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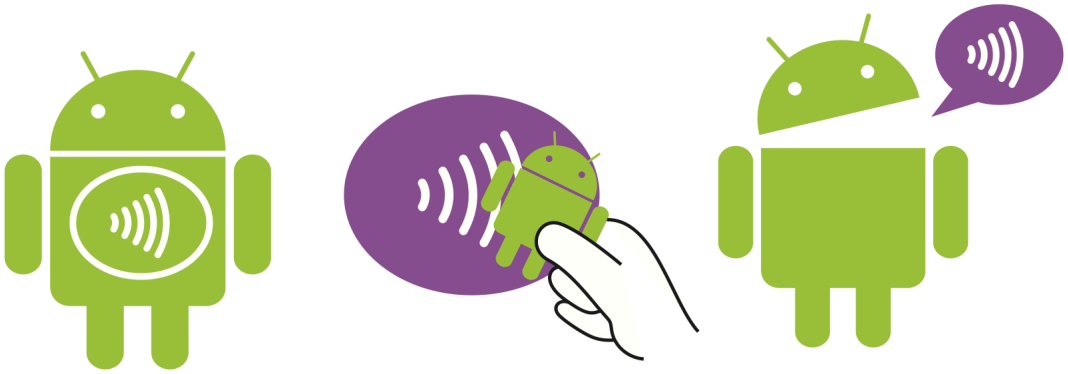

How to NFC

Nick Pelly & Jeff Hamilton
May 10th, 2011

feedback: http://goo.gl/syzQy

hashtags: #io2011 #Android

questions: http://goo.gl/mod/EkbN

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Agenda

- What is NFC
- Why use NFC
- How to NFC 101
- How to NFC 201

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What is NFC

What is NFC

- Near Field Communications
- Short range wireless (1-4cm typical, 10cm theoretical)
- Low speed (106 to 424 kbps)
- Low friction setup (no discovery, no pairing)
- Passive targets (look ma', no batteries)

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Why use NFC

Bridging the Physical and the Virtual Worlds

Demo – Basic tag read

- Tag's can be embedded in stickers
- Touch to read
- No need to launch an application
- Like QR Codes....but faster

