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NFC AND THE VEHICLE.

TESTING THE LINUX NFC STACK.

**BMW
GROUP**
BMW Car IT GmbH



NEARD 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. TRANSFERRING DATA.



- Simple NDEF Exchange Protocol (SNEP)
- NDEF Push Protocol (NPP)
- Personal Health Device Communication (PHDC)

LINUX NFC. CONNECTION HANDOVER.

Establish a Bluetooth or WiFi connection

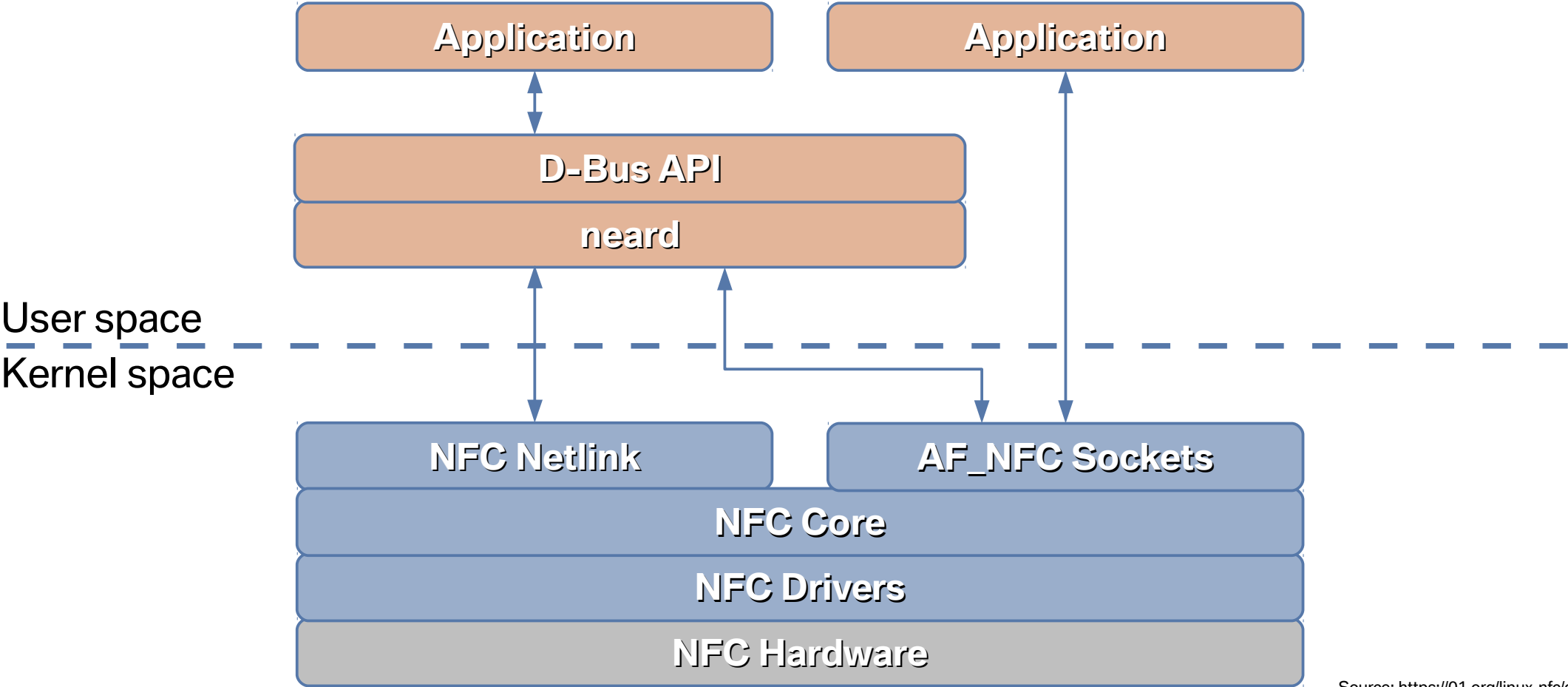
- By touching a device (Negotiated Handover)
- By touching a tag (Static Handover)



LINUX NFC. SECURE ELEMENT API.

