C3PO: a Spontaneous and Ephemeral Social Networking Framework for a Collaborative Creation and Publishing of Multimedia Contents

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Abstract

Online social networks have been adopted by a large part of the population, and have become in few years essential communication means and a source of information for journalists. Nevertheless, these networks have some drawbacks that make people reluctant to use them, such as the impossibility to claim for ownership of data and to avoid commercial analysis of them, or the absence of collaborative tools to produce multimedia contents with a real editorial value.

In this paper, we present a new kind of social networks, namely spontaneous and ephemeral social networks (SESNs). SESNs allow people to collaborate spontaneously in the production of multimedia documents so as to cover cultural and sport events.

Keywords: Social Networking, Opportunistic Computing, Collaborative Edition

1. Introduction

Online Social Networks (OSNs), such as Facebook, Google+ or Twitter, allow people or institutions to communicate on themselves. They are also designed to let people make long-term contact with members of their family, with friends or with people that share the same interests or goals by a simple invitation mechanism or a system of followers. People can easily share data and communicate with the persons they are in touch using comments, content rating, chat, videos, etc. Although these OSNs are accessed every day by billions of people from their mobile devices, these social networks have several drawbacks. First, they rely on a centralized architecture. All personal data are stored on the servers of the OSN operators and are often exploited for commercial purposes, thus entailing data ownership issues. Therefore, many people are reluctant to use these OSNs. A permanent Internet connectivity is furthermore needed to access these servers. Such an approach excludes that services can be provided by mobile devices themselves. Information exchange is done following links between users in the network, limiting the communication to "known" people. Finally, OSNs do not provide efficient tools to permit people to produce multimedia contents in a cooperative manner.

In this paper, we present a new type of social networks, so called Spontaneous and Ephemeral Social Networks (SESNs). SESNs rely on a peer-to-peer distributed architecture formed spontaneously by mobile devices carried by people and by devices deployed for a particular occasion to support such networks. In these networks, devices opportunistically communicate with each others thanks to wireless interfaces such as Wi-Fi or Bluetooth. Due to their spontaneous and ephemeral nature, SESNs are suited to produce multimedia reports on sport or cultural events in a collaborative way. SESNs are expected to favor the emergence of a participatory micro-journalism. To do so, people are linked together for the duration of the event, and each member of a SESN is expected to offer a set of resources and services (e.g., data sharing service, bib recognition service)

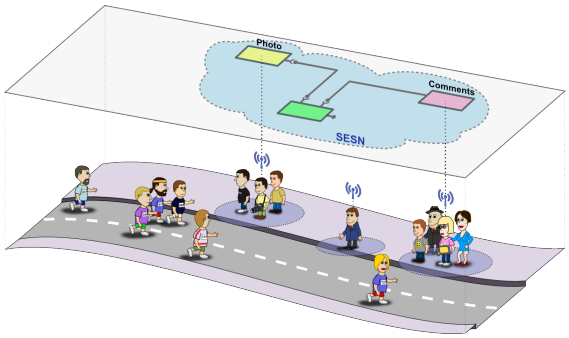

Figure 1: Illustration of a SESN dedicated to sport event reporting

to the other members. Members are provided with tools exploiting these data and services, and allowing them to collaborate on the production of multimedia reports. These data and reports are replicated on remote servers in order to ensure their lasting and their large diffusion after the end of the event. The multimedia contents produced by the SESN members are exchanged opportunistically and can be recommended by these members in order to ease the filtering and the retrieving of relevant contents. A SESN also provides mechanisms to incite users to share their own productions.

The next sections of this paper are organized as follows. Section 2 presents a practical scenario of usage of SESNs. Section 3 presents the main characteristics and challenges of SESNs. Related work is discussed in Section 4. Section 5 concludes this paper and describes our plan for future works.

2. Spontaneous and Ephemeral Social Networks: A Practical Example of Usage

In this section, we describe by example how a SESN can help at making reports on sport event like a marathon, and what such a social network can bring to people. For the sake of illustration, let us consider a marathoner, a spectator and a reporter, named respectively Mike, Lea and Thierry.

