

NFC experiments in the NFC city project*

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1 Introduction

In the NFC city project¹ some initial experiments with context sensitive social networking applications have been performed. These experiments explore how Near Field Communication (NFC) technology can contribute to improve the overall functionality and user experience of such applications. The outcome of these experiments is a set of tools, libraries, and new applications that demonstrates the usefulness of NFC technology.

NFC (Near Field Communication) tries to harmonize today's diverse contact-less technologies, enabling current and future solutions like access control, ticketing, payment, loyalty programs, discount coupons, and information collection and exchange.

By utilizing existing technologies to provide NFC services within ticketing, payment and physical access, the project will create an arena where services from different providers can run independently and with good usability on the same mobile handsets. In this context these initial NFC experiments with context sensitive social networking applications have been performed [4]. The applications are implemented for the Android mobile platform communicating with servers running on traditional computers.

2 NFC

NFC-Forum [6] describes the technology as follows: *Near Field Communication (NFC) technology makes life easier and more convenient for consumers around the world by making it simpler to make transactions, exchange digital content, and connect electronic devices with a touch.*

In short, NFC is a set of short-range wireless technologies. Where Bluetooth works within a range of 10 meters with a maximum bandwidth of 2.1 Mbit/s, NFC is limited to distances as short as 4 cm, and with a bandwidth ranging from 106 kbit/s to 424 kbit/s. NFC can be implemented in all types of devices, including your smart phone, tablet, computer and car.

NFC always involves an initiator and a target; the initiator actively generates an RF field that can power a passive target. This enables NFC targets to take very simple form

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¹<http://www.nfccity.net>

factors such as tags, stickers, key fobs, or cards that do not require batteries. NFC peer-to-peer communication, where both devices are powered, is also possible. However, the limited bandwidth makes it inferior to Bluetooth for big data transfers.

NFC tags contain data, and may be configured to be read-only or rewritable. The payload is described by a type, a length, and an optional identifier. The type identifiers may be URIs, MIME media types, or NFC-specific types. The tags can securely store personal data [3] such as debit and credit card information, loyalty program data, PINs and networking contacts, among other information.

3 The Experiments

To enable a simpler development process of NFC applications on the Android platform, we have developed an Eclipse library. The library contains extendible Activity classes for reading and writing to tags, P2P, and Bluetooth pairing of Android devices. It reduces the code required when creating NFC applications by hiding much of the boiler plate code from the application developer.

NfcPresenter

NfcPresenter is an Android application that simplifies the user-computer interaction by creating a more intuitive way to present slide-show presentations. Traditionally, starting a presentation is a cumbersome process. The person doing the presentation usually has two alternatives; either connecting his own laptop to the projector, or transfer the presentation with a USB memory stick to a local computer which is already connected. Both routines are unnecessary tedious.

With NfcPresenter we aim to create a smooth and painless presentation experience by utilizing NFC technology. Starting a presentation can be done by selecting the appropriate presentation file on the mobile device, and touching it to an NFC tag present at the presentation location. Simple as that. When the presentation has started, the Android device serves as a remote control. With a swipe you can show the next or previous slide. In addition each slide is shown on the screen of the mobile device for better control.

NfcPresenter also lets a spectator download the currently active presentation to his own mobile device by scanning a tag. This is a useful feature for distributing presentation material.

NfcPresenter utilizes NFC to collect the URL from a tag present at the presentation location. The URL directs to a server running on the local presentation computer, which is already connected to the projector. The application uses the recently acquired URL to upload the presentation file to the server. The server starts the presentation, and can now answer to other commands to control it remotely.

NfcSafari

NfcSafari is a tour guide application that aims to help people discover, experience and remember interesting locations and spots. The general application area is giving tourists visiting cities and locations for the first time a helping hand by guiding them to interesting sightseeing spots. The overall goal of creating the application is to explore how NFC can be utilized in pervasive applications.

The application initiates the tour by using the current location of the user to find nearby spots. The user is given a choice between the three closest spots, and the user will start

the Safari by choosing one of them. The next screen shows a map, guiding the user from his current location to the spot he chose.

When the user finds a spot, he needs to touch the nearby NFC tag to register his presence. By reading the ID of the spot, the application knows what web service to contact to download a description of the spot. If the user is logged in, he can share information about the spot through Facebook. It is also possible to give the spot a rating from 1 to 5 stars. When the user is happy with the experience he can continue the tour.

PartyShare

The goal of PartyShare is to bring multimedia from handheld devices to stationary devices in a seamless manner. It consists of a client running on an NFC enabled Android device, and a server running on a computer. The application lets you choose to share music or images from the android device to the computer in real-time. The transfer is done simply by touching the android device to the stationary device. As a result, the images are viewed and the music is played immediately.

PartyShare uses the HTTP protocol to transfer the multimedia from the Android device to the computer. The relevant URL is stored in the NFC tag. The ImageViewer, which displays the latest image, is created using Pygame, and the music sharing is implemented using a self made libspotify-wrapper (spotipy). On the client side we use internal Android activities to handle the camera and the gallery to choose image, and the Spotify meta data API to choose music. The music sharing works by transferring a Spotify URI which is then used by spotipy to play the song.

NFC quiz

“NFC quiz” is a simple quiz application where a phone is used to touch an NFC tag to provide an answer in a quiz game. The user sees a large screen (projector screen) that presents the quiz game. The phone is used as an input device for the game. Buttons or selection areas are touched with the phone to interact with the quiz. Each such area have an NFC tag representing the selection. The NFC tag is attached to the back of the screen and is not visible for the user. Depending on the context, touching such an area has different meanings. During the quiz three of these areas represent suggested answers where the user is supposed to select one. If the user succeeds with more than a given threshold level of correct answers, the quiz application is used to write a gift code to an NFC card. The user can then bring this with him to pick up a price. In our experiments this was a free coffee or drink at a nearby café.

Are You The One?

“Are You The One?” is a quirky “love tester” that calculates the compatibility between two persons. The goal of the application is to illustrate how NFC can be used in social scenarios. The application works by having the user enters his or her name, and then touch another handset with the same application. As a result their “love match”, or compatibility, is visualized on screen as a percentage. The compatibility is calculated deterministically using their names, and obviously has no basis in reality. Nevertheless, it is a fun example of a small application which delivers something new by incorporating NFC as a vital component.

BluetoothChat

This application is mostly an example application to show how NFC can be used to do setup and configuration. It is a simple chat client which enables users to set up a connection by touching each other's phone and chat via Bluetooth. The application can easily be extended to a secure generic (not limited to Bluetooth) chat application. When two phones are touched we can exchange public encryption keys, and later use these keys to encrypt messages and authenticate the other participant.

4 Conclusion

NFC is useful in many areas, such as payment, information sharing [7, 5], security [3], configuration, and social interaction [2]. It acts as a link between the physical and virtual world, giving us a simpler and more intuitive way of sharing information [1]. One of the properties of NFC is that context is implicitly defined. This stems from the very short range of the tags. This can simplify many aspects of development, including security and configuration. Apart from payment, we feel that NFC for mobile devices are most useful where it can simplify the user-interactions of services or applications. The best example is setting up connections for Wi-Fi or Bluetooth, as exemplified in BluetoothChat. A task that can be tedious is replaced by an intuitive gesture that connects touching devices.

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