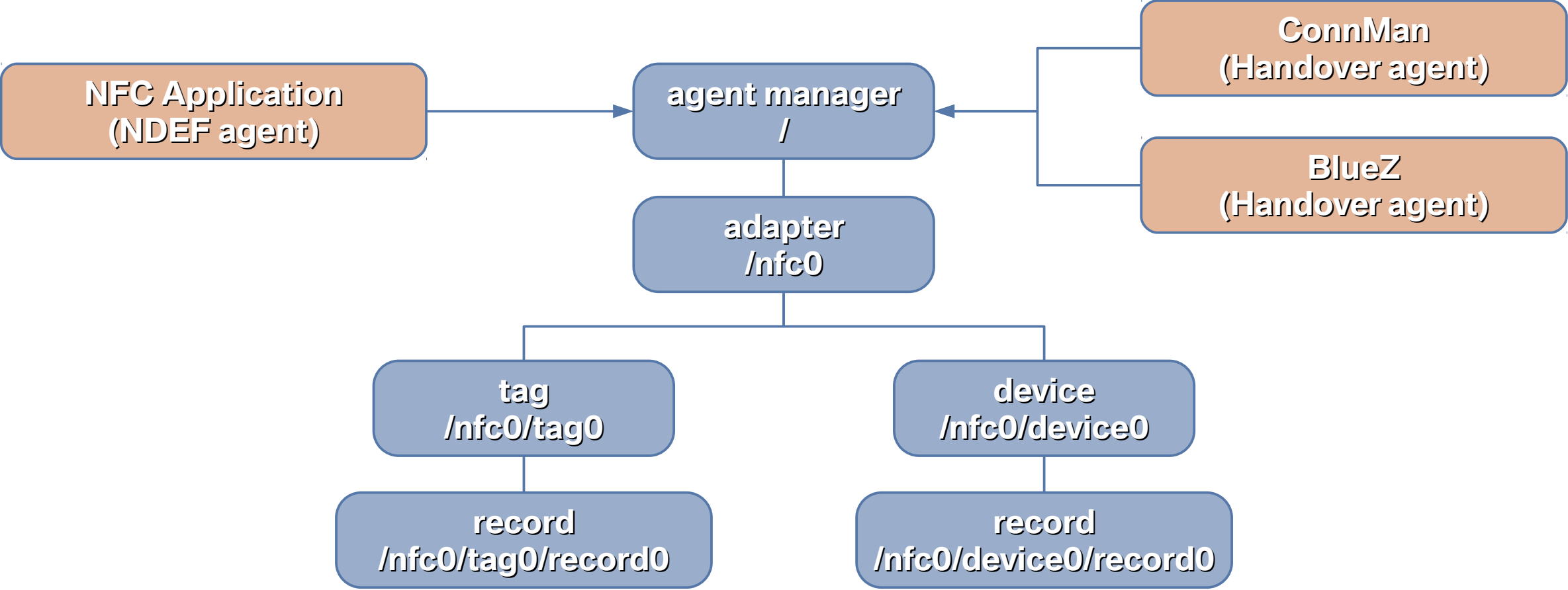
- Released with Kernel Release 3.13
- Netlink API for
 - Discovering attached Secure Elements
 - Enabling and Disabling of Secure Elements
- Currently only supported by the pn455
- Secure Element Daemon with D-Bus APIs will be part of neard

LINUX NFC. GENERAL ARCHITECTURE.



Source: <https://01.org/linux-nfc/documentation>

LINUX NFC. D-BUS API.

