SUPPORTING SAFETY THROUGH SOCIAL TERRITORIAL NETWORKS

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Abstract: Today, crime and fear of crime are related to a loss of social control in large cities. In combination with the bystander effect, help might not be provided in the case of an emergency. This paper suggests the framework of a Community Watch Service. The conceptional architecture enables citizens to join virtual, territorial communities. Citizens can create their own virtual territories. These territories are linked to software services offering functionality like reporting damage to public property, receiving information from public authorities or organizing help in the neighborhood. The framework aims to improve social control in a positive way and increase public safety in large cities. We demonstrate the Community Watch Service as a prototype which is available for standard web browsers and Android-based mobile phones.

1 INTRODUCTION

Crime in public places unfortunately happens everywhere and often. A 17-year old girl was injured by another girl in Karlsruhe. The incident was witnessed by several bystanders (KAN06, 2006). In Munich business man Dominik Brunner was beaten to death while defending young people against attackers (Spi07, 2010). Also in Munich senior citizen Bruno Hubertus was attacked by two young men because he stared at them (Spi07, 2007). All three cases have in common that the offenders are young people committing the crimes due to negligible causes. The attacks have taken place in large cities with lots of bystanders around. None of them provided help.

In the article (Ovelgoenne et al., 2010) an online service is described how to use one's personal social network to receive help in an emergency situation. This Emergency Alert Service (EAS) collects data from the user's own contacts and calculates a friendship network. This network is used in case of an emergency. By making use of geo-location data of the victim, friends close enough to provide help and authorities (e.g. police) are alerted through their mobile phones. The EAS has been designed on a peer-to-peer mechanism and is based on mobile applications. The success of the EAS critically depends on the size of one's social network, the local proximity of one's social groups, and the strength of the social norms leading to help (social control). Therefore, in this paper we extend the Emergency Alert Service to a service bundle of territory-based social services. The motivation for this is that territory-based social services lead to an improvement in 'real-life' social groups building in one's neighborhood and thus improve the social relations and reinforce a positive social control.

Our service framework integrates territories in social networks: People register with their home location to be able to join local territories. They can also create territories on their own. These territories and the services on top are used to pass on 'territorial' information. Different kinds of services are possible: chat functionality, broken windows or damage to public property can be reported to authorities and municipal administration can contact citizens, up to people in need that can ask for help.

With our work we aim to integrate and enable citizens to take over (more) responsibility for their place of living. We hope to create more of a feeling of ownership and commitment in the neighborhood. To achieve this, we focus on the power of social networks, pervasive computers and internet technology.

In section 2 we motivate our service by giving basic information when and how people feel secure and how safety in places, e.g. cities, can be achieved. Section 3 reviews current scientific work and applications in this field. In section 4 we describe our conceptional architecture for a territorial safety service framework

and present it's implementation as a prototype in section 5. We round up this paper in section 6 by a conclusion and look out for future work.

2 FUNDAMENTALS AND CHALLENGES

In 2010 for the first time worldwide more people live in cities than in the rural area (BPB10, 2010, p. 47). The consequences of that trend have been analyzed by Urban 21: the experts' report on the future of cities (Hall and Pfeiffer, 2000, p. 205). For mature cities the report predicts, for example, the proceeding separation of rich and poor people in urban areas and increasing conflicts between them. Crimes as a consequence of social tensions due to poverty are regarded as the classical theory in criminology (Eisner, 1997, p. 39-41). Statistics prove a higher occurrence of criminality in cities than in rural areas (e.g. (BKA07, 2007, p. 46)). For the reasons for having an urban-rural gap in criminality we refer to Oberwittler and Koellisch (Oberwittler and Koellisch, 2003, p. 135).

Not only is the criminality higher in big cities but also the fear of crime. Surveys from 1999 (compare (BKA99, 1999, p. 48) among others) show a remarkable difference in the categories 'felt insecurity' and 'going to be a victim soon' depending on the size of the population (Wurtzbacher, 2008, p. 59). Especially street crimes like the ones mentioned in section 1 have a considerable effect on the sense of security, due to a high number of possibilities to commit a crime on the one hand and the few chances to avoid such crimes on the other hand (Koetzsche and Hamacher, 1990, p. 6ff).

