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MANAGING THE CAR CLOUD CONNECTION.

CONNMAN, SYSTEMD, AND THE INTERNET.

BMW
GROUP
BMW Car IT GmbH

IVI CONNECTIVITY. GENERAL OVERVIEW.

- Apps in the car

- Software and Hardware Setups

- ConnMan Session API

- The Future

http://flic.kr/p/8Gu

EXPECTATIONS.

- Car owners expect their car to be integrated into their digital life.
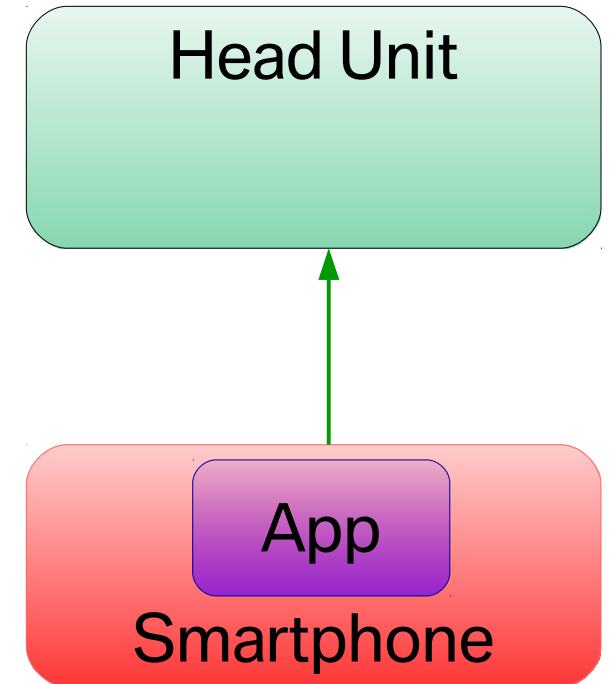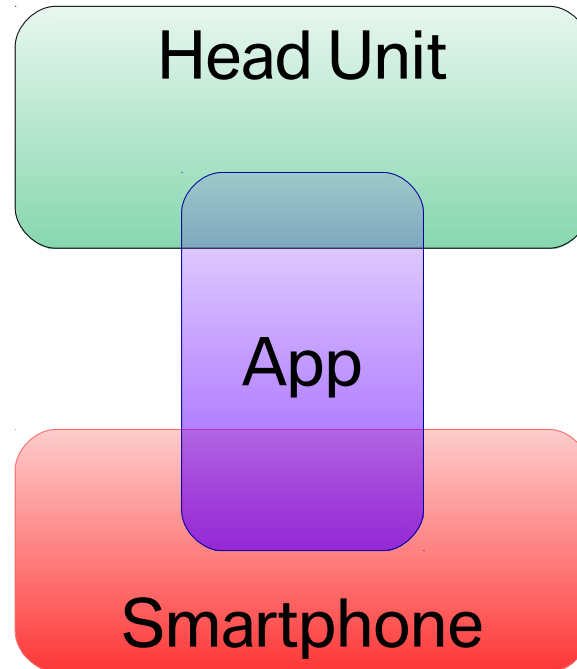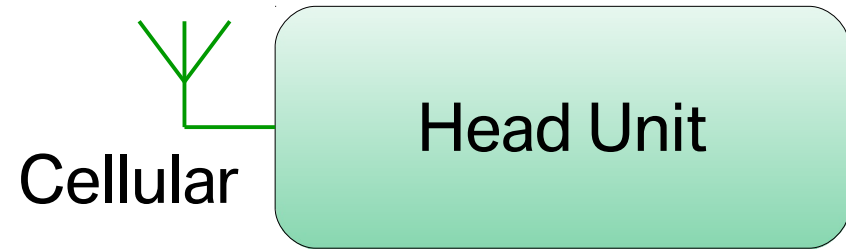- Services via Apps

http://flic.kr/p/6BZjjA

INTERACTIONS.

- Knobs
- Touch
- Voice

SOFTWARE.
PARTITIONING.

HARDWARE SETUP.
STAND ALONE.

Cellular | Head Unit

HARDWARE SETUP.
CONNECTION BOX.

