Extending the Reach of Online Social Networks to Opportunistic Networks with PodNet

Bernhard Distl, Gergely Csucs,
Sascha Trifunovic, and Franck Legendre
Computer Engineering and Networks Laboratory
ETH Zurich, Switzerland
{distl, csucsg, sachat, legendre}@tik.ee.ethz.ch

Carlos Anastasiades
Institute of Computer Science
and Applied Mathematics
University of Bern, Switzerland
anastasi@iam.unibe.ch

ABSTRACT

PodNet is an opportunistic architecture allowing to exchange multimedia content, or podcasts, from mobiles to mobiles in an opportunistic fashion using Wifi. Content can originate from the Internet (e.g., YouTube, BBC) but it can also be user generated content (e.g., pictures or video/voice recordings). We have enhanced the PodNet architecture to extend the reach of online social networking applications (e.g., Facebook, Twitter) to opportunistic networks. We'll demonstrate how Facebook feeds (public or private) are distributed opportunistically among the demo devices that are carried by participants. Using additional PodNet gateway components, content generated in the opportunistic domain can be sent to the Internet (e.g. updates on the Facebook page). Eventually, we will demonstrate an Infoscreen (embedded with a PodNet gateway), which displays useful high-level information (campus life, tram schedules) users can subscribe to, to fetch richer content provided through PodNet.

Categories and Subject Descriptors

C.2.1 [**Computer-Communication Networks**]: Network Architecture and Design—*Wireless Communication*

General Terms

Experimentation

1. INTRODUCTION

We will soon witness the development of opportunistic networking formed by mobile users taking advantage of any wireless contact opportunity using short range wireless technologies (Bluetooth, 802.11 in ad hoc mode). Using publish/subscribe [1] mechanisms, users will be involved in participatory social interactions (content distribution [4], fleamarkets [5], micro-blogs [2]) where they solicit services or content from nodes they encounter directly, without the need for routing. Inputs will spread from their authors to consumers through relays in a delay-tolerant epidemic fashion from hop to hop using mobility [3]. Possible areas of operations range from remote and rural areas, occasional events (e.g., conferences, expositions) to stationary and settled communities (e.g., work teams, military bases), and urban areas.

While we are aware of the increasing availability of cellular Internet connections available on mobile devices, extending the reach of online social networking application (e.g., YouTube, Facebook, Twitter) to opportunistic networks will have several benefits from unloading infrastructures (cellular, content servers) to getting social interactions back to their natural environment, real-world social networks. Besides, opportunistic networks will serve as an extensions to cellular networks in areas with insufficient coverage, but also in situations where costly roaming charges apply. Opportunistic networks will facilitate and foster applications like user generated content (videos), travel blogs, Twitter tweets and Facebook updates by providing them everywhere free of charge.

However, shifting from centralized online social networks to a distributed open environment opens for many new challenges. For example, there will be different requirements regarding the access to information that is distributed – in an epidemic fashion – by the system. While some applications will require full access for everyone interested (e.g., wiki or forum), there will be other cases where only read access is desired (e.g., official podcasts), for adding content may only be done by selected users (e.g., BBC). Sometimes it might be even necessary to limit read and write access for some applications (e.g., calendar sharing with a group, Facebook feeds).

The proposed demo illustrates three use cases of the PodNet architecture. The first one is podcasting with traditional and collaborative user created podcasts. The second is Facebook feeds that can be received and updated in an opportunistic environment to and from the wired Internet. The last one is is an Infoscreen – public information LCD screen embedded with a PodNet gateway – displaying general information with richer content available through the gateway.

2. RESEARCH FRAMEWORK

PodNet is a research project of the Communication Systems Group at ETH Zurich together with the Laboratory for Communication Networks, KTH Stockholm that was started

MobiOpp '10, February 22-23, 2010, Pisa, Italy.

