NFC – Near Field Communication

- Passive card powered by radio field
- 212kbps, 100ms read/write cycle
- Authentication, data integrity protection
- 4-36KB card size
- Public and private data blocks
- Sony Felica and Mifare
- ISO 14443
### NFC
- Short Range (2-5cm)
- 1:1
- Read / write
- Large Capacity
- Secure
- A few Dollars

### RFID
- Longer range (meters)
- Many to one
- Mostly read
- Relatively dumb
- Not necessarily
- Extreme low-cost

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**Mobile FeliCa**

- **Read ID / Data Block**
  - Read ID
  - Data Block

- **Push URL**
  - URL

- **Start Application**
  - Launch
  - Data

![Mobile FeliCa Diagram](image-url)
Standards and Vendors

- Physical Layer, Link Layer: ISO 14443
  - Phillips Mifare (ISO 14443 Type A)
  - Sony Felica (~ISO 14443 Type C)

- FeliCa Networks = “Mobile Felica”
  - NTT / JR / Sony joint.
  - Integration with mobile phone.

- NFC Forum (http://www.nfc-forum.org)
  - Tag Type specifications
  - Record Type specifications

- JSR 257: Contactless Communication API

Physical Touch Points

<table>
<thead>
<tr>
<th>QR Code</th>
<th>Felica Lite</th>
<th>URL Push</th>
<th>Just Touch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capability</td>
<td>Send Static URL</td>
<td>Send Static URL</td>
<td>Send Dynamic URL</td>
</tr>
<tr>
<td>Base Station Requirement</td>
<td>Minimal</td>
<td>Minimal</td>
<td>Power (solar / battery)</td>
</tr>
<tr>
<td>User Experience</td>
<td>Not Great • 10 secs + open page • User needs to initiate • Multiple menu levels • Very bad in low light</td>
<td>Not Great • 10 secs + open page • User needs to install app and initiate • Could be much better with Smartphone</td>
<td>Good • 1 sec + open page • No user action • Robust</td>
</tr>
</tbody>
</table>

Cost per station | <$1 | $1 | ~$30 | ~$80 + connectivity fee
Not just a better GPS

• **Precise.** <5cm vs. 5-10m. Indoors, underground.
• **Physical Cue.** The real world is a better “status bar”
• **Fast.** <500ms No need to stop walking or talking.
• **Explicit.** User’s choice.
• **User engagement.** User expresses interest.
• **Clear Intent.** As opposed to using location as surrogate.
• **Real World UI:** UI divided into a physical part and an online part.

200M+ Cards 60M+ Phones 1M+ Stations
Stages of Adoption

**Phase 1**
- Initial killer app (transport)
- Technology adoption

**Phase 2**
- Broad deployment
- Payment
- Mobile Felica

**Phase 3**
- Platform
- Social
- Points
- Games

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Local Search - NaviTouch

- At Station Exit
- Restaurants
  - Retail
  - Hotels
- Attractions
Local Search – Roppongi Retail Association

• 92 Lamp posts in Roppongi equipped with Felica
• Lamp post typically owned / operated by retail association
• Includes local search, basic navigation, open now

Local Search – Roppongi Retail Association
### Payments

**Payment: 370k Shops + 400k Vending Machines**

<table>
<thead>
<tr>
<th>決済方式</th>
<th>プレペイド (Prepaid)</th>
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<tbody>
<tr>
<td>利用環境</td>
<td>166,000個</td>
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<tr>
<td>Online</td>
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<table>
<thead>
<tr>
<th>决済ブランド</th>
<th>Edy</th>
<th>Suica</th>
<th>PASMO</th>
<th>Aeon</th>
<th>プラスワン</th>
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<tr>
<td>カード</td>
<td>3,500万枚</td>
<td>5,000万枚</td>
<td>1,000万枚</td>
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<td>利用環境</td>
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<td>Online</td>
<td>約2,000サイト</td>
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<table>
<thead>
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<th>决済ブランド</th>
<th>FeliCa</th>
<th>Type A or B</th>
<th>FeliCa</th>
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<tbody>
<tr>
<td>会員</td>
<td>1,000万人</td>
<td>970万人</td>
<td>1,000万人</td>
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<tr>
<td>会員数</td>
<td>100万人</td>
<td>97万人</td>
<td>100万人</td>
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<tr>
<td>口座</td>
<td>JCB</td>
<td>Visa</td>
<td>MasterCard</td>
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<tr>
<td>会員</td>
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支付方式有：Edy, Suica, PASMO, Aeon, プラスワン

支付方式有：FeliCa, Type A or B, FeliCa
Points / Coupons: Gurunavi Touch

- 10000 Devices, stand-alone
- 1200 in Tokyo, 19 in Roppongi
- Store owner gains insight
- Lottery game
- Stamp Card
- Loyalty: “free beer after 3 visits”

Campaigns

Collect Avatar items

Point / Coupons w/ POS Integration
McDonalds

- Download application to phone
- Select coupon
- Coupon stored in Mobile Felica chip
- Redeem via NFC at register
Games / Loyalty

“Stamp Rally”

- JR / SUICA

Shima Ken

- Reads SUICA/Edy purchase history to obtain a place as “territory”
- Think “Foursquare” based on spend

Advertising / Media Bridging
Platform / Systems – B.U.G.

- Devices and solutions
- Connected or stand-alone devices
- Battery or AC power
- Manufactured 150k – 200k devices

Do This at Home – Hardware is Hot!

- 32KB Flash, 2 KB RAM, 1KB EEPROM $2
- Internal / external clock, up to 20 MIPS
- Counters, A/D converters, Parallel & Serial I/O, PWM, BOD

- Libraries, GCC targets $0
- Programming and debug tools

- Turning hardware problems into software problems Priceless
Embedded Environments

$25 • Arduino
- Based on ATMel AVR328 – 32KB, 20 MHz
- IDE w/ C-like language, USB bootloader, debugger
- Good collection of “shields”, e.g. USB, Ethernet

$1 • AVR Bare Bones
- Cheap ($1-$2), open source tool chain
- Requires programmer (can build using AVR)

$60 • mbed
- Cortex-M3 running @ 94MHz, 512KB
- Cloud-based compiler

No Solder Solution
Making Printed Circuit Boards

- Sparkfun BatchPCB
  $20 + $2.50 / sq. in.
- 4pcb.com
  $33/each (1+)
- P-ban (Japan)
  50 boards $270

1. Design schematic with EAGLE
2. Create board layout from schematic
3. Export as Gerber files

NFC Reader / Writer Modules

- Retail USB Module RC-330
- Industrial module USART
Capabilities - Example

Base Station

Phone

Near Field
Connect

Read
Push URL

Connect

Server

Felica Card
ID
Data
Data

Browser

Connect

Server

Hotspot 0001
011a00027e0cbb0f

Do you connect?
http:

YES
NO

Select