Head Unit

Connection Box
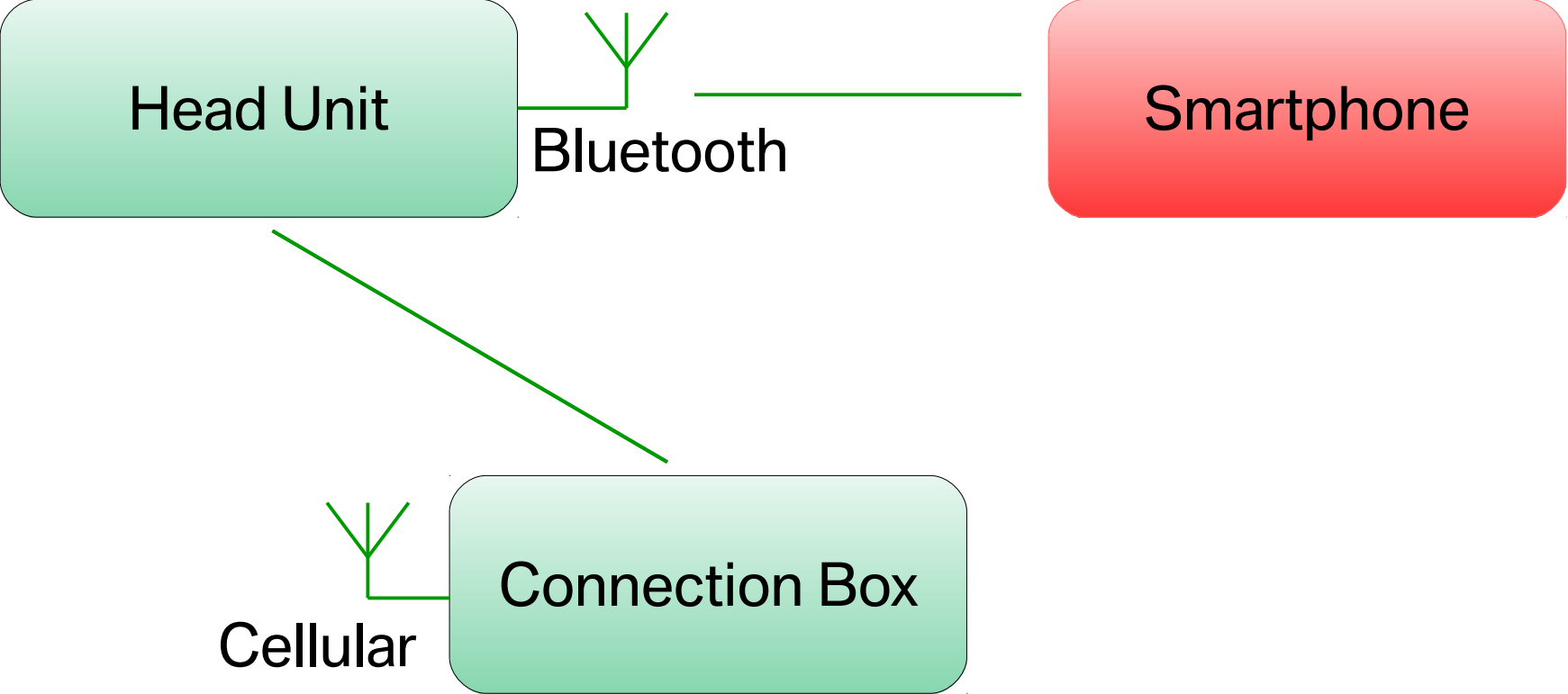
Cellular
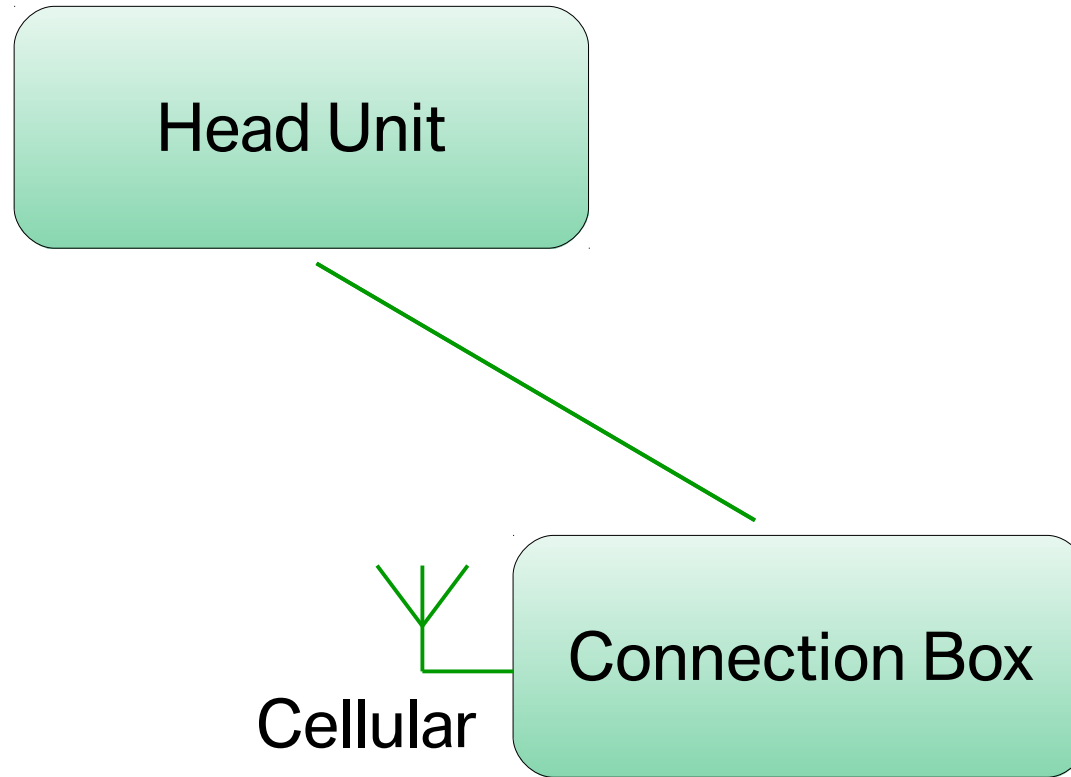