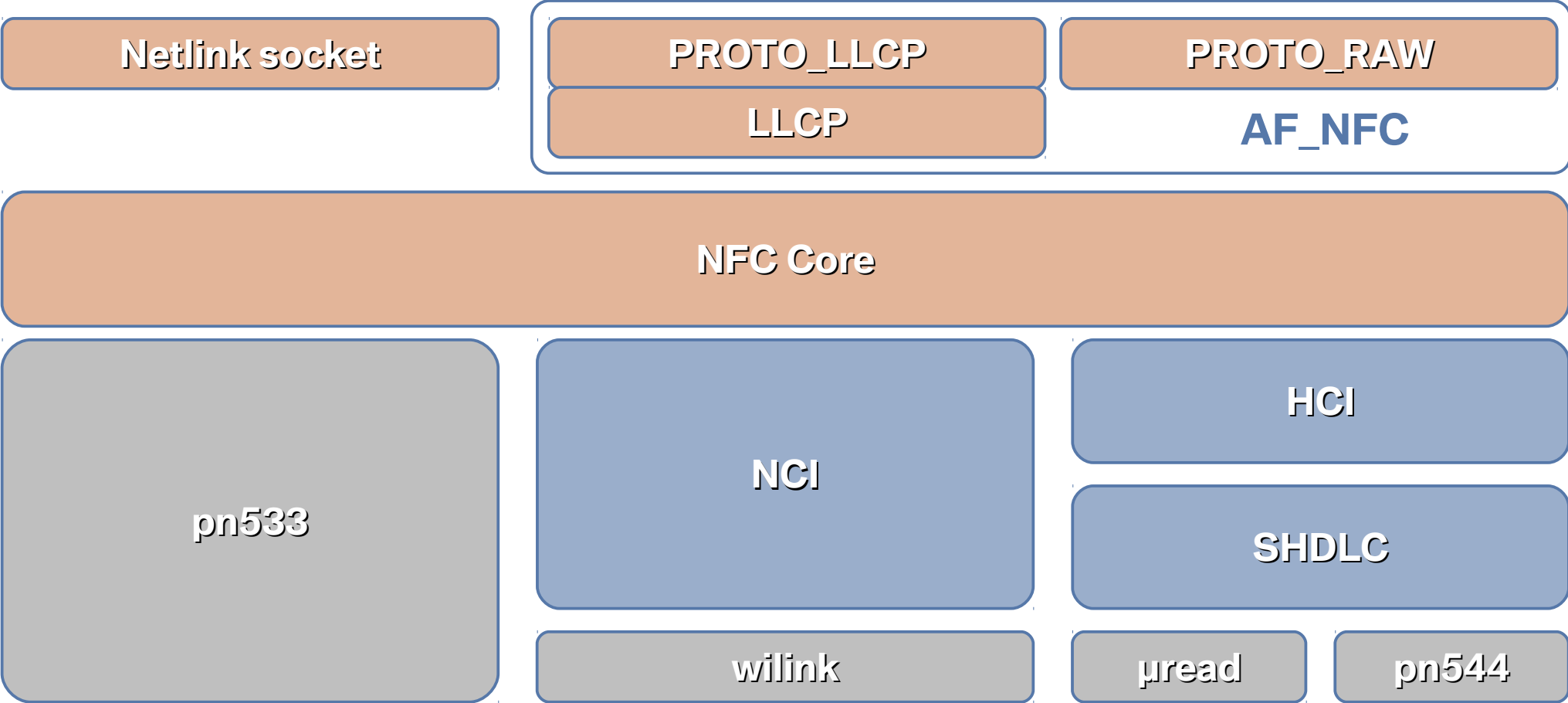


Source: <https://01.org/linux-nfc/sites/default/files/documentation/nfc-genivi-amm-2013q1-open.pdf>

**LINUX NFC.
LET'S GO FOR A SPIN.**



LINUX NFC. KERNEL ARCHITECTURE.