According to Boers, the reasons for a higher fear of crime can be broken down in three categories (Boers, 1991, p. 45ff): A person fears crime more after being a victim (victimization perspective), the fear of crime increases with the loss of informal social control (social-control perspective), and media, politics, and official institutions influence the perception of the security (social-problem perspective). The theory of the social control perspective is closely related to the Broken Windows Theory by Wilson and Kelling (Luedemann and Ohlemacher, 2002, p.144).

Since informal social control plays a major role in crime as well as in the fear of crime, it is worth to be investigated more deeply. Fassmann (Fassmann, 2009) describes the differences between urban and rural areas, also focusing on social relationships. In a big city it is not possible to know all people by their names, characteristics and history. The traditional interaction with neighbors through knowing and caring

for them is replaced by anonymous and often changing contacts to a big circle of acquaintances. Regarding to Simmel (Simmel, 1903, p. 122), townspeople can't face others with the same emotionality (participating, understanding) and they build up a shield against many of the stimuli in a city. Townspeople do not only react differently to their environment, but they also notice only parts of the reality around them (e.g. people in need).

The characteristics of people living in a city also affect the emergency process. Whether citizens are willing to help people in need depends on a number of criteria explained by Darley and Latane in the social help process (see figure 1). For a detailed analysis, especially focusing on the bystander effect, the main reason for unhelpful crowds, we refer to (Geyer-Schulz et al., 2010).

Studies also show that people help more often, if they know the area. A person, who has fallen down, gets less help in an airport than at a subway station (Luedemann and Ohlemacher, 2002, p. 154). We argue that the criteria 'known environment' influences helpfulness.

One main point of our suggested territory-based service framework is the aim to strengthen the informal social control of citizens since this reduces the fear of crime as well as crime itself.

3 RELATED WORK

This section takes a look at the latest concepts dealing with crime, participation of citizens and using information and communication technologies.

The region of Brandenburg (Germany) offers a portal offering persons, registered by email, the possibility to report issues to the city administration. Messages are categorized (waste, vandalism...), contain a description, a postal address, the possibility to add pictures and a processing status. The issues can be tracked by users and employees. Employees of the city administration update the issues. This leads to an increased transparency (Mae10, 2007). FixMyStreet (http://www.fixmystreet.com) follows a similar approach.

To inform their citizens about crime, the Los Angeles Police Department (LAPD) publishes a crime map. The crime map is part of an E-Policing strategy which applies the community policing ideas through the internet. A police district includes several 'Basic Car'-districts. Citizens have the possibility to engage as Senior Lead Officer who is the contact person for the local inhabitants. His task is to watch local criminality and to inform the police and the
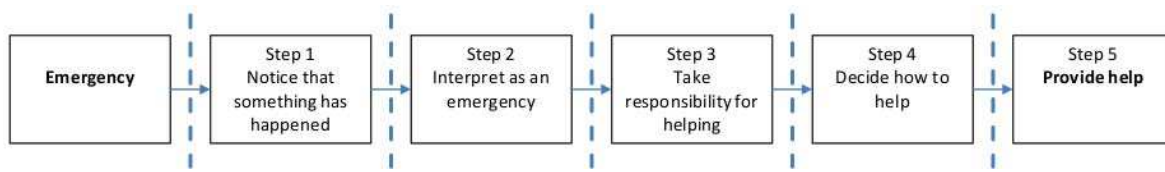
Figure 1: Social Help Process according to Darley and Latane ((Latane and Darley, 1970, p. 152-155) and (Brehm et al., 2005, p. 367)).

citizens about news (http://www.lapdcrimemaps.org). German newspapers have started to track the level of crime on a map, too (see the 'Blaulichtkurier' under http://www.berliner-kurier.de).

Video surveillance has been used for years to prevent crime on streets and public places. Many of the cities in Great Britain are using the closed circuit television-technology. A critical point of video surveillance is the monitoring of recorded videos (Floeting, 2007, p. 6-7). A concept for an involvement of citizens in monitoring is offered by the company Internet Eyes Ltd. People all over the world have the chance to watch randomly selected surveillance cameras without knowing their actual location. By reporting an incident they gain points and receive prices (http://interneteyes.co.uk).

The company Innovative Support To Emergencies Diseases and Disasters (InSTEDD) (http://instedd.org) has published the concept paper 'Watchfire'. It deals with emergencies (e.g. storms, fire, earthquakes and epidemics) in which inhabitants can't expect fast help from official aid organizations, but must rely on help from neighbors (Beckman and Rasmussen, 2010). As potential users InSTEDD especially addresses participants of neighborhood watch organizations. After signing up a user can see other users and their whereabouts on a map. Users can chat with each other and can send messages through mobile phones. Watchfire can be connected to professional aid organizations, but is primarily designed as local alert system for neighbors.