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Demo – Tag Content

- Tag's can contain:
  - URL
  - Text
  - Contacts
  - ...any MIME type

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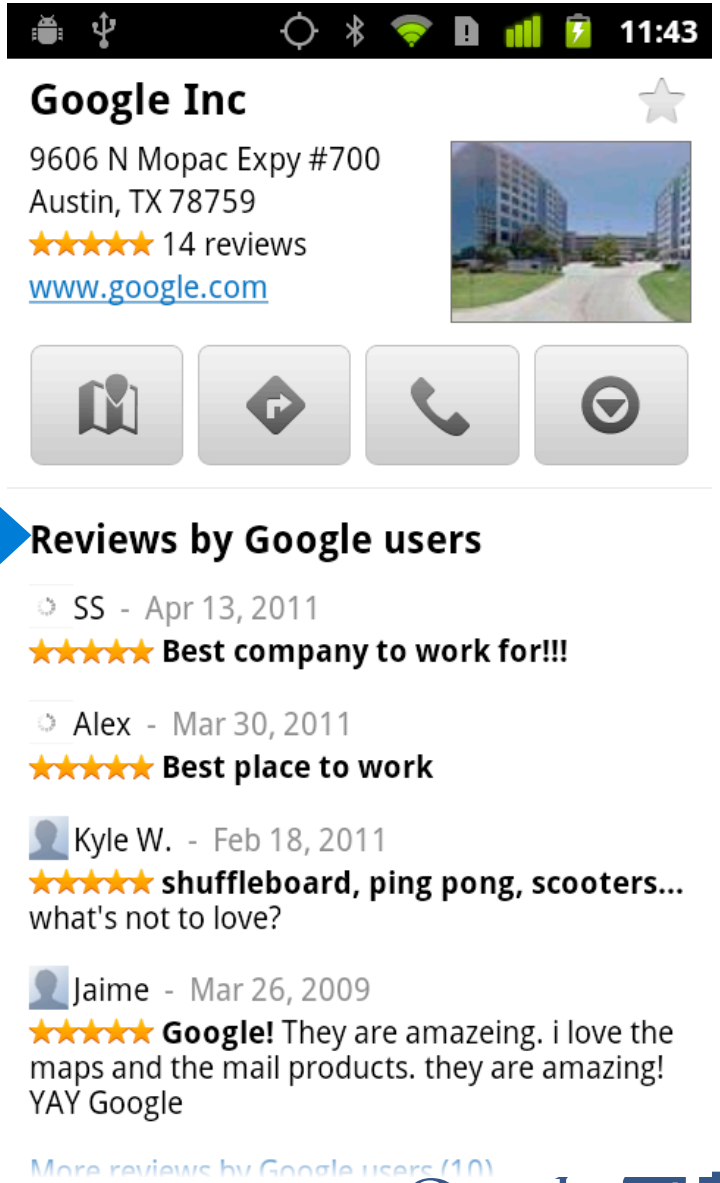
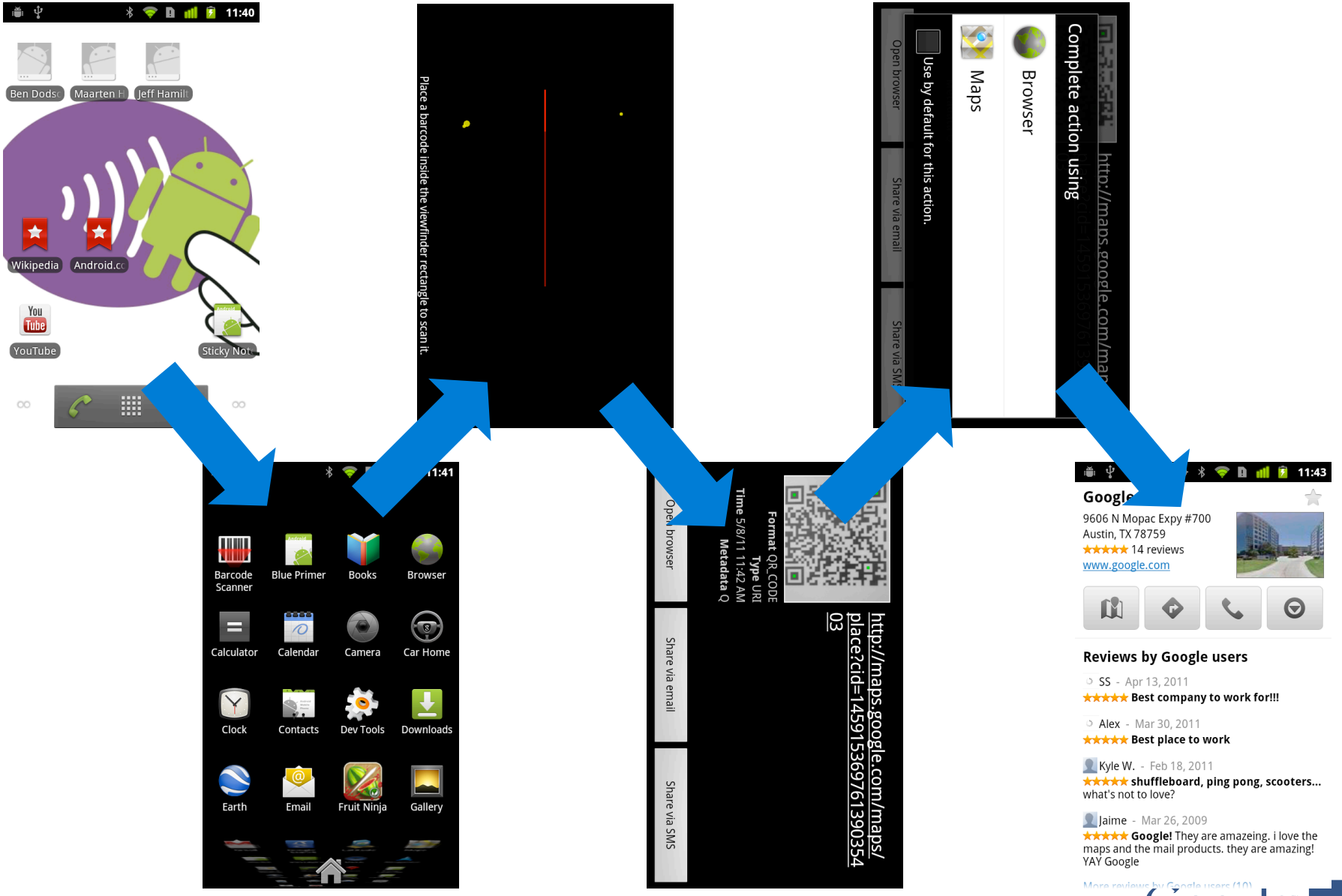
NFC – Low Friction



Demo – NFC vs QR-Code



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Demo – Sticky Notes

- Gingerbread has developer API's for:
  - Tag Read
  - Tag Write (Yes, Tags can be writable!)
  - Peer-to-peer
  - (and a lot more)

