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International Journal Of Engineering And Computer Science ISSN:2319-7242
Volume 3 Issue 6 June, 2014 Page No. 6509-6512

Near Field Communication for Transferring Files between Pair of Supported Devices

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Abstract: ***We explore new ways in which Near Field Communication (NFC) can be used on smart phones. NFC allows for Contextual Application Invocation (CAI)—the execution of code on the phone as a result of our environment. We can launch applications because of contextual information we learn from another transaction on our phone, or we can associate with a context virtual token to recall at a later time. We can also pass context from one phone to another so the devices can interact in a multi-party session***.

Keywords: NFC - Near Field Communication, CAI - Contextual Application Invocation, WPAN - Wireless Personal Area Networks.

1. Introduction

NFC is a short-range high frequency wireless communication technology that enables the exchange of data between devices over about a 10 cm distance. The concept is fairly similar to how you would use the EZ-Link card locally; you tap or bring two devices close to one another to exchange information. NFC is an upgrade of the existing proximity card standard (RFID) that combines the interface of a smartcard and a reader into a single device. It allows users to seamlessly share content between digital devices, pay bills wirelessly or even use their cell phone as an electronic traveling ticket on existing contact less infrastructure already in use for public transportation. NFC can also work when one of the devices is not powered by a battery (e.g. on a phone that may be turned off, a contact less smart credit card, etc.).

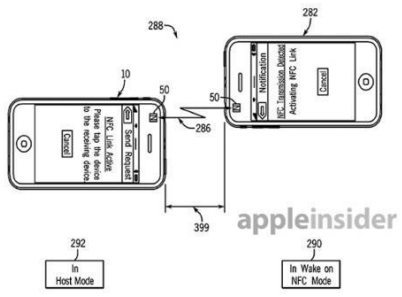

Figure 1: NFC media sharing

2. How NFC Works?

NFC is basically an evolution of radio-frequency identification (RFID) technology. It uses magnetic field induction to enable communication between devices which are close together. There are certain **operations** which are explained in three sections: signal technologies, tag types and modes of operation.

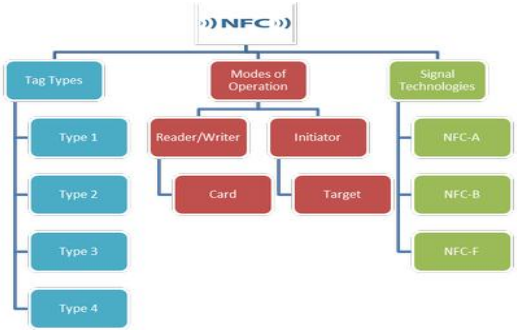

Figure: 2 NFC Operations

A radio frequency (RF) sine wave generated by the reader is used to transmit energy to the tag and retrieve data from the tag. When the NFC in the device is active then it continuously

generates periodic sine wave signal at frequency 13.56 MHz center frequency. If there is any tag within the area of magnetic flux generated by the sine wave, tag gets energy from the magnetic fluxes and create counter frequency or change the frequency properties of the original sine wave generated by phone. The changes are detected by the phone and phone knows that there is a tag nearby. RFID systems communicating on very short range are commonly known as close couple systems. The range where communication is considered to be close coupled is between 0 and 1 cm. This means that the tag has to be placed either in the reader or more or less pressed against the reader device. The benefit from these short distances is that a rather large amount of energy can be extracted from the magnetic field by the tag. More energy is available for signal processing in the tag at this distance without the need for a power supply in the tag. Close coupling is also preferred for systems with high security requirements. Following figure shows some simplified relation between NFC applications to NFC hardware.

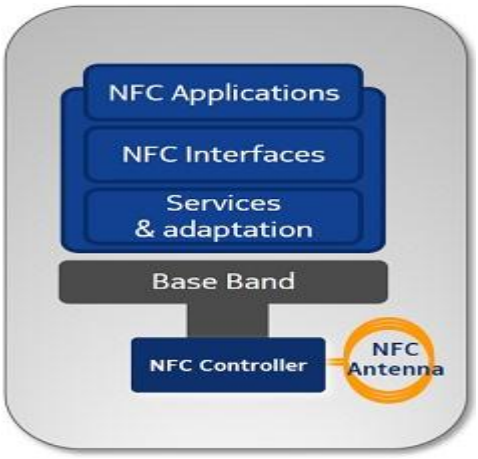

Figure: 3 Work of NFC

2.1 Sending process:

Depending on if current device is the group owner, we have to create local socket or connect to the remote one. We need to open input stream on given file and output stream on target socket. Then we transfer the file and notify main activity with a broadcast.

```
private void sendFile(final Uri fileUri, final InetAddress address) throws IOException {

BufferedInputStream input = null;
BufferedOutputStream output = null;
ServerSocket server = null;
Socket client = null;
try {
if (address == null) {
server = new ServerSocket(SOCKET_PORT);
client = server.accept();
}
else {
client = new Socket();
client.connect(new InetSocketAddress(address, SOCKET_PORT));
}
input = new BufferedInputStream(getContentResolver().openInputStream(fileUri));
output = new BufferedOutputStream(client.getOutputStream());
int oneByte;
while ((oneByte = input.read()) != -1)
{
output.write(oneByte);
}
Intent intent = new Intent(BROADCAST_ACTION_SENT);endBroadcast(intent);
}
finally {
try {
if (input != null) {
input.close();
}
}
finally {
try
{
if (output != null) {
output.close();
                }
            }
            finally {
            if (server != null) {
            server.close();
            }
             else if (client != null)
            {
            client.close();
            }}}}}
```