HARDWARE SETUP.
SMARTPHONE AS UPLINK.
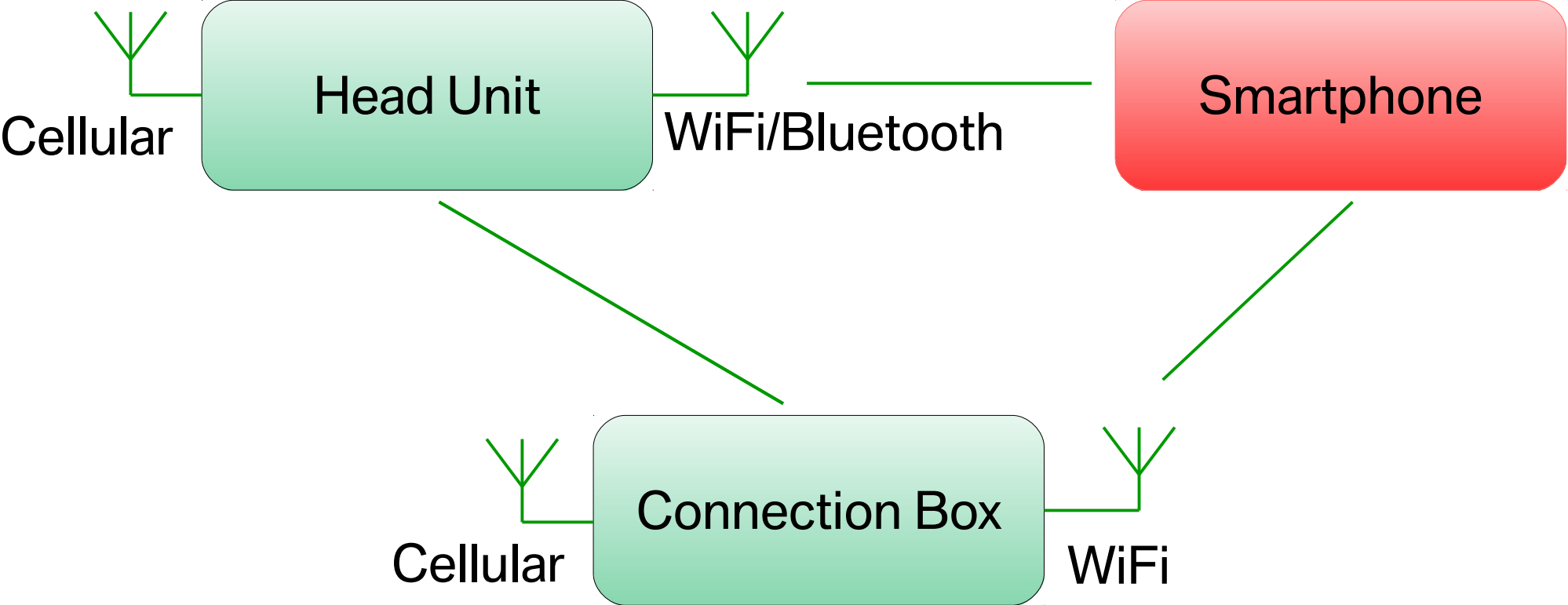
Head Unit

