The visitor explains that he had joined the development's Facebook group and found a few worrying posts. Ben's attempts to reassure him fail. Ben checks the group, and finds posts related to antisocial behaviour, high energy costs and crime. These reflect poorly on the development even though, in most cases, the problems have been resolved. He sends a message to the group administrator asking him to either be more cautious in accepting new members or to delete older, negative posts. The administrator replies that both options are difficult; he cannot vet all new signups short of posting a letter to their apartment or meeting each one in person. He cannot delete all negative posts, as the job is too large, and many 'negative' posts may still contain useful information. Ben is concerned what this could mean when he comes to sell.

SCENARIO F: SUSTAINABILITY

The residents in Ben's building are tired of the poor internet connectivity and most opt for the installation of fibre. The choice is between two companies, *A* and *B*, and each quotes a similar price. The administrator of the Facebook group phones each of the sales teams and secures himself free broadband for a year from company *B* if he is able to sway the deal with them. He extols the virtues of company *B* on the Facebook group. This is countered by another post that concludes that *A*

would be a better option. The administrator deletes this post. The residents choose company *B*. The administrator gets his free broadband. In the coming months, the person who championed company *A* states his irritation that his post was deleted, especially given that some of his concerns about company *B* have since been realized. An argument rages and the administrator is accused of profiting from free broadband. Angry, he deletes the group. Four years of information, discussions, recommendations, documents and pictures are lost to all.

Implications of Scenarios E & F
Most residents are unlikely to fully consider the implications of initially signing up to their development's online group or site. Short term motivations such as obtaining the answer to a pressing question will likely outweigh any longer term thoughts about access control, controlled data disclosure and moderation. As social media tools do not offer appropriate solutions the burden falls on residents, rather than technology, to provide approaches that meet their requirements. This has two consequences: first, because these are hard to get right, it is unlikely that there will be many residents with the time, skills and inclination to do so. Second, it can concentrate a surprising amount of power with an arbitrary resident (e.g. a group founder).

The characteristics of supporting services

Given the limitations of social media tools in meeting the needs of high-rise communities, we now discuss some of the services that are required to improve upon the status quo. One well-publicised startup, USA-based Nextdoor [6], provides 'neighborhood social networks' and tackles some of the issues we have described: it authenticates new users through letters, constrains group size, extends communication out to neighbouring developments and supports the transfer of group management between residents. Yet it is a closed, socially-focused platform that lacks the services we believe are required for innovation. Our vision is of an open platform, composed of services that solve common problems and which can be leveraged by developers to build applications tailored to the specific needs of high-rise communities.

Complexity
We have described a complexity that comes with high-rise living stemming from a combination of complex information, processes and collaboration. We see two fundamental services that need to exist to help mitigate this: information services and moderation/mediation.

INFORMATION SERVICES
The individual contributions of local, domain-specific data are key to residents being able to solve their problems. The creation of a comprehensive ontology encompassing high-rise developments and their communities is needed for richer application functionality. Support for semantically rich queries on resident-contributed data would present new opportunities for developers. We envisage a set of second-order services that offer the necessary scaffolding for applications to streamline and simplify complex processes, recognize, compare and contrast data (utility bills, rules, service charges), share contextually relevant knowledge and anticipate residents' needs.

Moderation & Mediation

We have described a prevalence of complex interactions across multiple stakeholders in residential high-rises. We believe that services that offer support for steering, mediation and moderation would help liberate residents' opportunities and reduce conflict. Although we are unsure how this should be provided (should it be outsourced, managed collectively or by a trusted resident?) or how it should be applied (what is the mechanism of policing, of intervention, of appeal?) we believe that it must be explicitly addressed and assigned.

Communication

We have stated that it may be more natural and efficient to orient communication around the structure of a building. The place-based abstractions (i.e. endpoints defined by apartments, floors, buildings etc.) would also benefit from notions of affiliation: the owner of the car with registration *xyz* or the owner of parking bay nine. Emergency messaging could be supported by exploiting all intended recipients' available channels (SMS, email, forums, Twitter, Facebook etc.). Provision of support for fully anonymous communication (rather than reliance on, for example, privacy preserving pseudonyms) will help protect people from reprisals and can offer a means for participation amongst people vulnerable to discrimination. The service will impose sensible policy restrictions upon the communication scope, such that it remains both useful and resilient to abuse.

Management

A resident or stakeholder's affiliation with a high-rise can change at any time and services must be designed with this in mind. Here we consider the implications upon data management and authentication services.

Data management

We have briefly outlined the information services required to provide support for high-rise communities. Yet there are also questions around the scope of data use. Who owns it and how should it be exploited? It appears reasonable that any data related to a development should be managed and exploited by the *current* community. The responsibility for the management of portions of this data will rest with groups or individuals, and should be governed by their affiliation with the community. In this way, data may be thought of as belonging to the *building* with residents acting as custodians. For example, so long as a person lives in an apartment, they may manage and contribute to the pool of information that relates to it. When they leave, this information should remain with the apartment. Similarly, a management company should be permitted to access and use data related to a development and its occupants as required, but this data should remain available to a future management company if they are replaced. Data about high-rise communities and their properties will have value to local businesses. With an increase in the sophistication of this data comes a need for services that offer principled and scoped access for third parties and applications [7].

Authentication

Authentication approaches must take account of two types of resident: off-site (non-resident owners) and on-site (resident owners and tenants). Development occupancy and ownership records are rarely up-to-date and/or accurate given the transience of residency and

ownership. We're unaware of any robust, purely technical solution capable of confirming a registrant's affiliation with a property. With on-site residents, one approach is to post access credentials to each resident's address (an approach taken by Nextdoor [6]). Another is to use a shared secret that can only be obtained locally, although the particular mechanics of this will likely differ from development to development. Detecting changes in occupancy and ownership is harder. The solution may lie in making inferences based upon residents' data and behavior (e.g. the services/tools that they use) and offering support for residents to police their own community.

Conclusion

Communities living in high-rises are especially vulnerable to a range of problems. High-rises are hard to maintain, expensive to run and their residents will often need to digest complex information and negotiate difficult processes. Many problems are shared and resolution can require sophisticated collaboration in a challenging environment. Social media tools are commonly adopted by these communities but they offer limited support. New startups [6] have begun to emerge that specifically target residential communities, but we have argued that a fuller set of services are required to meet the needs of high-rise communities and to encourage innovation. We have briefly described the characteristics of some of these services and the challenges in their design.

Civic participation, social cohesion and community engagement have long been held up as important goals in urban environments. By better supporting the challenges inherent in living in large scale high-rises we may go some way towards meeting these goals.

References

[1] Create Streets.

http://www.createstreets.com

[2] Gifford, R. The consequences of living in high rise buildings. *Architectural science review 50*, 1 (2007), 2-17.

[3] Leasehold Advisory.
http://www.leaseadvice.org/publications/documents/document.asp?item=21

[4] Trust thy neighbor? No way, says half of the UK.
http://propertyreporter.co.uk/view.asp?ID=11508

[5] Judge rules in luxury high-rise spat.
http://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=10884732

[6] Nextdoor.

http://www.nextdoor.com

[7] Becoming Dataware.
http://www.horizon.ac.uk/Projects/becoming-dataware.