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Demo – Google Talk Portal

- Tag Read to initiate a connection through the cloud

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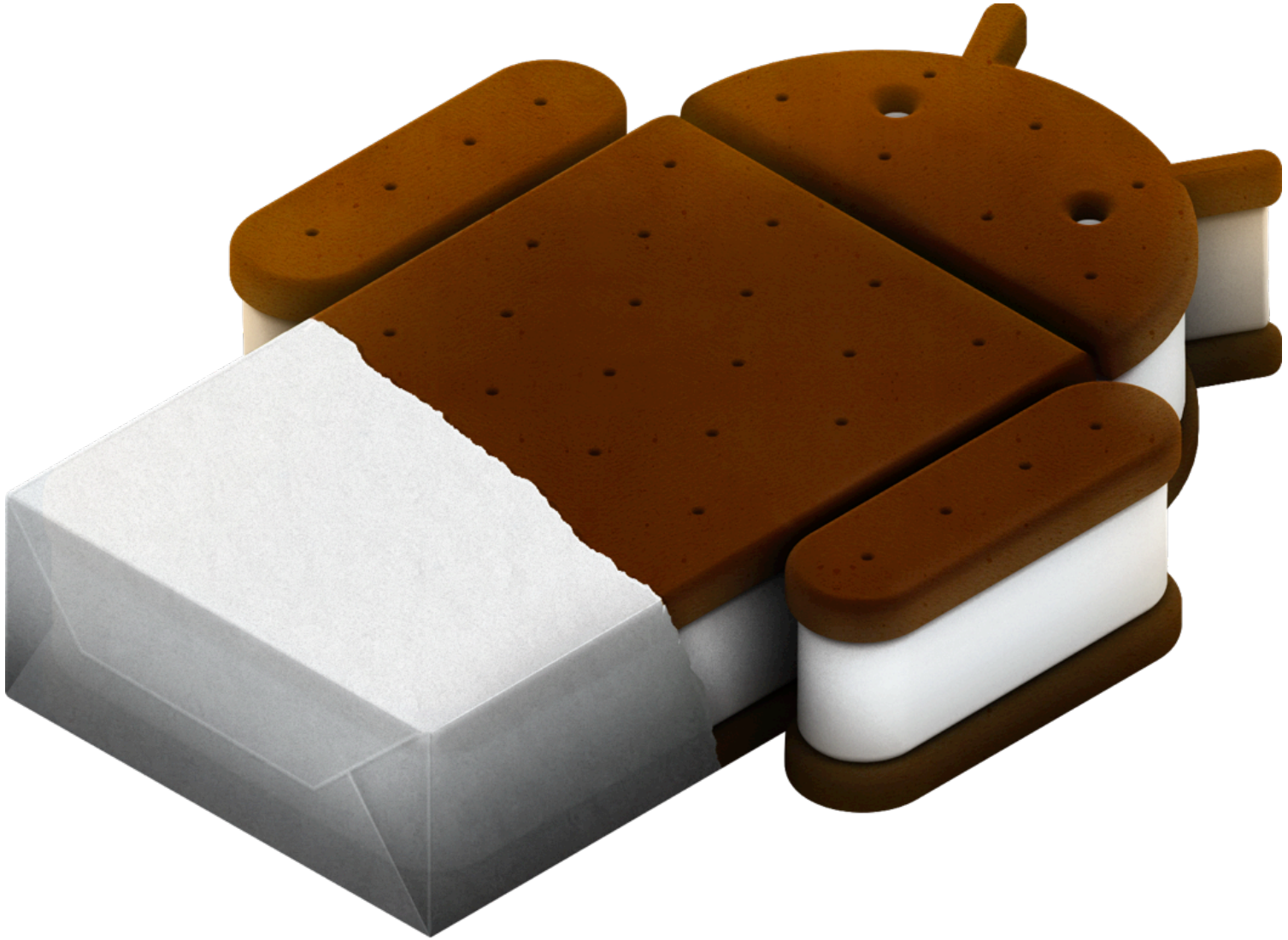
Demo – Fruit Ninja

- NFC peer-to-peer to initiate connection
- Connection handover to Bluetooth

Ice Cream Sandwich Preview



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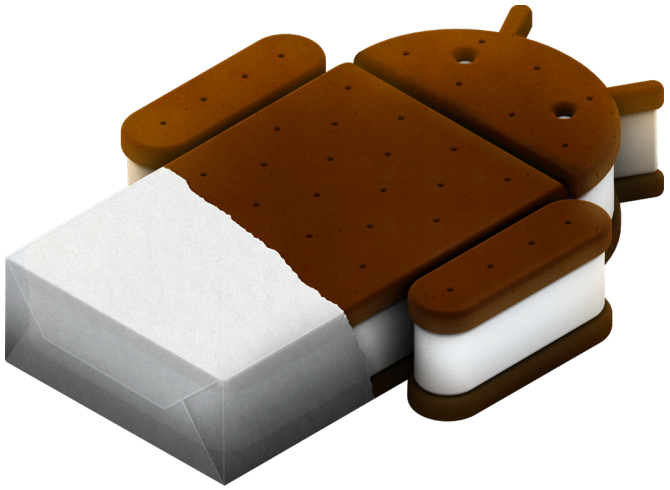
0-click

A new peer-to-peer interaction model

0-click contact sharing

0-click web page sharing

0-click youtube video sharing



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0-click

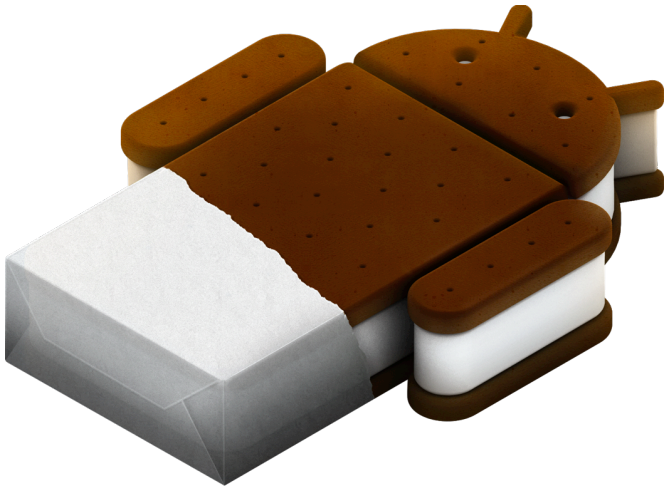
A new peer-to-peer interaction model

0-click contact sharing

0-click web page sharing

0-click youtube video sharing

0-click application sharing



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How to NFC, 101

How to NFC

- Reading
  - NDEF
  - Dispatching
- Writing
  - NDEF to a tag
  - NDEF to P2P
- Advanced
  - Beyond NDEF: Tag technologies
  - Advanced Dispatching
  - NFC and Bluetooth
  - Security & Privacy