Source: <https://01.org/linux-nfc/documentation>

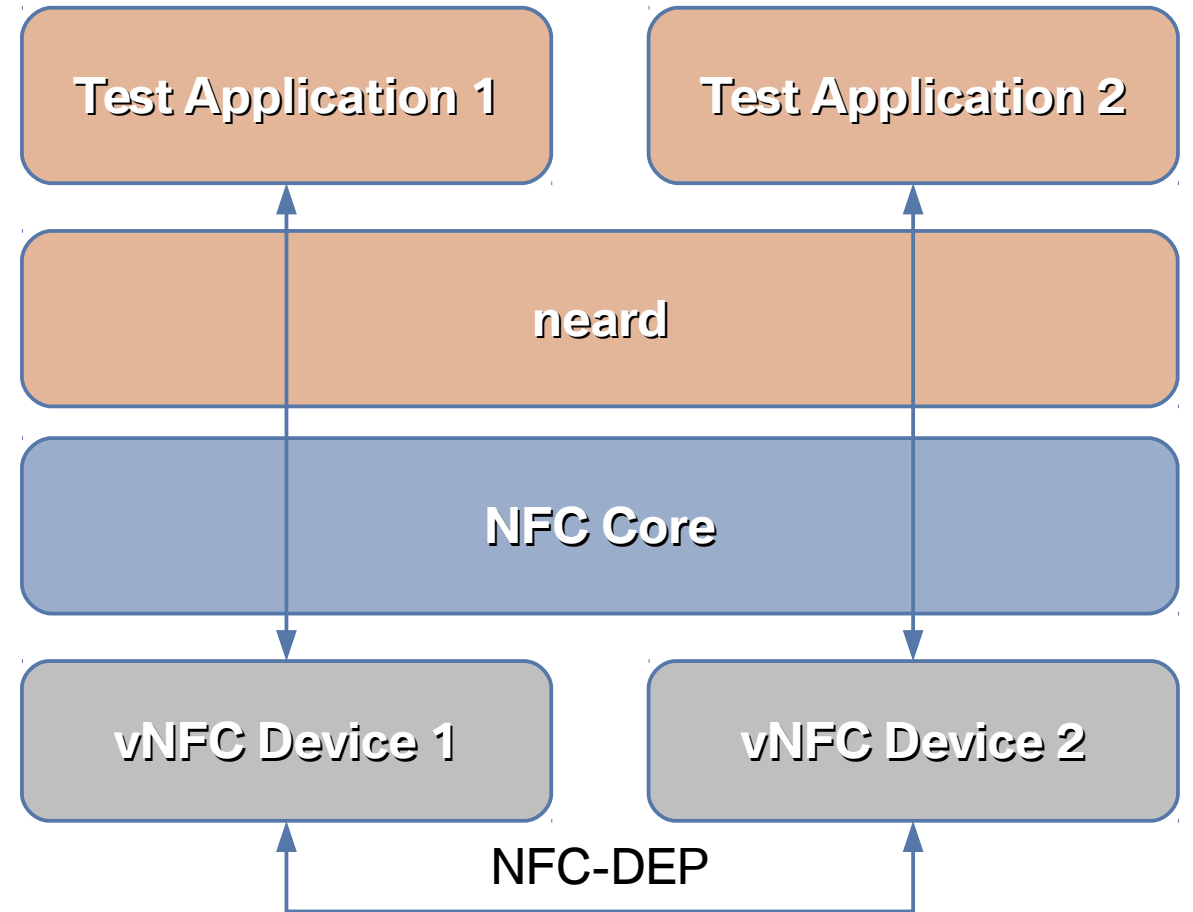
TESTING THE LINUX NFC STACK. MANUAL TESTING.

- Python test scripts for
 - Connection Handover
 - PHDC Manager