4 THE CONCEPT OF THE COMMUNITY WATCH SERVICE

In section 3 we described some ways of dealing with crime and fear of crime. A recurring element is the focus on social-control. Social-control is hard to promote especially in larger anonymous cities. Most of the existing concepts have territorial aspects included: Segregation, urban development of territories, neighborhood watch organizations, the police who is responsible for a district, reporting issues to the local city administration or a chat functionality to talk to neighbors. But also concepts like Getting Help In A Crowd (see (Geyer-Schulz et al., 2010)) which are independent of setting up a territory are possible. All of them have in common that there needs to be a motivation why persons participate in crime prevention or the emergency response process.

The main idea of the concept, named 'Community Watch Service' (CWS), is to create and improve relationships between neighbors. We do this by offering territory-based services in which only residents can participate. One consequence out of that is to know and verify the residence of a user. Another is, to map services to arbitrarily shaped territories. By this, we aim to strengthen the identification of persons with 'their' territories since only in-territory-people (in-group) may join. Furthermore, services can be offered in well-defined territories only, making sure that only local users can participate. We have to ensure privacy of personal data, especially geo-locations of users. We expect people do not want to see personal information like their address being public information. Therefore, we do not show geo-positions of users but ensure only, that they can join territories only their place belongs to. Furthermore, we use pseudonyms.

The creation of a relationship between people often starts with the fact that they live next to each other. This closeness can result in the feeling of belonging together as a group. Living next to each other creates common interests (e.g. talking about city topics, shared problems with vandalism, traffic related issues, fear of crime, ...) and opportunities to help each other (e.g. borrowing milk, receiving parcels, recommending a restaurant, taking care of children, ...) which could be channeled and supported by information and communication technology. The hypothesis is: Shared interests, opportunities for mutual help and the size of one's social network strengthens the motivation to engage locally even to the point that help is provided in the case of an emergency.

We do not restrict territory-based services to crime-related topics: Results of research on neighborhood watch programs show that services only motivated by crime related issues tend to get inactive over

Figure 2: Combination of different territories.

time (Garofalo and McLeod, 1989, p. 336). There-fore, we offer a mixed bundle of services which can be crime related but need not to. The question which needs to be answered is, how to enable citizens to make use of multiple services in an easy way. Right now there are a lot of services available, offered by police, city administration or others. The Community Watch Service must offer its services in an easy, auto-mated and structured way.

The living situation of a citizen can be very differ-ent. There are mini-neighborhoods with one-family-houses and block constructions. People in both places may have different attitudes and possibilities to engage in their neighborhood. Therefore, offered territory-based services may differ as well. E.g. in a highly anonymous environment, a local chat func-tionality may be a good starting point. A rescue ser-vice asking residents for help in the case of an emer-gency may be futile at first. Nevertheless, an in-creasing number of people using local services of-fered through CWS may improve the relevancy (ac-ceptance) of such an emergency service later: First, people start with chats, then make use of something like fixmystreet. Later a network with a Senior Lead Officer can evolve and then the willingness to partic-ipate in more demanding services like a local rescue service may rise. In other words - to reach the aim of 'Supporting Safety Through Social Territorial Net-works' one must start with non-safety relevant ser-vices first an can build upon that.

The shape of a territory is determined by the of-fered service. A fixmystreet-like service territory needs to be set up according to the administrative area of the city administration. Reported issues in territo-ries are forwarded to the responsible employee by the service. The size and shape of territories may fol-low 'official' boundaries like city limits, districts, 911 service areas, or can be defined freely by the users' needs. For architectural reasons for territory shap-ing, we refer also to the book of Christopher Alexan-der (Alexander, 1979). In any case the owner of the territory has the power to shape it. To simplify the shaping of territories, the company Urban Mapping Inc. offers official boundaries which may then be ap-plied (http://www.urbanmapping.com). They can be used as orientation for owners of territories in order to shape them. Figure 2 shows an example from the prototype described in section 5.

A resident (whose actual location is hidden for data protection reasons) is the owner of the grey, in-ner most small circle territory. It is linked to a emer-gency response service wherein the user participates as emergency helper (the latter information is not de-picted in the figure). The same person is registered in the territory 'Neighbors and friends' (brown, small circle) and 'fixmystreet' (turquoise, large on the left). There is another territory for which he is not regis-tered (purple, large territory on the right). Detailed information about territories, linked services, owner, subscription state and so, on pops up when moving the mouse over the territory marker (see figure 3).