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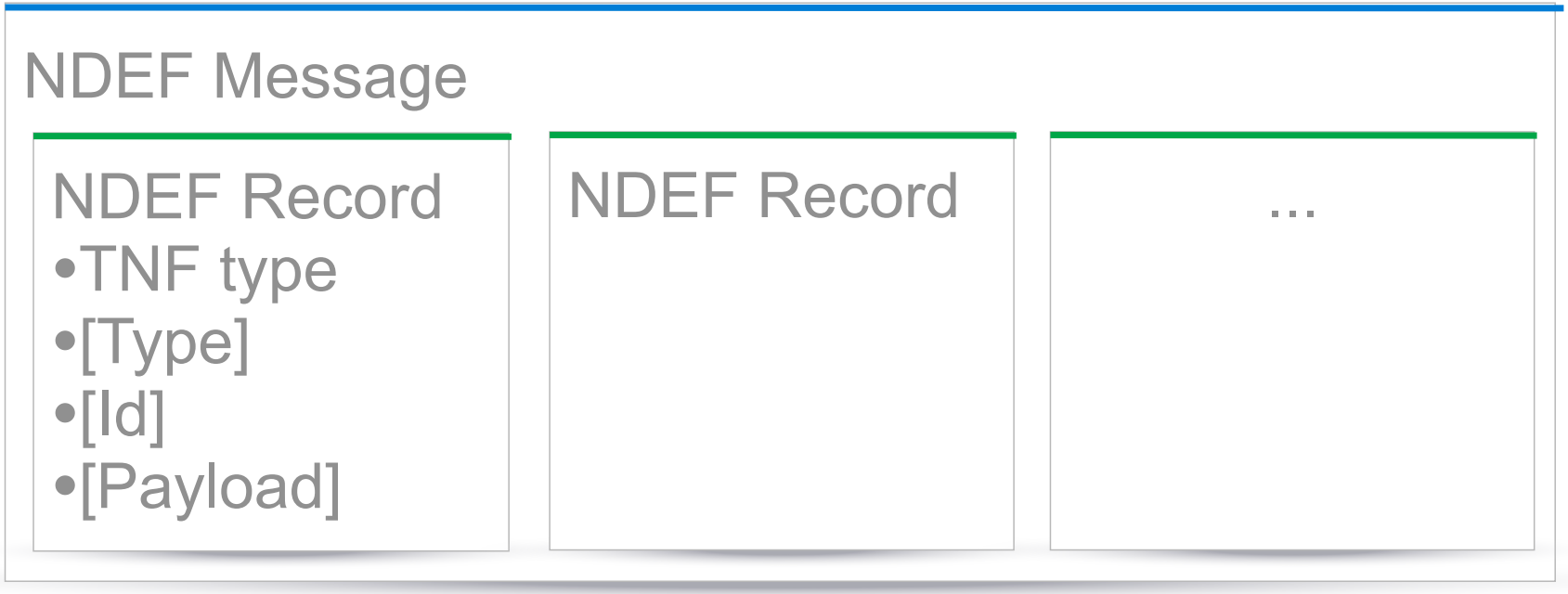
Standards – NDEF

Nfc **D**ata **E**xchange **F**ormat

- *The* data container format for NFC



See NdefMessage and NdefRecord classes

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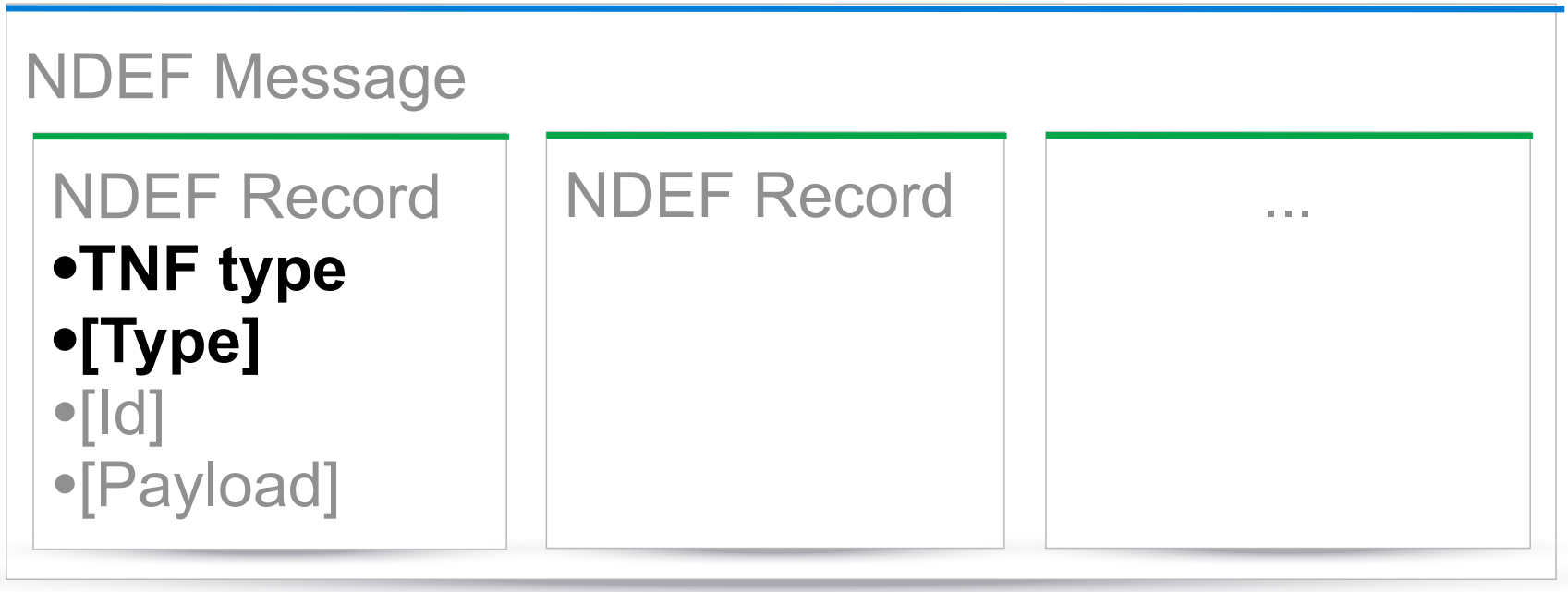
Reading NDEF

