NFC AND THE VEHICLE.

TESTING THE LINUX NFC STACK.

BMW GROUP
BMW Car IT GmbH
NEAR FIELD COMMUNICATION.  
WHAT IS IT?

„Easy connections, quick transactions, and simple data sharing.“

NFC-Forum.org

- Fast connection setup
- Contactless
- Short range
- Communication with passive and active devices or tags
- Compatible with RFID
NFC AND THE VEHICLE.
WHAT TO DO WITH NFC IN THE CAR?

• Connect Bluetooth and Wireless Devices by a single touch
• Touch the car to unlock or start
• Transfer data like navigation destinations or contacts
• Wireless charging
NFC AND GENIVI. HOW ABOUT COMPLIANCE?

- APIs of a NFC stack are defined in GENIVI
- Part of the GENIVI compliance since release 5.0 (07. Oct 2013)
- NFC kernel subsystem and neard are GENIVI compliant
LINUX NFC.
GENERAL CAPABILITIES.

- Reading and Writing Tags
- Card Emulation
- Peer-to-Peer Connections (LLCP-based Transports)
- Handover with Bluetooth and WiFi
- Supported Hardware:
  - NXP pn544, pn533, pn532
  - TI nfcwilink
  - IS microread
LINUX NFC.
TRANSFERING DATA.

- Simple NDEF Exchange Protocol (SNEP)
- NDEF Push Protocol (NPP)
- Personel Health Device Communication (PHDC)
LINUX NFC.
CONNECTION HANOVER.

Establish a Bluetooth or WiFi connection
• By touching a device (Negotiated Handover)
• By touching a tag (Static Handover)
LINUX NFC.
SECURE ELEMENT API.

• Released with Kernel Release 3.13
• Netlink API for
  • Discovering attached Secure Elements
  • Enabling and Disabling of Secure Elements
• Currently only supported by the pn455
• Secure Element Daemon with D-Bus APIs will be part of neard
LINUX NFC.
GENERAL ARCHITECTURE.

Source: https://01.org/linux-nfc/documentation
LINUX NFC.
D-BUS API.

NFC Application
(NDEF agent)

agent manager

adapter
/nfc0

tag
/nfc0/tag0

record
/nfc0/tag0/record0

device
/nfc0/device0

record
/nfc0/device0/record0

ConnMan
(Handover agent)

BlueZ
(Handover agent)

Source: https://01.org/linux-nfc/sites/default/files/documentation/nfc-genivi-amm-2013q1-open.pdf
LINUX NFC.
LET'S GO FOR A SPIN.
LINUX NFC.
KERNEL ARCHITECTURE.

Source: https://01.org/linux-nfc/documentation
TESTING THE LINUX NFC STACK.
MANUAL TESTING.

- Python test scripts for
  - Connection Handover
  - PHDC Manager
  - SNEP Agent
  - Communication via D-Bus APIs
- Monitor Traffic with nfctool and monitor-near
TESTING THE LINUX NFC STACK. USING THE LOOPBACK DEVICE.

- NFC_SIM Kernel Driver
- Two virtual NFC Devices are created that act as loopback devices
- Peer-to-Peer Connections can be tested.
TESTING THE LINUX NFC STACK. WHAT’S MISSING?

- Testing NFC R/W Interface
- Testing Card Emulation Modes
PROPOSAL FOR TESTING WITHOUT HARDWARE.
NFC CONTROLLER INTERFACE.

Source: NFCForum-TS-NFC-1.0 2012-11-06
PROPOSAL FOR TESTING WITHOUT HARDWARE.
A VIRTUAL NFC CONTROLLER.

- Create a complete virtual NCI Device
- Emulate NCI Data Packets based on RF Protocols
  - Tag Type 1-4
  - ISO-DEP (Poll and Listen)
  - NFC-DEP
NFC OVER SOMEIP.
VIRTUAL NFC CONTROLLER AND REAL HARDWARE.

• NFC Reader is somewhere in the vehicle connected to an ECU
• ECU allows opening or starting the car when the Head-Unit is off
• Remaining NFC functionality is handled by the Head-Unit
NFC OVER SOMEIP.
VIRTUAL NFC CONTROLLER AND REAL HARDWARE.

- Send NCI control and data packets over SOMEIP
- Expose the virtual NCI device as a virtual networking adapter
- Route the IP packets containing NCI data via iptables or nftables
THANK YOU VERY MUCH FOR YOUR INTEREST.
RESOURCES.

nfc-next:
http://git.kernel.org/pub/scm/linux/kernel/git/sameo/nfc-next.git

neard:
http://git.kernel.org/pub/scm/network/nfc/neard.git

01.org/linux-nfc
http://www.nfc-forum.org

www.press.bmwgroup.com

Samuel Ortiz: The Linux NFC subsystem, 2013
https://01.org/linux-nfc/sites/default/files/documentation/nfc-genivi-amm-2013q1-open.pdf

Samuel Ortiz: Mobile Payments with Linux, 2013

NFCForum-TS-NCI-1.0: NFC Controller Interface (NCI) Specification, V1.0 November 2012