Mike is 20 years old. He runs with his smartphone to follow his performances (speed, calorie expenditure, etc.) with a dedicated application. He launched a service that transmits his position regularly. Using the SESN, he can hear voiced information on the position of friends or opponents. Sometimes, he publishes photos and videos taken with his GoPro camera in the SESN. At the end of the race, Mike writes small messages on the SESN (e.g., difficulties, sensations, health state). He is informed of the arrival of friends and usual opponents. He reads content posted by them in the SESN. He also gets automatically all the contents that concern him (official time and ranking, photos and videos where he appears, etc.). When the event is finished, the SESN itself is closed, but most of the produced contents have been transfered to the organizer's web site. In the evening at home, he goes to this web site, reading or downloading photos, videos, organizers' comments or journalists' articles issued in the SESN.

Lea often drives her best friend Mike to marathons, but she does not run herself. As a spectator, she subscribes to the marathon SESN. She stands at the last km of the race. Other spectators provide photos, videos and messages at their relative location so she can follow Mike's race. She is also interested in general information on the marathon, posted by the organizer, journalists or other contributors. She does not hesitate to tag information with "like" when she has appreciated some posts. When competitors arrive at her location, she publishes in return as much information as she can about them. Lea publishes her photos with restricted rights, indicating that their commercial use require her explicit permission. The automatic bib recognition on photos service offered by the organizer is an appreciated service, even if she sometimes has to help the system by entering the number by hand. The tipping system in the SESN fills her virtual purse each time she publishes information. When other participants put "like" tags on the content she has provided, she gets additional tips. Her virtual purse allows her to get some goodies at the marathon organizer's desk. Still following her friend's race, Lea receives a warning when Mike arrives in her vicinity. She will not miss him as he passes.

Thierry is a journalist for the local newspaper, he quite always covers sport events in the local area. Entering the dedicated SESN, he has an inside view of the event happenings and relies on the participants posts to make his own opinion on the marathon. When organizers have accredited official reporters, Thierry uses the SESN to access their writings online. Thierry shares most of the photos taken with his professional camera within the SESN. Authoring rights can be put on his photos if he wants to get paid for photo reuse. Sometimes, Thierry does not have time to go to all sports events of the week-end. In the evening, he can go to the organizers' web sites to gather information.

Other profiles are interested in SESNs. Events organizers are often the initiators of SESNs for their events. Subcontractors of the event organizer are also involved, e.g. companies specialized in races timing, accredited official reporters, sponsors or communication staff provide content in the SESN. Computer scientists interested in data analysis can also provide dedicated ser-

vices, like the automatic identification of the bib of participants on photos, or the automatic construction of personal journals for participants etc.

3. Spontaneous and Ephemeral Social Networks: Definitions and Design Proposal

In this section, we first define the main notions and concepts considered in SESNs. Then, we present the general architecture of the C3PO framework, and we detail the main features of this one.

3.1. Definitions

- A *SESN* is a social network that is limited in time and space and dedicated to a single event. A SESN can be created by a user of a mobile device that runs a C3PO-based application. The lifetime of a SESN is defined at its creation time. In most situations, the creation and the lifetime definition of a SESN will be achieved by organizer of an event. For example, a SESN is built for the 2015 Paris Marathon few hours before the beginning of the race, and is destroyed few hours after its end. A SESN is formed spontaneously by the devices carried by people who attend the event and by specific devices deployed to support such a network. A SESN is intended to be geographically limited to the area where the event takes place.

- *Members* of a SESN are users of mobile devices that attend the event related to this SESN. They provide resources and services in order to support the collaborative production of multimedia contents to make reports on this event. If a user has not received an announce from the creator of the SESN after a given time, he will no longer be considered as member of a SESN.

- *Resources and services* are offered by the members of a SESN in order to support the collaborative creation of multimedia contents. These services can be content sharing services, editorial services, ranking services (”like” mechanism) and processing services (e.g., face recognition, bib recognition). Members provide computation, communication, storage and energy resources.

- *Valuable and relevant contents* are multimedia contents (e.g., photos, videos, comments or reports) produced by the members of a SESN and that have been highly recommended by these ones. In order to ensure their lasting and their large diffusion, these contents are expected to be replicated on an centralized infrastructure (organizer’s Web site).