Part 1 – Dispatch

- By design, NDEF data is dispatched to only **one** activity
- The type of the first NDEF record is used for dispatch



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Reading NDEF

Part 2 – Different Dispatch Types

TNF_WELL_KNOWN
RTD_TEXT
“The lazy dog jumped...”

→ `<data android:mimeType="text/plain" />`

TNF_MIME_MEDIA
text/plain
“The lazy dog jumped...”

TNF_MIME_MEDIA
application/vnd.example
0100100110101110 0

→ `<data android:mimeType="application/vnd.example”/>`

TNF_WELL_KNOWN
RTD_URI
http://example.com/foo

→

```
<data android:scheme=”http”
android:host=”example.com”
android:path="/foo”/>
```


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Reading NDEF

Part 3 – Receiving

AndroidManifest.xml:

```
<intent-filter>
  <action android:name="android.nfc.action.NDEF_DISCOVERED" />
  <data android:mimeType="text/plain" />
</intent-filter>
```

MyActivity.java:

```
protected void onResume() {
    ...
    NdefMessage msg =
        getIntent().getParcelableArrayExtra(NfcAdapter.EXTRA_NDEF_MESSAGES)[0];
    Byte[] payload = msg.getRecords()[0].getPayload()
    ...
}
```


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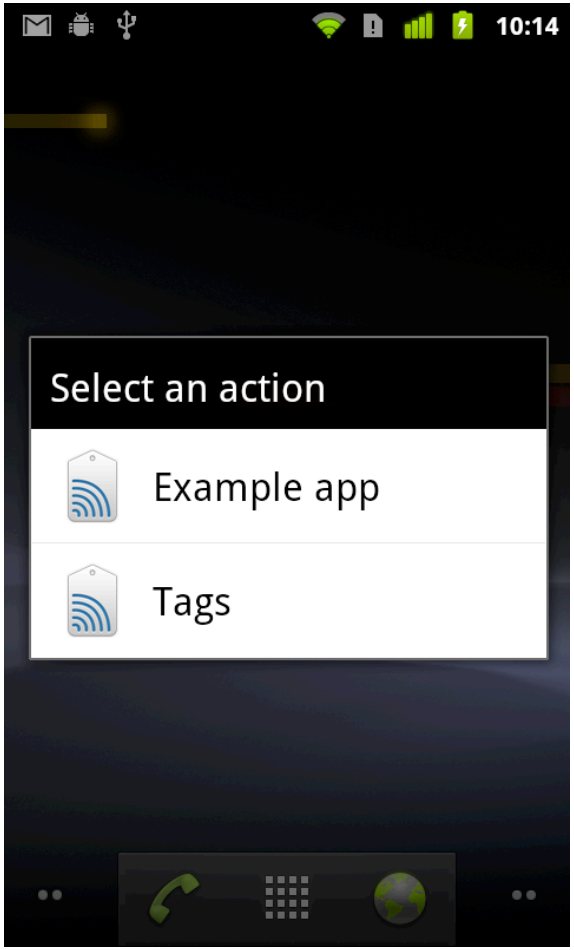
Reading NDEF

Part 4 – Best Practices

- Always use precise intent filters



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What can I read NDEF from?

- Passive NFC Forum Tags
  - Tag Type 1: Topaz ™
  - Tag Type 2: MIFARE Ultralight ™
  - Tag Type 3: Felica ™
  - Tag Type 4: MIFARE Desfire ™
- Proprietary NFC Tags
  - MIFARE Classic ™ (supported by Nexus S)
- Peer to Peer Devices
  - Android to Android