 - SNEP Agent
 - Communication via D-Bus APIs
- Monitor Traffic with `nfctool` and `monitor-near`



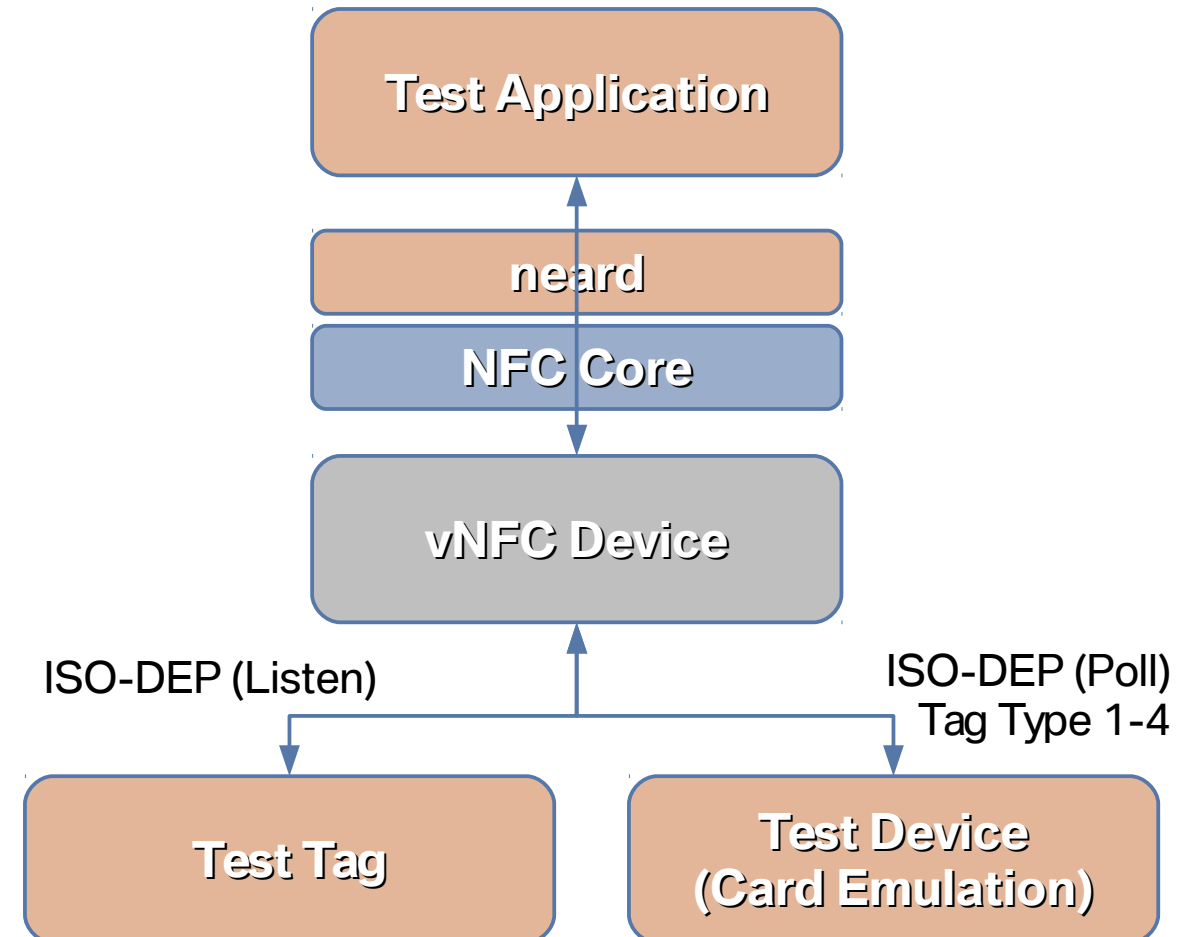
TESTING THE LINUX NFC STACK. USING THE LOOPBACK DEVICE.