Generally, a user can create his own territories and link them to services. Furthermore, a user can sign up to existing services covering his registered place of

Figure 3: Edit of territories.

living. The sign-up process may include the approval of the territory owner. The CWS framework supports general functions. These include among others the registration of a new user with checking his residence, creating and editing territories and linking them to services, searching for them and editing user settings. The service itself might be offered by third parties. A territory is always linked to exactly one service. Otherwise, users registered for a service would have to sign-up for new services attached to the same territory again. Nevertheless, the shape of a territory can be (technically) reused for another territory (with the same shape) but linked to another service. The idea is to have encapsulated services with a given set of functionalities. Groenroos conceptional augmented service models can be applied to differentiate core services (Groenroos, 2007, p.163ff). 'Small and similar' functionalities can extend an existing core service (attached to a territory) but (different) new core functionalities would lead to a new service.

We expect CWS being successful only if valuable services are provided for territories. Therefore, the following paragraph is dedicated to give some examples of territorial services. The order of examples reflects the degree of commitment or participation level of the citizens. Services with a lower requirement level are listed first.

- Information Service of the City.
  The city informs selective territories about planned construction sites, street festivals, cultural events, ...

- Information Service of the Police.
  The police provide general information about crime in the territory, crime prevention activities,

and specific information on crime prosecution. Police publishes mug shots in the newspaper or on the police's homepage. Those mug shots can be published promptly and selectively even on the mobile if offered.

- Chat Functionality.
  People talk to people nearby about neighborhood gossip (weather, found a cat), but can also talk about security relevant stuff: an open car in front of the house, persons loitering in front of the house.

- Fixmystreet Similar Service.
  Either the city administration offers this service and deals with issues (CustomerToAdministration) or people in the neighborhood take care themselves (CustomerToCustomer).

- Local Emergency Helper.
  In the field of medical emergencies there are already first responder concepts in place in which people agree to do locally voluntary work. The German red cross association has built up local first responder teams to bridge the gap until professional help of aid organizations arrives. Those teams are integrated in the rescue chain and get informed by the headquarter (Schoechlin and Ayasse, 2004, p. 1). The local emergency helper is a service where the helper is registered for a territory and others using this service push a button on their mobile which locates themselves and informs helpers registered in the callers territory.

In addition to these more security related services the CWS framework offers the freedom to be ex-
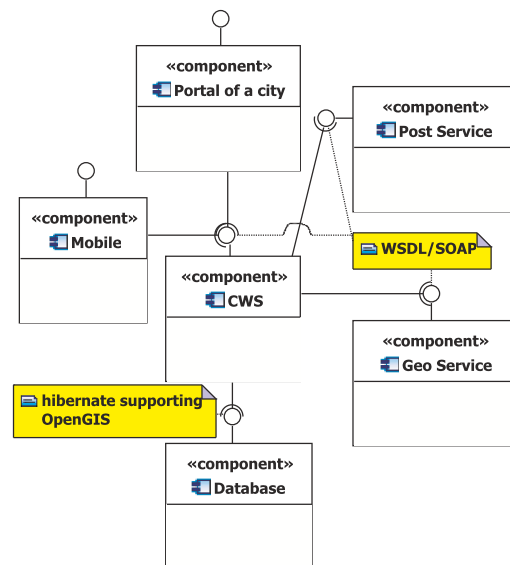