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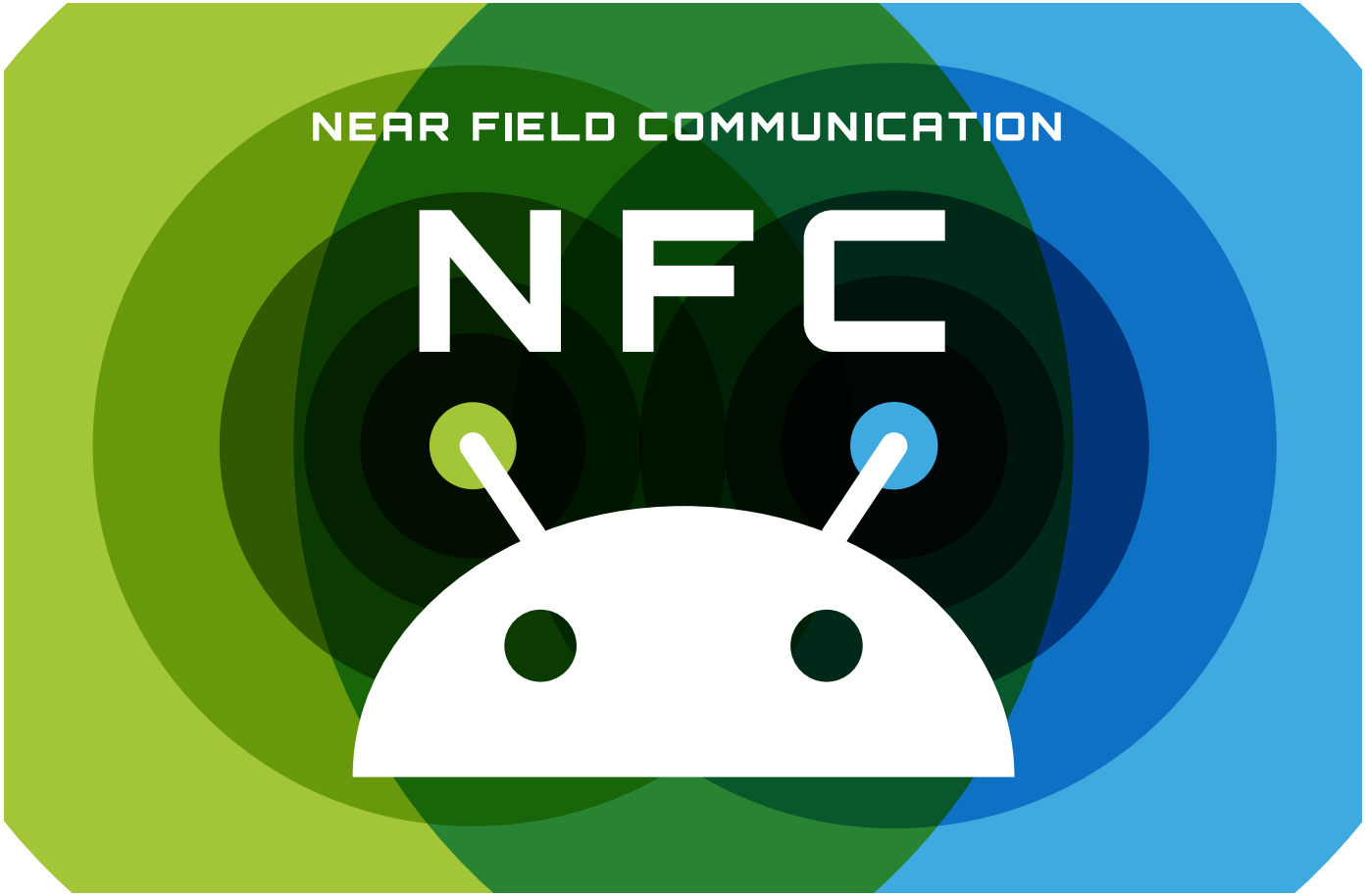
NFC Stickers



Type 4 Tag, 2KB

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Writing – Passive tags

- NDEF Tags can be writeable

  Write the payload while the tag is in the field

```
String text;
NdefRecord textRecord = new NdefRecord(NdefRecord.TNF_MIME_MEDIA,
    "text/plain".getBytes(), text.getBytes());
NdefMessage textMessage = new NdefMessage(new NdefRecord[]{textRecord});
Tag tag = getIntent().getExtra(NfcAdapter.EXTRA_TAG);
Ndef ndef = Ndef.get(tag);
ndef.writeNdefMessage(textMessage);
```


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Writing – Peer to Peer

- **Foreground** Activities can register an NDEF payload for P2P push

  Register the payload in advance

```
adapter.enableForegroundNdefPush(this, ndefMessage);
```

- Ice Cream Sandwich preview

  Register interest in P2P in advance, push the payload live

```
public interface NdefPushCallback {
    public NdefMessage createMessage();
}
adapter.registerForegroundNdefPush(this, callback);
```


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How to NFC, 201

We've talked about

- NDEF Tag Read
- NDEF Tag Write
- NDEF peer-to-peer

...

...are all NFC Tags NDEF?

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Beyond NDEF…

There are over 5 billion NFC tags already deployed, that you might want to read or write, but most of them do not contain NDEF

