Demo: Mobile Opportunistic System for Experience Sharing (MOSES) in Indoor Exhibitions

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ABSTRACT

Information-Centric Networking (ICN) is an alternative architecture for computer networks, where the communication is focused on the data being transferred instead of the communicating hosts. This paper describes a demo of an experience sharing application for mobile phones built on an ICN platform designed for devices with intermittent connectivity. In particular, we detail how this application will be showcased in an indoor exhibition where experience is shared with media content that is geo-tagged using Bluetooth beacons and spread opportunistically to other users.

1. INTRODUCTION

Information-Centric Networking (ICN) is an alternative communication architecture focusing on the content rather than the hosts. It emerged from the observation that the Internet nowadays is mainly used as a content distribution network, where users share and consume content instead of explicitly requesting an end-to-end communication with a remote host.

This architecture is particularly interesting for the most popular applications on the Internet, such as web browsing [6], file sharing [3], or even video streaming [5]. Experimental platforms have been implemented over IP such as DONA [4], CCN [2], or Net-Inf [1] for applications to directly request named content instead of specifying host destination. A convergence layer is typically used to map the requested content to an IP destination hosting that content.

Modifying and revisiting the core architecture supporting these traditional applications is a challenging task, as despite its benefits, any proposed ICN implementation would still compete with mature original host-centric implementations. The emergence of less mature network paradigms such as the Internet of Things (IoT) or Delay-Tolerant Networks (DTN) is a timely opportunity to explore how they can benefit from an ICN architecture and include such architecture in their design. A growing interest is observed in the research community, leading to international research projects and standardisation efforts¹. In the MOSES project, work has been car-

ried out to develop platforms for opportunistic experience sharing in large events and remote areas.

This paper describes a scenario involving a mobile application built with an ICN architecture over a DTN within the MOSES project. The application is an indoor instantiation of the experience sharing platform to be deployed over a set of users participating in an exhibition or conference, and used to share their experience with other fellow participants.

2. SCENARIO

When participating in an exhibition, sharing experience and communicating with other participants is useful to spread information and make new contacts. However, most exhibitions not only lack the appropriate mobile software, but also lack the infrastructure to support such application. Especially in international venues where roaming charges apply for many participants, access to the internet cannot be assumed and relied on by any application.

In this scenario, most participants of an exhibition or conference do not have internet access. However, they do have smartphones featuring communication technologies such as Bluetooth and WiFi, and an embedded camera to take pictures. When the participants are in the exhibition or conference venue, they would like to share their thoughts or comments on products and ideas being presented to fellow participants. Their experience can be shared with multimedia content, but also with simple text messages about related works or products, tips, or even warnings about scams and plagiarism. All shared content is geo-tagged when created so that the content can be made available to fellow participants who are currently in the same location, or will be visiting the area later on.

At any time, users can see the content previously shared by other users within a custom range of their location. When approaching a stall, or entering a room, the relevant information shared by other participants can be read, and photos of demonstrations can be at the location at which they were spotted.

Accessing local information with a limited connectivity to the Internet is made possible using a DTN. When content is created, it is shared with other users in range, using a device-to-device communication link (eg, Bluetooth). Content is then spread in an epidemic fashion, each user sharing their own content and the content collected so far from other users. Only local information is interesting to the users, but their cache might contain content that was created in remote locations, that was epidemically spread to them after several hops. To limit the size of their cache and/or to limit the transfers and save battery, users can choose to only receive, store, and forward, content that are within a custom range of their own location.

¹<http://irtf.org/icnrg>

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Figure 1: The application running on an Android smartphone, and displaying a map of the area with markers indicating where media content were shared by other participants.

This scenario is prone to benefit from an ICN architecture: users are not interested in communicating with a particular device, but are rather interested in getting content, wherever it comes from.

3. IMPLEMENTATION AND DEMONSTRATION

The application is currently implemented on the Android operating system, and has been tested on smartphones. Content is created using the smartphone itself, using the built-in camera and the virtual keyboard on the touch screen for the text messages. The content is then geo-tagged using the either (i) the built-in positioning systems such as GPS, Wi-Fi or cellular-based positioning system, or (ii) for indoor locations, a custom Bluetooth-based position system, that was built by deploying Bluetooth Low Energy devices.

A NetInf implementation for Android is used by the application to communicate with other devices in Bluetooth range. The application regularly sends Search requests that are sent by NetInf to all devices in range. A Search-Response is then returned to the application, with a list of content IDs available, along with the corresponding meta-data. The application then sends a request to all devices in range to get the content it does not already have in-cache. By only requesting the content without specifying hosts, the architecture is information-centric.

Controlled experiments are being conducted in laboratory to study how content is spread and how efficient the system is in different conditions. In parallel, experiments in the wild with real users is important to observe the behaviour of the system in a real environment. The system will be demonstrated during the demo sessions of the ACM Mobicom'14 conference. Five pre-configured smartphones will be distributed to voluntary participants of the workshop and other participants will be invited to download and run the application on their own smartphones, including an implementation of NetInf. Participants will then be invited to run and use the application (as shown in Figure 1) by sharing their experience with media content.

3.1 Customisability

Each exhibition is different, and it is important that the system is easily customisable to new deployments. Therefore, our prototype supports rapid customisation for new events. It allows a new map to be loaded into the system and an edit mode allows an administrator to specify on the map where the Bluetooth beacons are located to make the system ready for use. This will allow us to quickly adapt

Figure 2: Estimote devices, using the Bluetooth Low Energy technology, will be deployed to allow geo-tagging of the content created by smartphones.

the prototype to the floor plan of the Mobicom demo session and deploy a system that is customised to this particular event.

4. SETUP

The demonstration involves both equipment deployment and participants. A table with a laptop and paper versions of this article will be disposed on a table to provide more information to the participants.

4.1 Equipment

Three types of equipment will be deployed: Smartphones, Bluetooth devices, and Raspberry Pis.

Five pre-configured smartphones, with the last version of the application and an adapted version of NetInf pre-installed will be made available for participants to use.

To allow indoor localisation of the content created by the smartphones, 5 devices broadcasting regular Bluetooth signals, called Estimotes², will be deployed around the demonstration area, as shown in Figure 2.

Finally, a Raspberry Pi will be deployed to collect all content created by the participants and emulate an intermittent internet connectivity. The device will act as a simple Wi-Fi access point.

4.2 Participants

While participants will be able to download and install the application on their own device, the current communication technology being Bluetooth, it would require from them to pair their device with a few existing devices. We expect most participants to just use one of the smartphones made available to them, and walk around for a few minutes, sharing and consuming content, and come back to us to give back the smartphone.

5. EXPECTED OUTCOME AND ONGOING WORK

The demonstration will allow to collect important logs to understand how the content is created and spread to the other participants. Such deployment will also provide valuable feedback from the participants to improve the application. Our ongoing work includes optimising the application to use less battery and spread the content more efficiently. We are also designing and deploying this application in other contexts to shape it as a generic experience sharing application.

²<http://www.estimote.com>

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