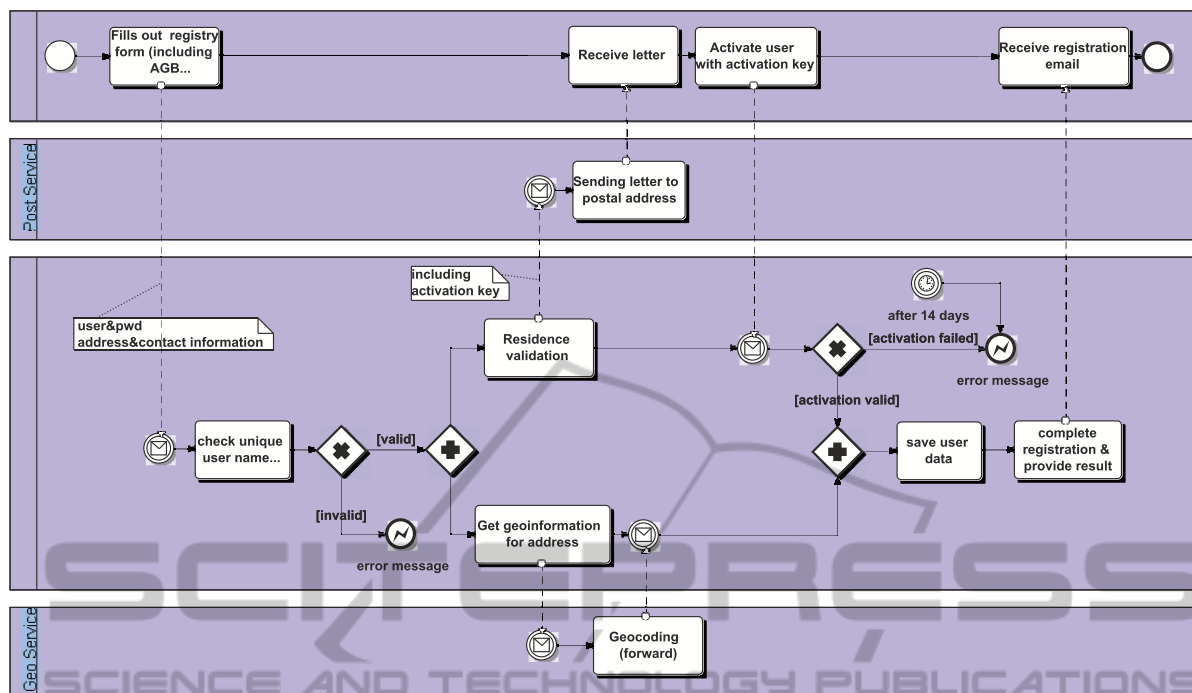Figure 4: Architecture of the CWS prototype.

Figure 5: BPMN process of a CWS user registration.

tended with other applications. A lot of room for creativity: a territory for finding people to go out with, organizing a street festival, offering mutual help, or other services which improve social interactions in the neighborhood are possible.

From these requirements it follows that people may want to be informed about new territories/services in their environment. Nevertheless, to much information would possibly be reflected as spam. To deal with excessive generation of territories the territory creation and user perspective must be analyzed. One solution is to collect notifications of new territories and send out personalized newsletters one's a month.

5 PROTOTYPE

Our CWS prototype includes the basic functions of the described concepts. This includes registering for CWS, creating and editing territories, finding territories and joining them. The prototype is currently available for standard personal computers through a web browser and also for mobile phones based on Android (http://www.android.com).

To make use of (backend) services already available, we used a web service technology for our implementation. Pautasso et al. (Pautasso et al., 2008) discuss the difference between big web service (WS-

) and REST. Their result is, that REST needs less architectural decisions to make but 'lead[s] to significant development efforts and technical risk, for example the design of the exact specification of the resources and their URI addressing scheme' (Pautasso et al., 2008, p. 813). Since CWS wants to be an open framework for services with territorial aspects, for an encapsulated application the full complexity of WS- services can be used. Figure 4 shows the components and their connections, the communication interfaces and protocols of the chosen architecture. The main intention of the figure is to give an overview of the needed components. The components can be related to the lanes of the process description in figure 5 - the sub processes in the lane 'User' are implemented by 'Mobile' and 'Portal of a city'.

A key issue in the CWS concept is the residence of a user. This location is verified during the sign-up process of a user. This can be done by trusted third parties like the city administration who maintain the city register listing all residents. If trusted third parties lack an API or the permission to access these kind of data, a validation process as used e.g. by credit card companies can be applied. The CWS prototype integrates the services offered by 'Postal Methods' (http://www.postalmethods.com) to send letters to an address of a user. The letter contains an activation key which secures that the user really lives at the specified address. Only after activation, the user registration process for territories is finished success-
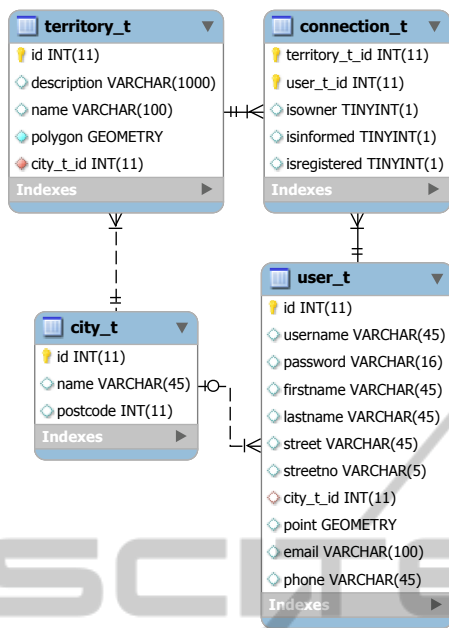
Figure 6: Entity Relation diagram of the CWS prototype.

fully.