- Transit
- Credit Cards
- Passports
- Physical Access Cards

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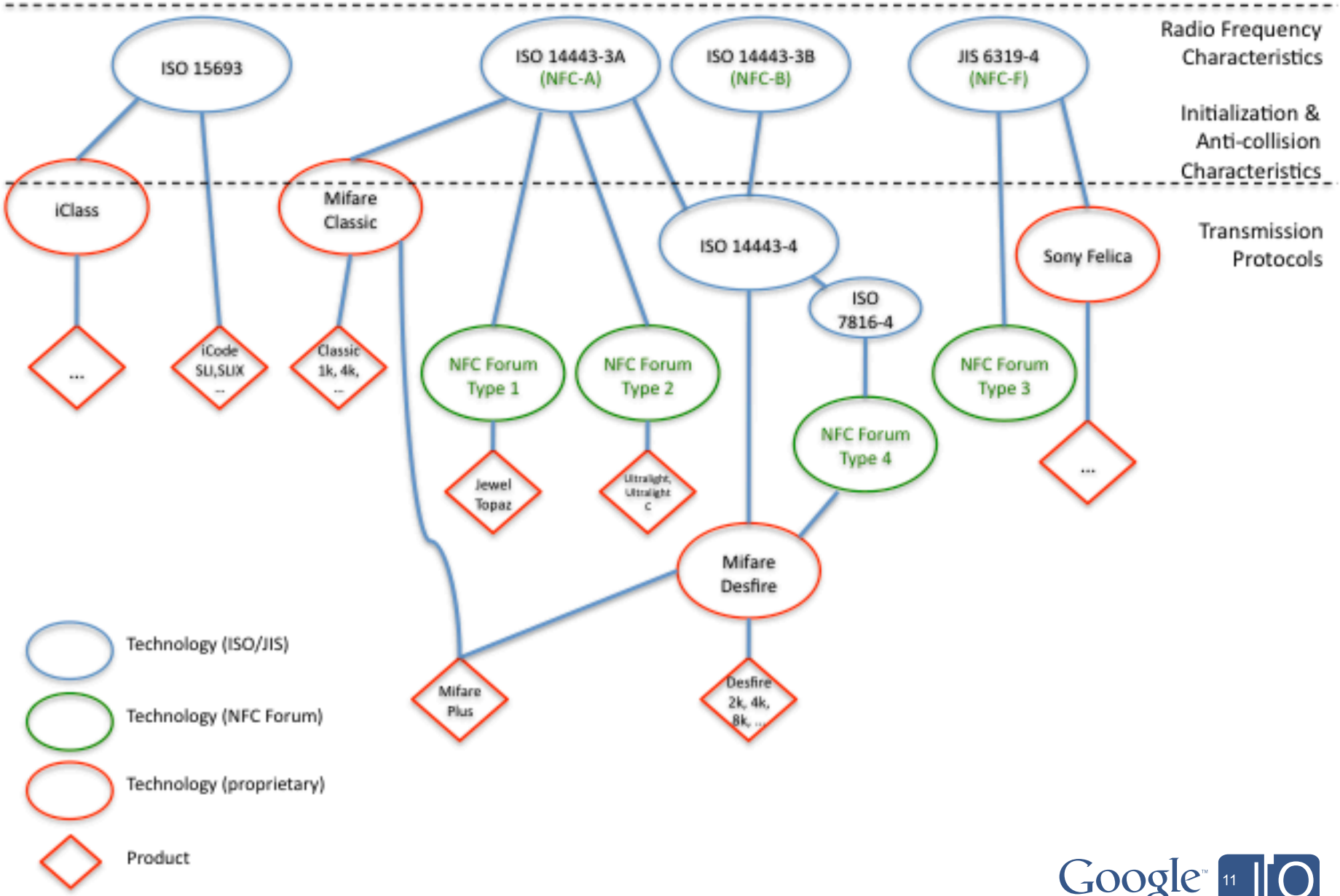
Beyond NDEF…



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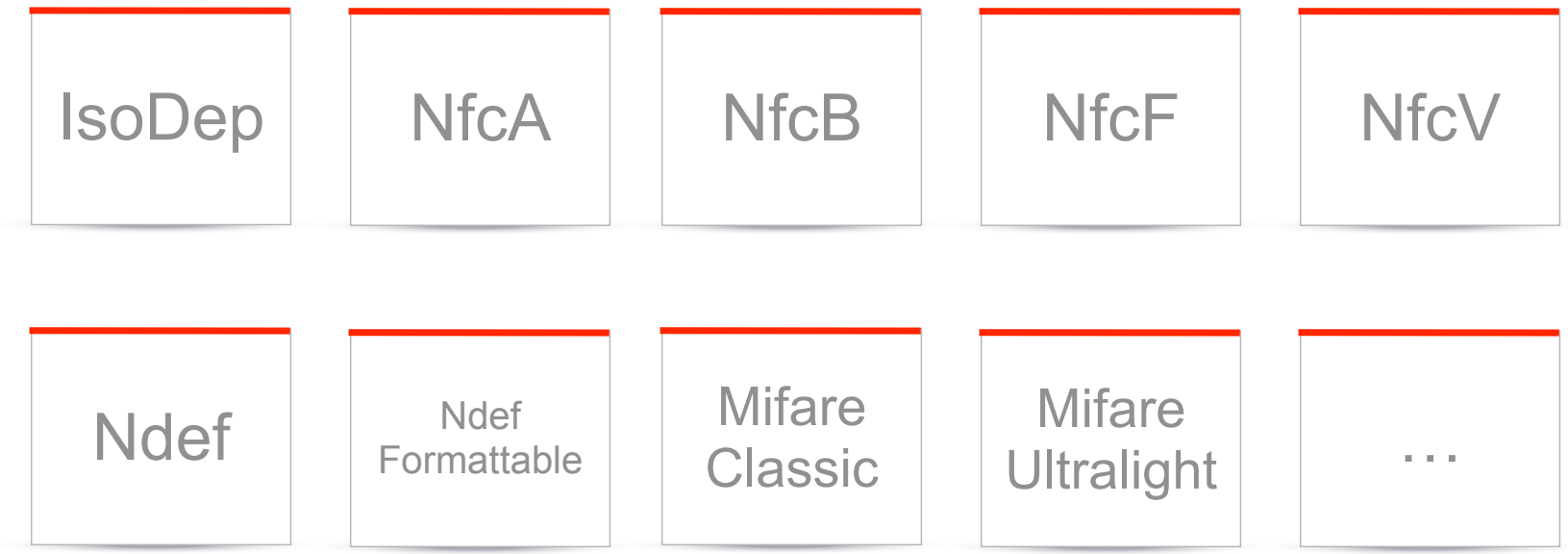
Beyond NDEF…

android.nfc.technology

- Classes to expose *technology specific* functionality
- A tag may have **zero or more** technologies present