- NFC_SIM Kernel Driver
- Two virtual NFC Devices are created that act as loopback devices
- Peer-to-Peer Connections can be tested.

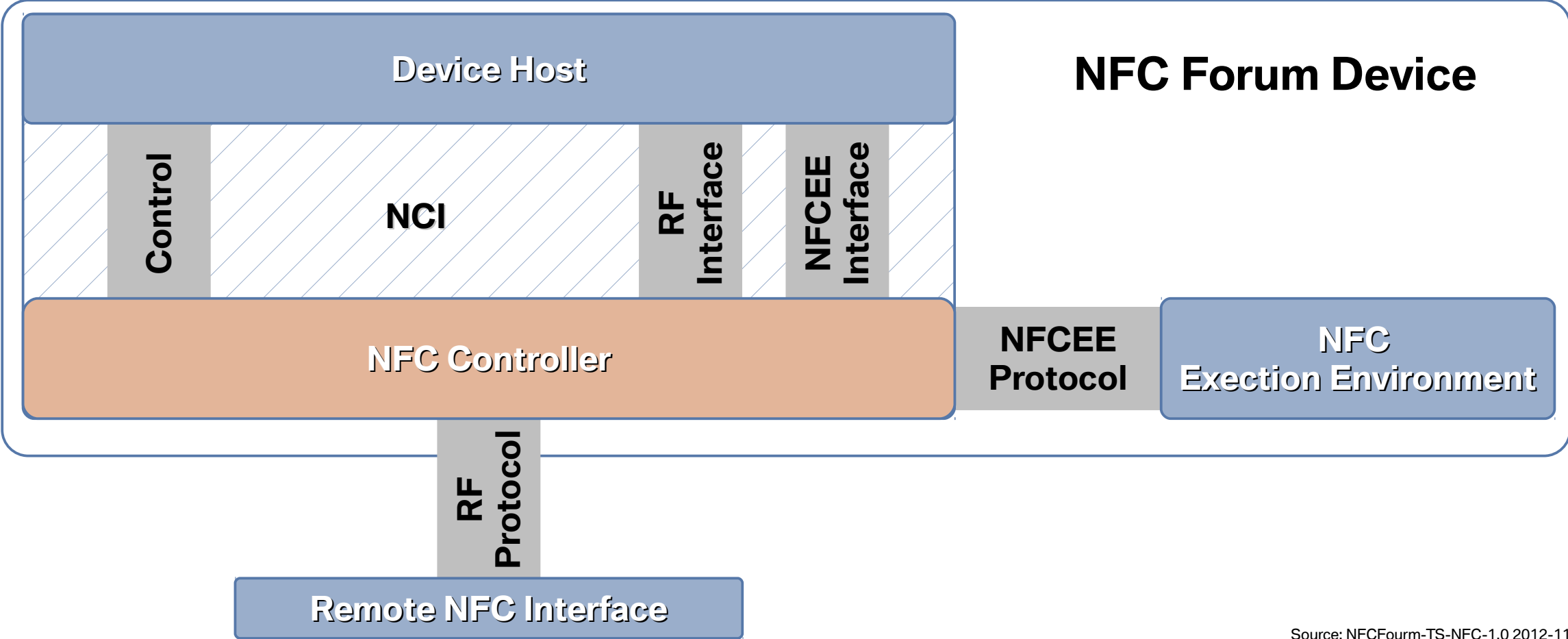


TESTING THE LINUX NFC STACK. WHAT'S MISSING?

- Testing NFC R/W Interface
- Testing Card Emulation Modes



PROPOSAL FOR TESTING WITHOUT HARDWARE. NFC CONTROLLER INTERFACE.



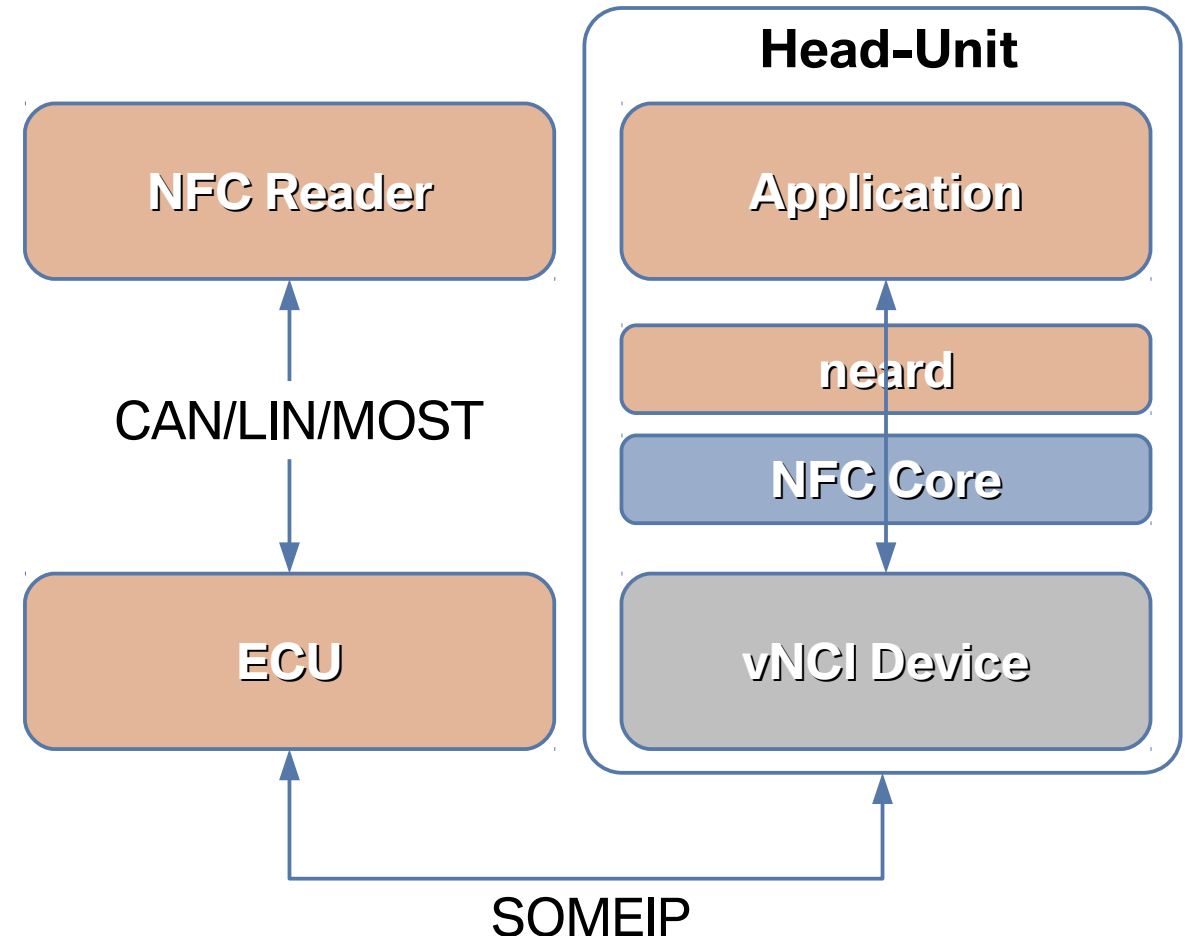
PROPOSAL FOR TESTING WITHOUT HARDWARE. A VIRTUAL NFC CONTROLLER.