To be able to do calculations with the address of a user, the address is translated to spatial data for which the geo-referencing service of Via Michelin service is used (http://www.ViaMichelin.com). Of course the user data and especially the location must be stored on a database level. Since later on there will be frequently requests for users of a territory, spatial data is directly saved in the OpenGIS format to be able to perform this request on the database level.

Figure 5 shows the different steps that are executed during user registration as a BPMN diagram (SOAP messages are shown as a postal symbol). After a successful activation, the user can create, edit and delete own territories by using map functionality. Google Maps (http://maps.google.com) offers the Google Maps API. The API allows creating polygons in all desired shapes. Such polygons consist of multiple geographic points which are transferred to the CWS. The CWS saves the territory and the corresponding user data in its database.

Furthermore, a user can search for territories and is notified by email if new territories are created 'on top of' him. The territory search makes use of the hibernate criteria technology to efficiently execute complex searches (combination of multiple search criteria over many databases). By doing so, an user can explore different parts of the city and their social cohesion. Territories can be assigned properties like 'isHidden' to allow citizens to exclude their territory and the linked service from public view. This feature may be used e.g. in the service 'senior citizen part-

nership' which would otherwise give criminals easy targets.

The search function supports owner-related, location-related and service-related attributes. When a new territory is created, users with their residence inside this territory are identified. If these users have activated email notification, they are informed by email to explore the new territory. Figure 6 shows how the underlying ER-diagram looks like to store the necessary data. A user may also join existing territories. He can only join, if the territory related to the service includes the user's residence.

6 CONCLUSIONS AND FUTURE WORK

Public crime and fear of crime is common in larger cities. In section 2 we have presented some fundamentals, how a low level of social control correlates with the size of the population. Besides other aspects, this is an important factor in crime and felt crime level. Furthermore, the bystander effect may prevent help in the case of emergencies.

To strengthen social control we suggest the Community Watch Service (CWS) Framework. The service framework enables citizens to form territorial communities. Every participant in the CWS can join communities related to his place or create own territories. Such a community is linked with certain functionality. For example, in one community, information about planned construction sites is distributed to the participants by the city administration. Another community service deals with damage to public property: Citizens report damage while employees of the city administration track these issues and fix them. A third possibility is local emergency helpers, who respond to help requests.

In this article we described the conceptional architecture of the Community Watch Service and its realization as a first prototype. A full implementation of this service and a field test remain for future work. Even without a full CWS system in the field, user surveys can give a first indication of how a concrete territorial service bundle should look like. First acceptance tests with residents could be conducted with mockups of the user interface.

The mobile aspect of CWS hasn't been discussed in this paper that much but holds a significant potential. There are many appliances thinkable. A very sophisticated way of integration CWS in a mobile application (next to just locate yourself and show the map on the Android-based mobile phone) is shown in figure 7.

Figure 7: Augmented reality in combination with territorial services.

The user sees through a camera display the real world with a digital overlay of territories above him - he might feel safer since he is walking through the supervised neighborhood 'NW-Block 17'.

With regard to existing social networks, like e.g. Facebook, the CWS concentrates on real social relations: the identity and the residential address of persons participating in the CWS are validated. Only locals are allowed to participate in territories. The aspects of belonging together present in local neighborhoods, local commitment and informal social control are strengthened.

From a technological point of view, CWS is an open framework (available for standard web browsers and Android based mobile phones) which is using different existing web-services. CWS and all the web-services employed rely on flexible rights management services which handle location and group-based access requests. Today, none of the existing commercial social networks provides this functionality. The independence of an existing commercialised social network with given APIs leaves the freedom of development completely new functionalities like searching for new services/territories nearby. Yet, CWS could be coupled with or added to the existing functionality of a social network - provided the rights management services of the social network are flexible enough and extended with territorial functionality - because in the end - the people that are assigned to local territories, connected with each other indirectly, are potential customers of a social network.

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