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Advanced Tag Dispatch

Introducing ACTION_TECH_DISCOVERED

Filter on the technologies you want to use (instead of NDEF contents)

For example

- I want all tags with NfcA **AND** IsoDep
- I want all tags with NfcA **OR** NfcB

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Advanced Tag Dispatch

Introducing enableForegroundDispatch()

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Peer-to-peer revisited

NFC

- Low Friction (no discovery or pairing)
- Low Range (1-4cm)
- Low Data Rate (106-414 kbps)

Bluetooth

- High Friction (12 second discovery, UI for pairing)
- High Range (10's of meters)
- High Data Rate (3Mbps, higher for 3.0)

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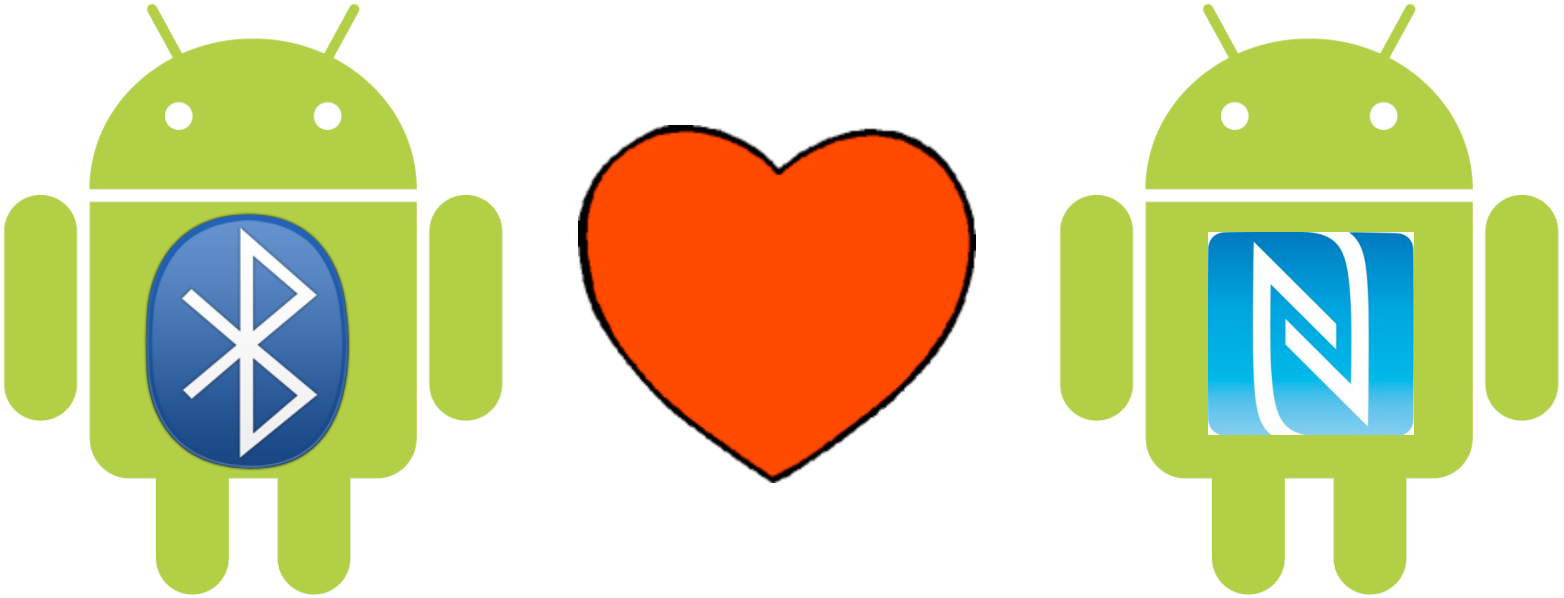
Bluetooth + NFC == Wireless Nirvana



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Recap

- Quick connection setup
- Passive devices
- NDEF dispatch – precise intent filters!
- Foreground interaction
- Bluetooth + NFC == Wireless Nirvana

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Question 1 – Privacy

- Proximity – NFC is not RFID
- On Android NFC is off when the screen is off (no butt sniffing)
- 3rd party applications must be in the foreground to use NFC

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Question 2 – Security

- NFC is by design extremely low power, attacker needs to be less than a meter away
- That said, there is no link level encryption built into NFC
- Applications should implement their own cryptographic solutions on the data being transferred over NFC if security is extremely important (access control, financial instruments)

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Question 3 – Card Emulation

- We've talked a lot about Peer-Peer and Reader/Writer
- Gingerbread has no API support for Card Emulation
- Most popular topic on android-developers@googlegroups.com
- This is a useful use-case for deployments with legacy reader terminals

Why?

1. A single phone can read and write many different tag technologies, but can typically only emulate **one** technology
2. Limited resource, which application gets the right to manage card emulation?

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Sample Code, Documentation

http://nfc.android.com

Feedback

feedback: http://goo.gl/syzQy

hashtags: #io2011 #Android

questions: http://goo.gl/mod/EkbN

Q&A