NFC on Linux

Current status and future developments

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Agenda

- What is NFC
- Existing stacks
- Linux NFC project
- Development tools
- Future developments

What is NFC?

NF What ?

- Stands for Near Field Communication
- Short distance communication
- Limited bandwidth

Devices

Tags

- 5 different tag types
- Devices can read and write
- Dedicated usage for a tag

Use cases

Reading tags

Peer to Peer

- Communication between 2 devices
- Data exchange
- Handover

Host Card Emulation

- Device simulates a tag
- Payment, ticketing, authentication
- Emulation through Secure Elements

Existing solutions

Android

- User space stack
- NXP and Broadcom chipsets
- HCI and NCI support
- Maintained by Broadcom and Google
- Support all tag types
- Supports LLCP and HCE modes

libnfc

- Academic LGPL licensed project
- USB and UART devices support
- Community supported
- Hosted on Github

nfcpy

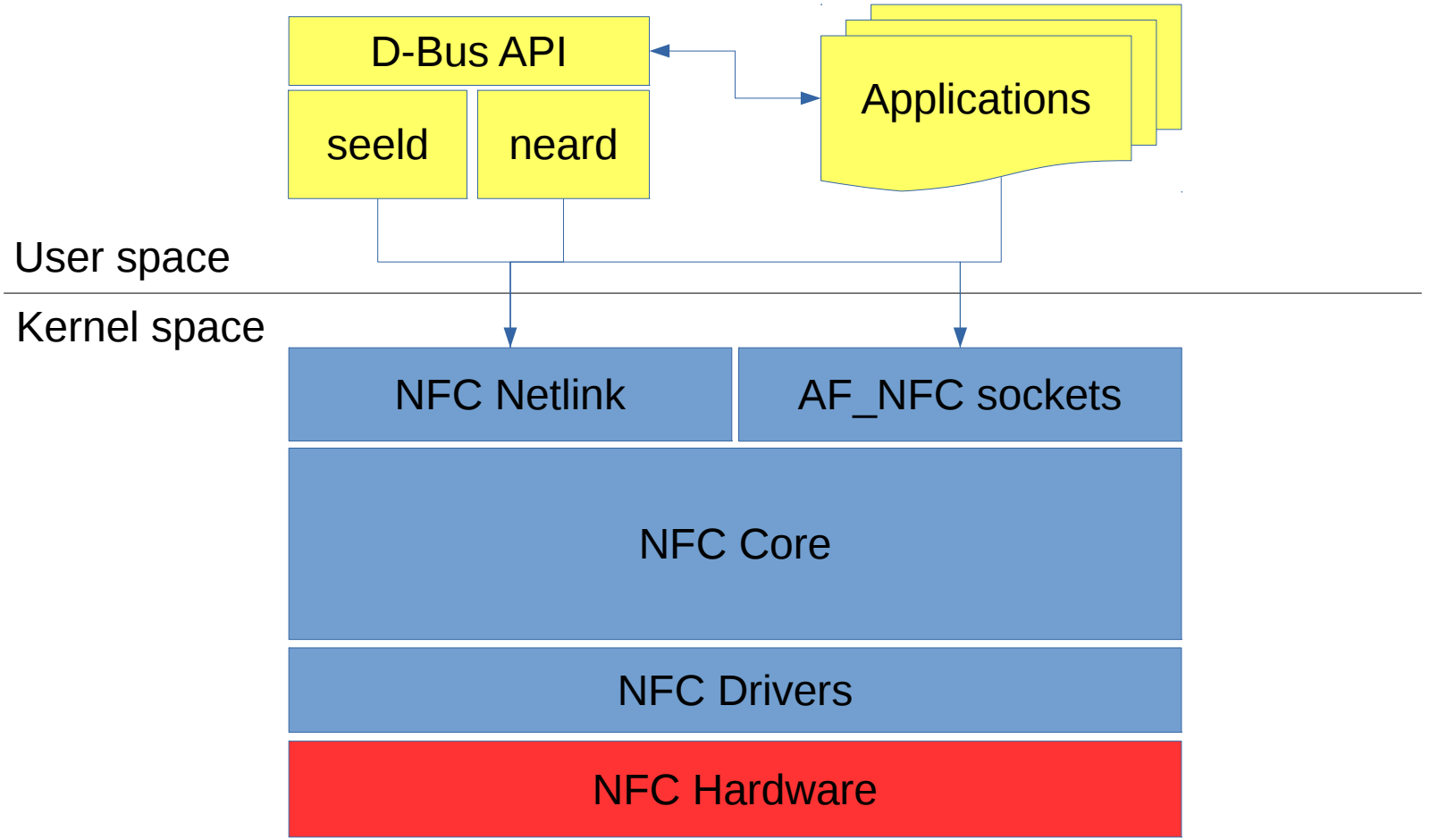
- Written in python
- Nice implementation
- Supported by Sony
- No HCI or NCI support
- USB dongles only