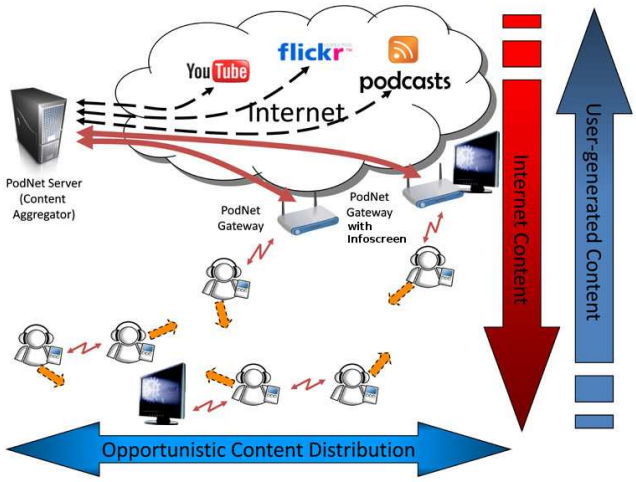
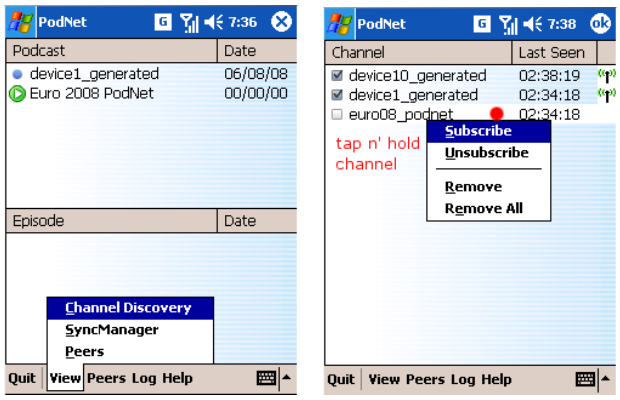


Figure 1: The PodNet architecture



(a) Open channel discovery (b) Subscribe to a channel

Figure 2: Screenshots

in 2006[1]. The research within this project focuses on various topics including but not limited to mobility modeling and measurements, content spreading, and security and privacy protection.

To address opportunistic issues as extensively as possible, additionally to modelling and simulations, a practical testbed and proof-of-concept implementation was created for this project. It is used mainly to verify simulation results and collect mobility traces. It also serves to shed some light on opportunistic networks research from a practical point of view.

Through the course of the PodNet project, the testbed was increased in size and now a complete architecture allows bringing Internet based content to the opportunistic realm and vice versa with gateway devices and a PodNet server as illustrated in figure 1.

3. OPPORTUNISTIC CONTENT DISTRIBUTION - DEMO DESCRIPTION

As mentioned in the introduction, the demo will show three different applications of PodNet. First, the opportunistic podcasting case. There, the participants will be able to use traditional podcasts that are delivered using opportunistic communications as well as user-generated collaborative podcasts, that are generated by the users themselves and then made available on the Internet. Second, the dissemination of Facebook updates in the opportunistic realm to and from the Internet. Eventually, an infoscreen displaying high-level information about the conference will provide further information through PodNet.

3.1 Opportunistic Distribution

In general, the PodNet program runs on various platforms and device types ranging from Linux to Windows Mobile and Symbian. This demo will feature Windows Mobile based devices with Wifi. The user interface is stylus operated (see screenshots later). A second class of devices will also be part of the demo - Infoscreens. Infoscreens are PodNet gateways connected to a large screen which shows the content of specific channels (e.g. today's menu, upcoming events). Infoscreens can act as PodNet clients only or as gateways if an Internet uplink is available on the Infoscreen.

To give the participants more insight into what their devices neighborhood and its current status look like, there are some information screens available. They allow users to view who else is in range, who they are connected to and who they already synchronized with. This information is available on two dedicated screens that can be opened anytime.

3.2 Subscribing and Viewing Available Podcasts

The traditional podcasts are initially available only via the PodNet server and gateways (which look like any other device in the opportunistic realm). As users subscribe to and receive such podcasts, this content will also be served by devices that already downloaded it. Collaborative user-generated podcasts are also preconfigured and ready for use. They can also be created by the users during the demo.

Participants will be able to browse through all available podcasts on a dedicated screen and also use this screen to subscribe to the podcasts they are interested in. This can be seen in the screenshot in Figure 2.

As soon as a user has subscribed to a podcast, the device will automatically download episodes when it opportunistically encounters another device that already has content for this podcast. Podcast details can be shown and if there is an enclosed media file, it can be opened and played from within the application.