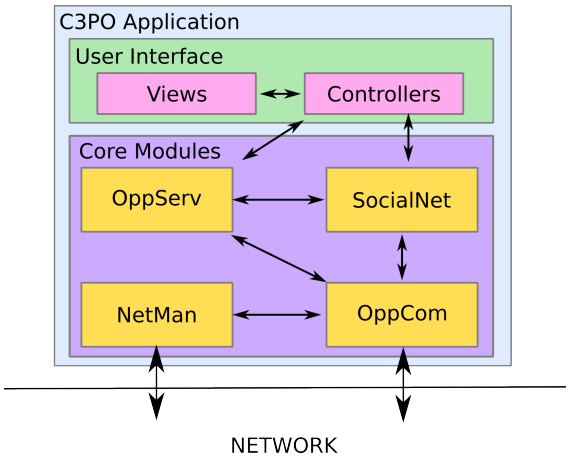

Figure 2: Architecture of the C3PO framework.

3.2. General architecture of the C3PO framework

The general architecture of the C3PO framework, whose a description is given in Figure 2, relies on the latest advances in mobile applications. It is composed of 4 main modules, called respectively NetMan, OppCom, OppServ and SocialNet. NetMan is responsible of the network management and of device discovery. The OppCom module implements the ”store, carry and forward” principle, and provides opportunistic communications between the devices of a SESN. OppServ makes it possible to discover and to invoke the services offered in a SESN. Finally, the SocialNet module provides most of the mechanisms we have in traditional online social networks, such as data sharing, comment publishing, etc. SocialNet is implemented as a set of services that can be discovered and invoked using the OppServ module. SocialNet also provides specific services that enable the collaborative production of multimedia contents by members of a SESN. This framework is currently under development. We have also designed a proof-of-concept Android-based application that uses this framework.

3.3. Opportunistic Computing

Each member of a SESN supports and contributes to this social network by providing a set of resources and services. These services are discovered and invoked using opportunistic networking techniques. In C3PO, each device is responsible for discovering the services offered in the SESN, and for maintaining their own list of services. The reactive discovery is usually achieved

when service providers broadcast service advertisements, while the proactive discovery occurs when service requesters broadcast services requests. Unicast and anycast service invocations are implemented in order to reduce the number of service requests disseminated in the network, and to improve the response time. Indeed, only one request is sent to invoke several providers at the same time.

In SESNs, services are provided using opportunistic communication to cope with connectivity disruptions due to the mobility of users and to the short communication range of the wireless interfaces. Thanks to these communications, the localization of members of a SESN is implicitly limited to the geographical area covered by the radio wireless interfaces of this collection of devices. When the event is finished, the members vanish and the network is destroyed automatically.

3.4. Content exchange

Content exchange must be done in a fast and easy way. Exchanged contents are mainly small messages that look like tweets. They reference photos, short videos, texts. This rough material can be enhanced by some processing services, with comments given by participants, etc.

Content exchange is based on a push principle : the content creator sends his message to the SESN. Each message can be thrown to all the SESN participants or to specific targets within the SESN. It is highly similar to the Twitter publishing mechanism. We do not use permanent followers, since a user may use a new id for each spontaneous and ephemeral group he belongs to. As soon as a user enters a group he gets all messages posted to this SESN, in a way similar to IRC. When you leave the SESN you do not get any remaining messages. Yet, some messages, or referenced material may be ranked by users. These messages are regularly reposted on the SESN. Thus, when a user enters a SESN he gets both live messages and top messages that have been highly ranked by participants. It is a way to get top-stories among more casual information.

3.5. Content recommendation

Content recommendation is used to organize published content on participants' user interface. The recommendation technique is a hybrid between content recommendation and social recommendation. As users of the SESN are any people in the vicinity, no relationship between people exists at the start of the SESN. Also, no user profile is available. The only way to characterize users is to learn from their activity in the SESN. Our content recommendation system thus will base its algorithm on three elements: activity traces, content popularity, and tags. Activity traces are built by observing the user service consumption; measures like duration of consultation or number of consultations of a specific message are used. Content popularity is built on exchanging information on the most viewed contents within the SESN network. Comments and tags are put by users when they have particularly appreciated a message. Tags are similar to the popular Facebook "like" feature. These tags and comments are used both in the content popularity measure and in the user's profile setting up.