Linux NFC Project

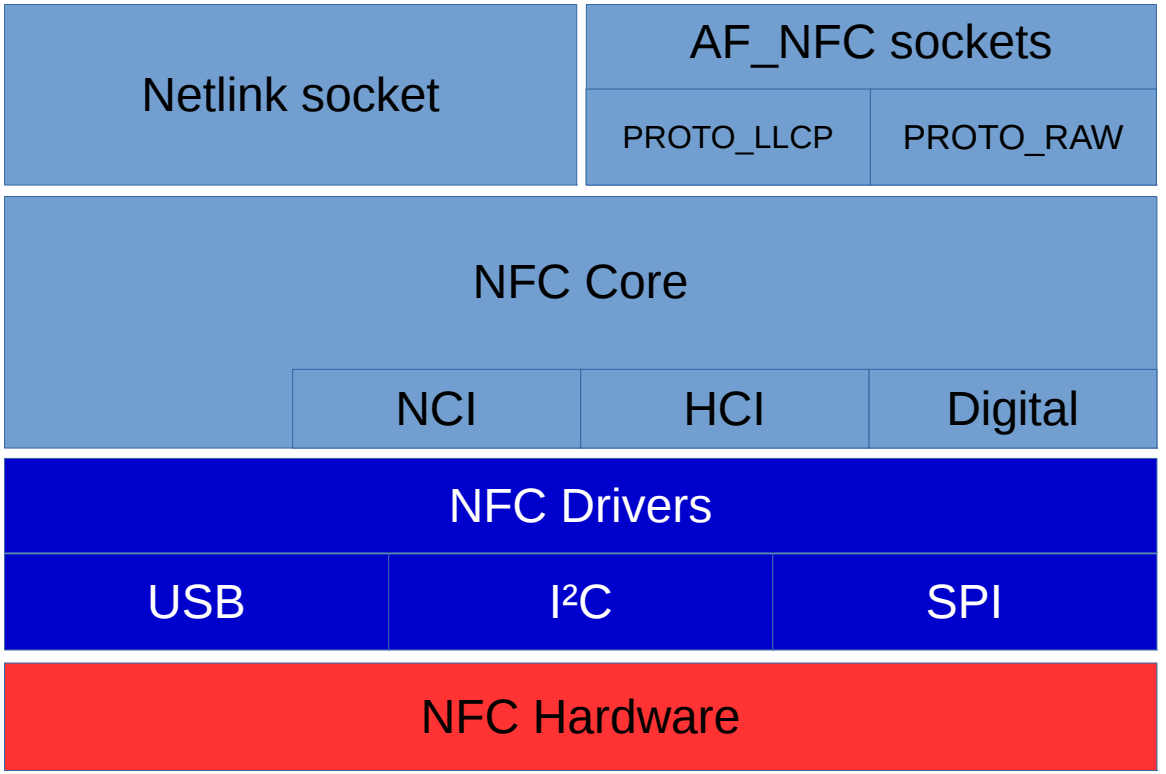
Linux NFC

- Hardware independence
- POSIX NFC APIs
- Licensed under GPL v2
- Kernel and user space separation
- D-Bus APIs
- Maintained by Samuel Ortiz