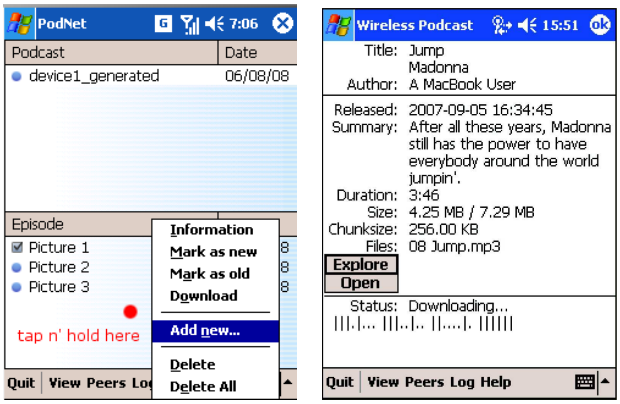
3.3 Adding User Generated Content

Users are not restricted to a passive consumer role, they can also create content and share it using the same opportunistic distribution mechanism. It is very easy for users to create new podcasts or add new episodes to existing ones. However, the PodNet system prevents users from adding episodes to "official" podcasts like BBC news (which are read only for the users). A new episode or podcast can be created with a single click as illustrated in Figure 3.

3.4 Receiving and Posting Facebook Feeds

The second feature available to the demo participants is the reception of Facebook feeds using the opportunistic content distribution system. There will be Facebook accounts

[1]http://podnet.ee.ethz.ch



(a) Create new episode (b) Episode details

Figure 3: Screenshots

prepared for users to try this feature.

A Facebook feed is not necessarily a public information that should be available to all others. We hence use the security features of the PodNet system to limit access to specific users only. For demo purposes, there will also be some world readable feeds available (which will be also displayed on the Infoscreens). Users opportunistically receive updates for their streams and can also add items to their feed while on the move. Those updates will be sent out using opportunistic networking until they reach one of the gateway devices, from where they will be published on the Facebook page by the PodNet server.

3.5 Automatic Content Display on Infoscreens

Additionally, there will be another class of devices shown that are called Infoscreens. The purpose of Infoscreens is to show selected channel information to anyone passing by (Figure 4). Infoscreens can be configured to show any channel content they have read access to. Infoscreens can be embedded into the opportunistic domain (with a PodNet gateway acting as a PodNet device only) and serve as a stationary cache for content. Infoscreens could also be connected to the PodNet server thus acting as a regular PodNet gateway.

The Infoscreens will be preconfigured to show the content of some channels and some Facebook feeds. As the Infoscreens behave like any other PodNet device, they will opportunistically update and serve the content they are set to display. The content displayed on the screen will automatically update with every opportunistic exchange that results in new content being available on the Infoscreen.

4. TECHNICAL REQUIREMENTS

The demonstration presents a minimalist version of the architecture comprising the PodNet server (ThinkPad T60 laptop), one PodNet gateway (ASUS WL-500G Premium), a couple of handheld devices running our PodNet application on different OSs (i.e., HP iPAQ / Windows Mobile, HTC / Windows Mobile devices, Nokia N95 / Symbian) and an Infoscreen (embedded Linux device connected to a TFT screen). The wireless communication is done using IEEE 802.11 in ad hoc mode. The devices will be distributed to attendees during the demo possibly with the offer to install

Figure 4: Infoscreen with screenshot

the software directly on the participants devices (depending on compatibility). The demo requires a power outlet and an Internet access (wireless or wired) for the PodNet server.

5. REFERENCES

[1] P. Eugster, P. A. Felber, R. Guerraoui, and A.-M. Kermarrec. The Many Faces of Publish/Subscribe. *ACM Computing Surveys*, 35:114–131, 2003.

[2] S. Gaonkar, J. Li, R. R. Choudhury, L. Cox, and A. Schmidt. Micro-Blog: sharing and querying content through mobile phones and social participation. In *ACM MobiSys*, New York, USA, June 2008.

[3] R. Groenevelt, P. Nain, and G. Koole. The message delay in mobile ad hoc networks. *Perform. Eval.*, 62(1-4):210–228, 2005.

[4] G. Karlsson, V. Lenders, and M. May. Delay-Tolerant Broadcasting. *IEEE Transactions on Broadcasting*, 51(1), March 2007.

[5] E. Oliver. Enabling the next frontier in mobile applications. poster/demo session. In *ExtremeCom*, 2009.