Bluetooth

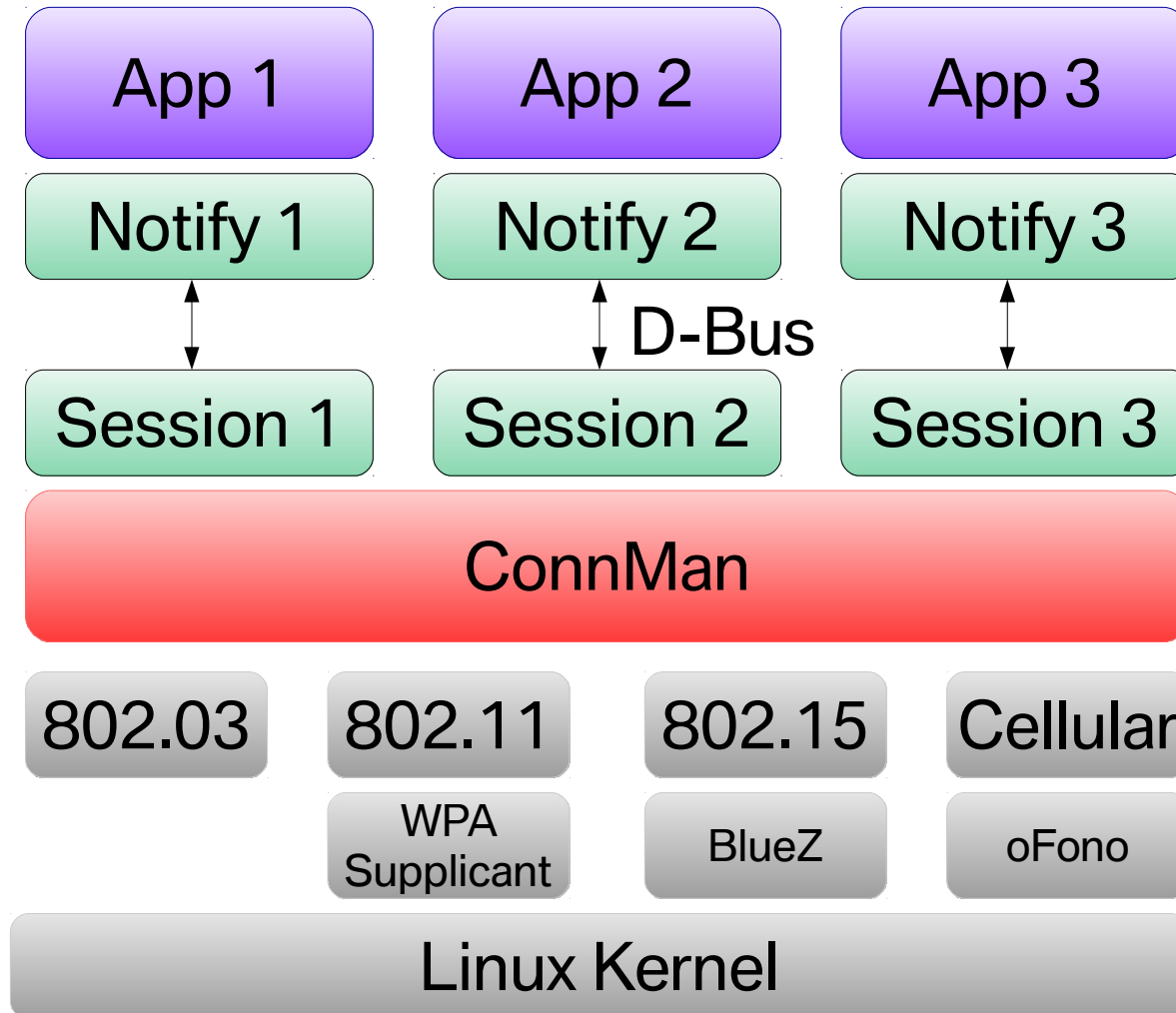Smartphone

HARDWARE SETUP.
MULTI LINKS.

HARDWARE SETUP.
FULL MONTY.

PROTOCOL STACKS.
BASED ON IP.