2.2 Receiving side

Receiving file is implemented very similar to sending. The only difference is that we open input stream on socket and output stream on generated target file.

```
private void receiveFile(final InetAddress address) throws IOException {
BufferedInputStream input = null;
BufferedOutputStream output = null;
ServerSocket server = null;
Socket client = null;
File file = getFile();
try {
if (address == null) {
server = new ServerSocket(SOCKET_PORT);
client = server.accept();
}
else {
client = new Socket();
client.connect(new InetSocketAddress(address, SOCKET_PORT));
}
input = new  BufferedInputStream(client.getInputStream());
output = new BufferedOutputStream(new FileOutputStream(file));
```

```
int oneByte;
while ((oneByte = input.read()) != -1) {
output.write(oneByte);
                                        }
Intent intent = new
Intent(BROADCAST_ACTION_RECEIVED);
intent.putExtra(BROADCAST_ACTION_RECEIVED_EXTR
AS_FILE, file);
sendBroadcast(intent);
}
finally {
try {
if (input != null) {
input.close();
}
} finally {
try {
if (output != null) {
output.close();
}
}
finally {
if (server != null) {
server.close();
else if (client != null) {
client.close();}}}}}

private File getFile()
{
Time time = new Time();
time.setToNow();
return new File(getExternalFilesDir(null) + File.separator +
time.format("%Y%m%d%H%M%S"));
}
```

3. File sharing between two devices

NFC allows peer- to-peer communication, Payment & ticketing and Service initiation. where NFC is used to enable communication between two devices.

- Peer-to-Peer is used for communication between two devices.
- Payment & ticketing will build on smart ticketing and electronic payment infrastructures.
- Service initiation is used to perform service lock or to unlock another service.

In **File Sharing** applications, NFC can be used to set up local communication between two devices. For relatively small amounts of information (up to a few kilobytes), NFC can be used to transmit the data itself, as this can be exchanged during the short period of time the NFC devices are touching each other. However, for larger amounts of data, NFC is more likely to be used to establish a separate wireless connection (such as Bluetooth or WiFi) to carry the content to be exchanged. A typical peer-to-peer application would be printing photos straight from a picture phone or digital camera: the user would simply select the photo or folder to be printed and then touch the device against the NFC-enabled printer to establish a Bluetooth connection to transmit the digital photos.

Figure : 4 File sharing using NFC

In the future, with a view to incorporating this technology into mobile phones, PCs and PDAs, we intend to make a concerted effort to develop this technology to make it operate faster consume less power.

4. Need For Research

The performance of NFC is better as compared to other technologies and best to connect network within some distances. There is no any type of problem of hackers or say threat as our phone itself is the transmission media. These days the main issue is transmit important File. It is solved by NFC. It provides very high speed within very short distances. The evolution of NFC technology is a big achievement and which will likely be targeted for use in applications such as Commercial, Social networking, Bluetooth and WiFi connections, and Identity documents. This could get as simple as two people equipped with NFC devices being able to exchange data such as text files as well as business cards just by putting phone near to each other.

How NFC is better compare to Bluetooth.

Aspect	**NFC**	**Bluetooth**	**Bluetooth Low Energy**
RFID compatible	ISO 18000-3	Active	Active
Standardization body	ISO/IEC	Bluetooth SIG	Bluetooth SIG
Network Standard	ISO 13157 etc.	IEEE 802.15.1	IEEE 802.15.1
Network Type	Point-to-point	WPAN	WPAN
Cryptography	not with RFID	Available	Available
Range	< 0.2 m	~10 m (class 2)	~100 m
Frequency	13.56 MHz	2.4–2.5 GHz	2.4–2.5 GHz
Bit rate	424 kbit/s	2.1 Mbit/s	~1.0 Mbit/s
Set-up time	< 0.1 s	< 6 s	< 0.006 s
Power consumption	< 15mA (read)	varies with class	< 15 mA (read and transmit)

Table 1 Comparison between Bluetooth and NFC

5. Conclusion:

Providing secure channel will avoid the draw backs such as eavesdropping or data modification. NFC is compatible with existing RFID infrastructures. NFC is an efficient technology for communications with short ranges. We have presented our vision of how smart phone applications will change when NFC becomes commonplace. NFC will allow what we term contextual application invocations. Applications can be invoked as a side-effect (attachment) of another transaction that provides it meaningful context. Applications can also be launched to exchange tokens, with our phones responding to the context of the token grantor. Finally, one phone may provide context to another to create a junction between them, allowing them to partaket in a cross-device activity. We have implemented the Junction platform and written several applications for it, demonstrating the usefulness of programmable NFC on smart phones.

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