3.6. Incentive mechanism

So that SESNs can be adopted and used by a large number of people, several features must be taken into account. The success of such social networks mainly depends on quality of the applications dedicated to these networks, but also on the quality of the information and the services offered in these networks [1]. Members' motivation to use SESNs is intrinsically dependent of this quality. Information quality is a multidimensional concept that depends of the context of use [2]. Each SESN is evaluated by its members on its ability to provide information that is fit for use [3]. Relevance, timeliness and quantity of published contents in the SESN are defined as the three main dimensions for the evaluation of a SESN. Moreover, motivations of SESN members can be intrinsic and/or extrinsic [4]. Intrinsic motivations refer to enjoyment-based and community-based motivations. Extrinsic motivations refer to recognition mechanisms (payoffs, social motivations). In order to favor the adoption of SESN by people, incentive mechanisms are envisioned (publication of the most popular contents and their owners, invitations to meet an athlete, tickets for next events, etc.). A content assessment system will be built, in which organizers and/or journalists will be able to choose among a set of criteria in order to nominate the most valuable contents and members in the SESN.

4. Related Work

Nowadays, it exists a plethora of social networks (see the non exhaustive list on Wikipedia [5]). Most of them rely on a centralized architecture and require connectivity to the Internet. Over the last years, decentralized social networks have been studied and developed by researchers and non-academic open source projects. Diaspora [6] is a popular open source decentralized on-

line social network based on multiple small independent servers. Several academic research works have addressed privacy issues in decentralized online social networks, such as LifeSocial [7] Safebook [8], PeerSoN [9], MyNet [10] and Sodensson [11], but none of them have considered social networks formed spontaneously by a set of mobile devices.

Data sharing in opportunistic networks have been studied in projects Haggle[1], Sarah[2], PodNet[3], SocialNet[4], Crowd[5] and Scampi[6]. Haggle [12] takes advantage of contact opportunities and of device mobility in order to follow the "store, carry and forward" principle in the communication between devices. Haggle, PodNet and Crowd implements a publish/subscribe model, where users can express their interests via keywords and receive content items accordingly. PodNet extends the OSNs to opportunistic networks [13]. In Crowd [14], multimedia contents are exchanged via an online Web portal through Wi-Fi hotspots. SocialNet mainly aims at detecting the social links between people to improve the opportunistic forwarding of contents. Social links rely on community memberships, history of contacts, recurrent mobility patterns and/or user interests.

In C3PO, people implicitly express their common interests by physically attending sport or cultural events, and by being members of the SESNs dedicated to these events. Due to the ephemeral nature of the SESNs, the exploitation of information such as the history of contacts or the recurrent mobility patterns is not relevant. Projects Sarah and Scampi [15] both have defined a middleware platform to support communication and service provision in opportunistic networks. They have also implemented Android applications based on these middleware platforms [16]. Sarah allows to discover neighbors, manage a list of contacts, exchange contents in a secure manner. Nevertheless, none of these projects provides incentive tools to support a collaborative production of rich multimedia contents during ephemeral events.

5. Conclusion

In this paper, we have defined the concept of Spontaneous and Ephemeral Social Networks. We have shown their main difference with the traditional social networks, including peer-to-peer based architecture, opportunistic communication, event-related location and time limits, services dedicated to collaborative reporting so as to support micro-journalism from the crowd. The corresponding social networks are created by chance and vanish as people leave the event location. Created contents are persisted on external systems. Scientific locks concern the opportunistic network support for services, the recommendation of contents to members and the definition of an incentive mechanism that boosts the collaborative reporting.

A prototype dedicated to the reporting and the promotion of sport events is currently under development. The objective is to experiment this prototype in real situations, and to have a feedback in order to improve it, and to show how SESNs can contribute to support the micro journalism of the future.

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