- WiFi Display
  - Basically it replaces a HDMI-cable
  - a.k.a. Miracast
  - Uses WiFi Direct
- MirrorLink
  - USB, Wi-Fi, Bluetooth,
  - Real-Time Protocol (RTP, for audio)
  - Universal Plug and Play (UpnP)
  - VNC
- ...

CONNMAN. SESSION API.

App 1	App 2	App 3
Notify 1	Notify 2	Notify 3

D-Bus

Session 1	Session 2	Session 3

ConnMan

802.03	802.11	802.15	Cellular
	WPA Supplicant	BlueZ	oFono

Linux Kernel

Per Application
- Configuration
- Routing
- Statistic

SESSION CONFIGURATION.

- AllowedBearers (e.g. ethernet, wireless, cellular...)
- Connection (e.g. local, internet)
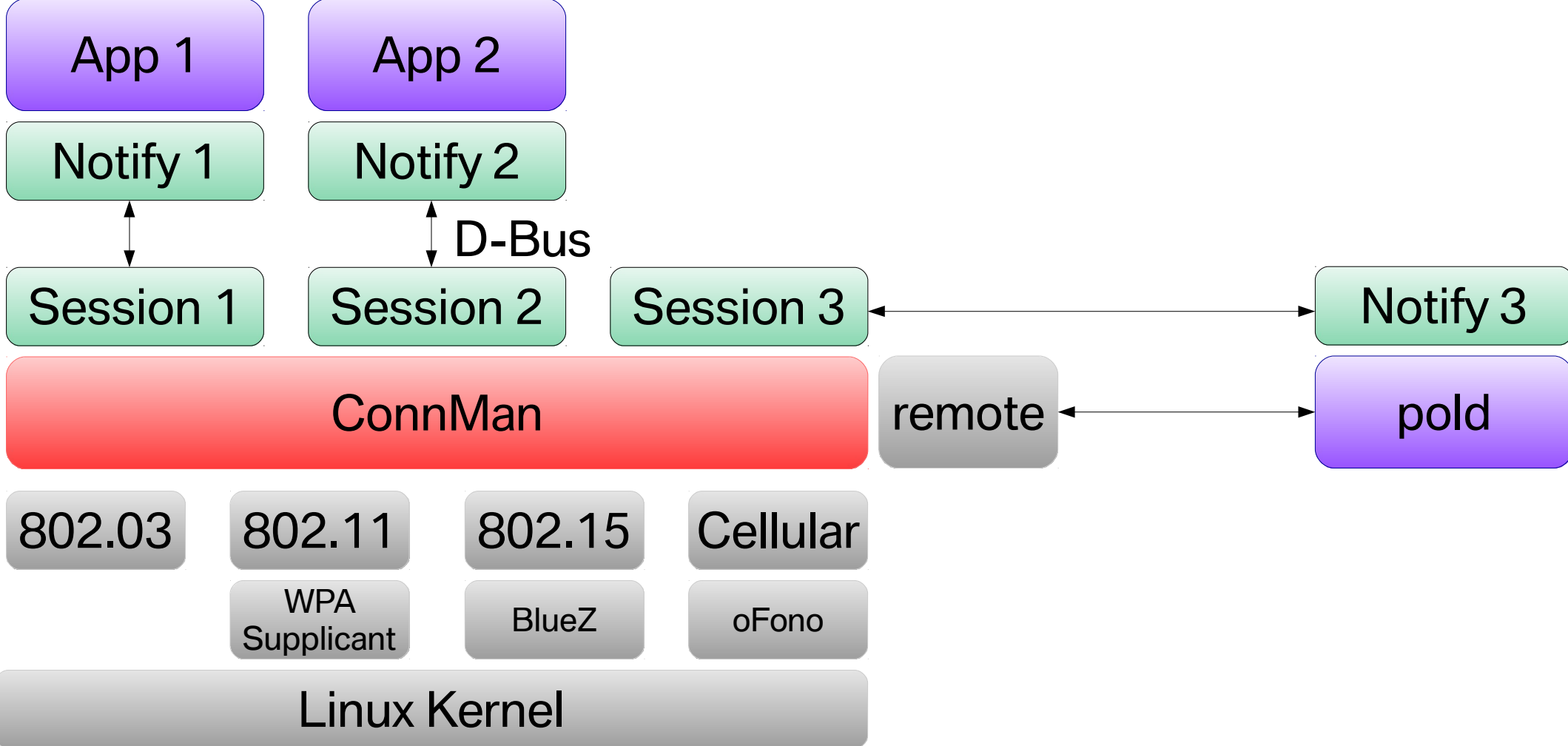- Priority
- EmergencyCall
- RoamingPolicy

SESSION CONFIGURATION.
KEEP IT UP TO DATE.