- 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



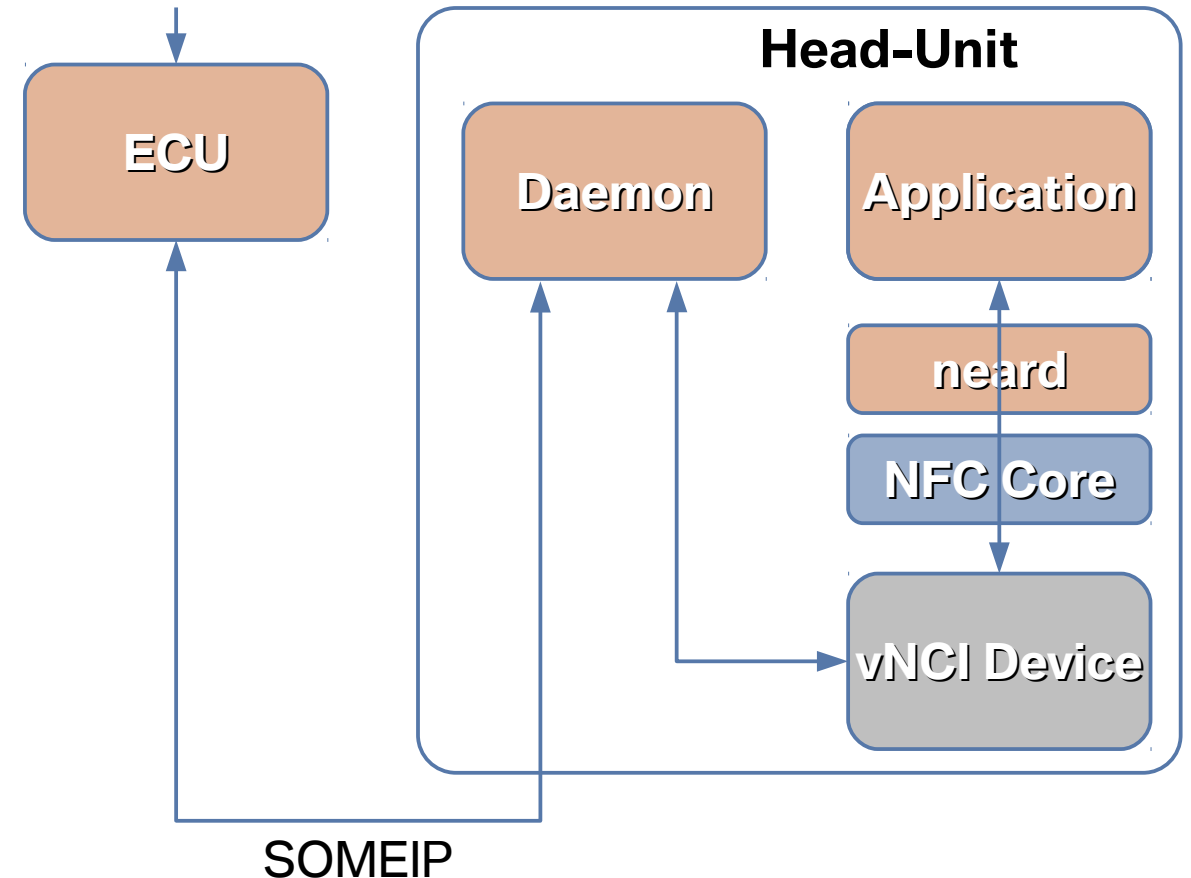
NFC OVER SOMEIP. VIRTUAL NFC CONTROLLER AND REAL HARDWARE.

- 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:

[git://git.kernel.org/pub/scm/linux/kernel/git/sameo/nfc-next.git](https://git.kernel.org/pub/scm/linux/kernel/git/sameo/nfc-next.git)

neard:

[git://git.kernel.org/pub/scm/network/nfc/neard.git](https://git.kernel.org/pub/scm/network/nfc/neard.git)

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

https://01.org/linux-nfc/sites/default/files/documentation/mobile_payments-linuxcon.pdf

01.org/linux-nfc

www.nfc-forum.org

www.press.bmwgroup.com

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