Architecture diagram



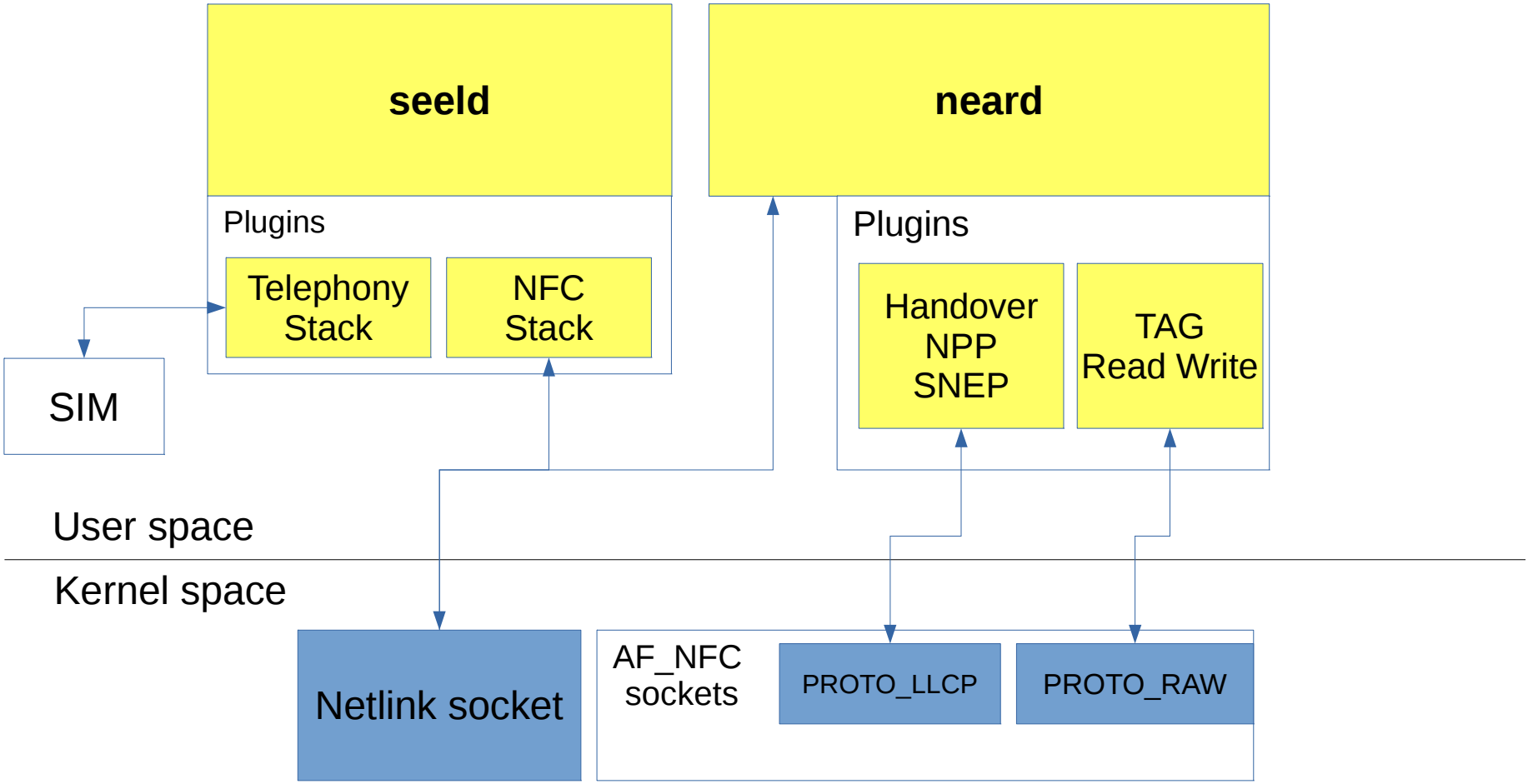
Kernel architecture



Kernel architecture

- Drivers can register against:
  - The core stack directly
  - The HCI backend
  - The NCI backend
  - The Digital protocol layer
- User space commands go through netlink
- Dedicated socket domain for data transfer

User space architecture



User space architecture

- User space daemon “neard”
- Secure elements daemon “seeld”
- Plugin based
- API Abstraction using D-Bus
- Tag reading & writing
- NDEF parsing
- LLCP protocols
- WiFi and BT handover

Development Tools

Hardware Simulation nfcsim

- Special driver declaring 2 virtual devices
- Supports NFC-DEP protocol only
- Act as a loopback device
  - Everything sent from one device is sent back to the other one.
- Useful to debug the whole stack

nfctool

- List attached devices
- Enable / disable devices
- Start / stop poll
- Set connection parameters
  - Link timeout
  - Receive window
  - Max information unit extension

The sniffer

- Monitor LLCP traffic
- Support decoding for
  - LLCP
  - SNEP
  - NDEF
- Digital Layer frames decoding coming soon

The sniffer in action

```
$ ./tools/nfctool/nfctool -d nfc0 -n
Start sniffer on nfc0

 << nfc0: local:0x20 remote:0x01
    Connect (CONNECT)
    Service Name: urn:nfc:sn:snep
    Maximum Information Unit Extensions: 2047
    Receive Window Size: 15

 >> nfc0: local:0x20 remote:0x04
    Connection Complete (CC)
    Maximum Information Unit Extensions: 2047
    Receive Window Size: 15

 << nfc0: local:0x20 remote:0x04
    Information (I)
    N(S):0 N(R):0
    Simple NDEF Exchange Protocol (SNEP)
      Version: 1.0
      Request: Put
      NDEF Record
        Message Begin: True
        Message End: True
        Chunk Flag: False
        Short Record: True
        ID Length present: False
        Type Name Format: NFC Forum well-known type [NFC RTD] (0x01)
        Type Length: 1
        Payload Length: 14
        Type:
         0000: 54                                          |T|
        Payload:
         0000: 02 65 6E 48 65 6C 6C 6F 20 77 6F 72 6C 64   |.enHello world|

  ▪▪▪
```

```
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 >> nfc0: local:0x20 remote:0x04
    Receive Ready (RR)
    N(S):0 N(R):1

 >> nfc0: local:0x20 remote:0x04
    Information (I)
    N(S):0 N(R):1
    Simple NDEF Exchange Protocol (SNEP)
      Version: 1.0
      Response: Success

 << nfc0: local:0x20 remote:0x04
    Receive Ready (RR)
    N(S):0 N(R):1

 << nfc0: local:0x20 remote:0x04
    Disconnect (DISC)

 >> nfc0: local:0x20 remote:0x04
    Disconnected Mode (DM)
    Reason: 0 (Normal disconnect)
```

Future Developments

- NCI User channel
- Host Card Emulation

Q & A

- nfc-next kernel
  https://git.kernel.org/cgit/linux/kernel/git/sameo/nfc-next.git
- nfc-next-stable kernel
  https://github.com/tescande/linux-nfc-next-stable
- Daemons
  https://git.kernel.org/cgit/network/nfc/neard.git
- Mailing list
  https://lists.01.org/mailman/listinfo/linux-nfc
- IRC
  #linux-nfc on freenode