Configuration update needed because

- Roaming policy changes

- New customer (rental car)

- ...

Applications need to be blocked before configuration is updated

CONNMAN.
SESSION DYNAMIC CONFIGURATION.

App 1

App 2

Notify 1

Notify 2

D-Bus

Session 1

Session 2

Session 3

Notify 3

ConnMan

remote

pold

802.03

802.11

802.15

Cellular

WPA Supplicant

BlueZ

oFono

Linux Kernel

CONNMAN.
IPTABLES AND POLICY ROUTING.

- ## Per application rules

```
iptables -t mangle -A OUTPUT -m owner —uid-owner 1234 -j MARK —set-mark 1234
```
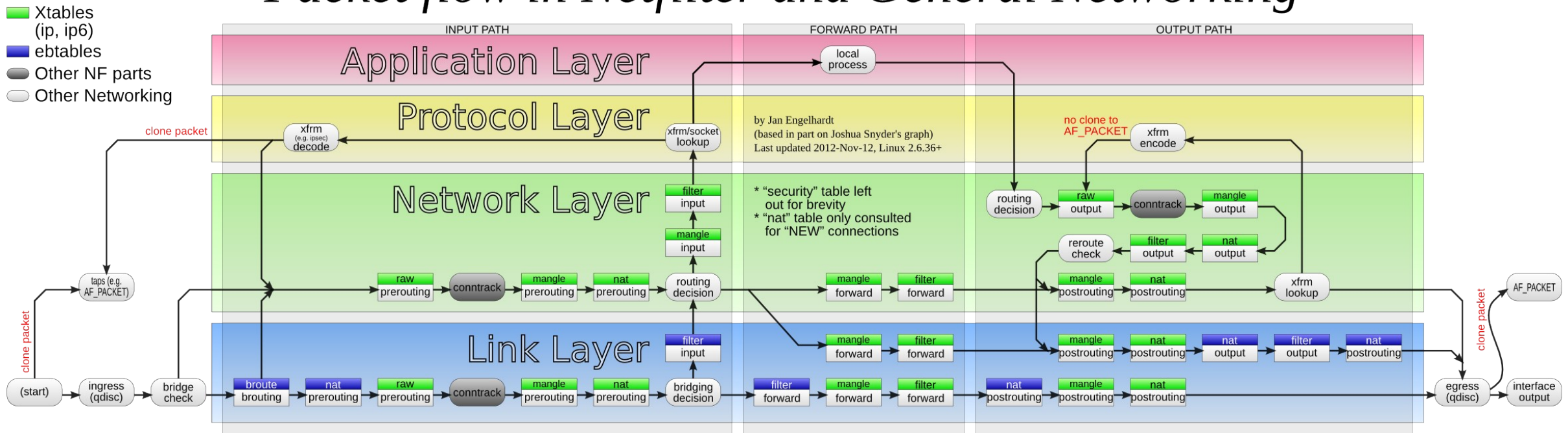
- ## Global rules

```
iptables -t mangle -A INPUT -j CONNMARK —restore-mark
iptables -t mangle -A POSTROUTING -j CONNMARK —save-mark
```

- ## Policy routing

```
ip rule add fwmark 1234 table 1234
ip route add default via 1.2.3.4 dev wlan0 table 1234
```

CONNMAN.
ROUTING.

Packet flow in Netfilter and General Networking

CONNMAN. STATISTICS.

- Android uses two kernel modules:

  - **xt_qtaguid**: tags all traffic from/to sockets

  - **quota2:** Accounting and enforcing. Counters reported through NFLOG

- netdev maintainers suggested to use NFQUEUE

  - Look at all packets in userspace (zero copy)

  - Each packet has meta information attached (GID, UID, etc.)

  - Work in progress

SYSTEMD.

- DHCP library recently added
  - Based on ConnMan's gdhcp
  - ConnMan will use it in future
- systemd suppports 'only static/simple' setups
  - Network boot
- Needs to learn to handover
  - Work in progress

THANK YOU VERY MUCH FOR YOUR INTEREST.

RESOURCES.

01.org/connman

www.press.bmwgroup.com