How to Use Vehicle Data to AGL

10/18/2017
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About Myself

- Yuichi Kusakabe (FUJITSU TEN LIMITED)

- Software Engineer of IVI about 10 years
  (for 16-bit and 32-bit architecture)

- Linux Software Engineer(2011-2013)
- Linux Software Lead Engineer(2013-Now)

- BSP Porting/Customizing
- Supporting for in-house software developers
- AGL(Automotive Grade Linux) Advisory Board member

Agenda

- What's current problem
- Standard Linux CAN IF & OSS CAN Tool
- How to use Vehicle Data to AGL
- Support Hardware and Demonstration details
- Conclusion

What's current problems

What is current problems

On differences from actual products related to Vehicle data (include kaizen)

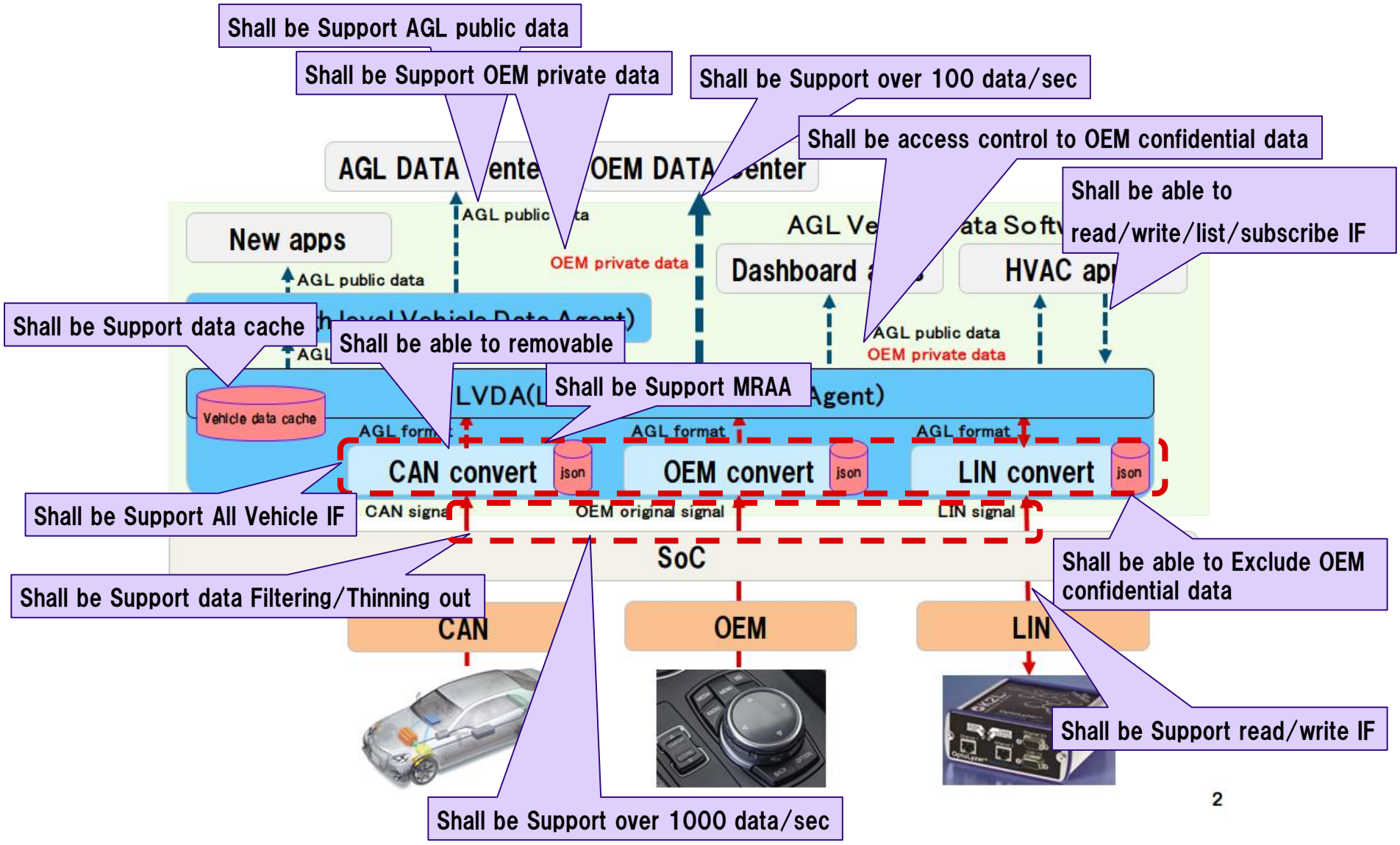
- Apps side
  - Apps is depend vehicle Low level HW IF
  - Apps is depend Low level CAN data format
  - Apps is depend destination requirement

  ->Shall be all vehicle data change to AGL public data provide to Apps

- MW side
  - MW need to very high cycle vehicle data received
  - MW need to support OEM private confidential data
  - MW need to protect OEM private confidential data
  - MW need to support many vehicle HW IF
  - MW need to vehicle data cache
  - MW need to easy removable vehicle HW IF

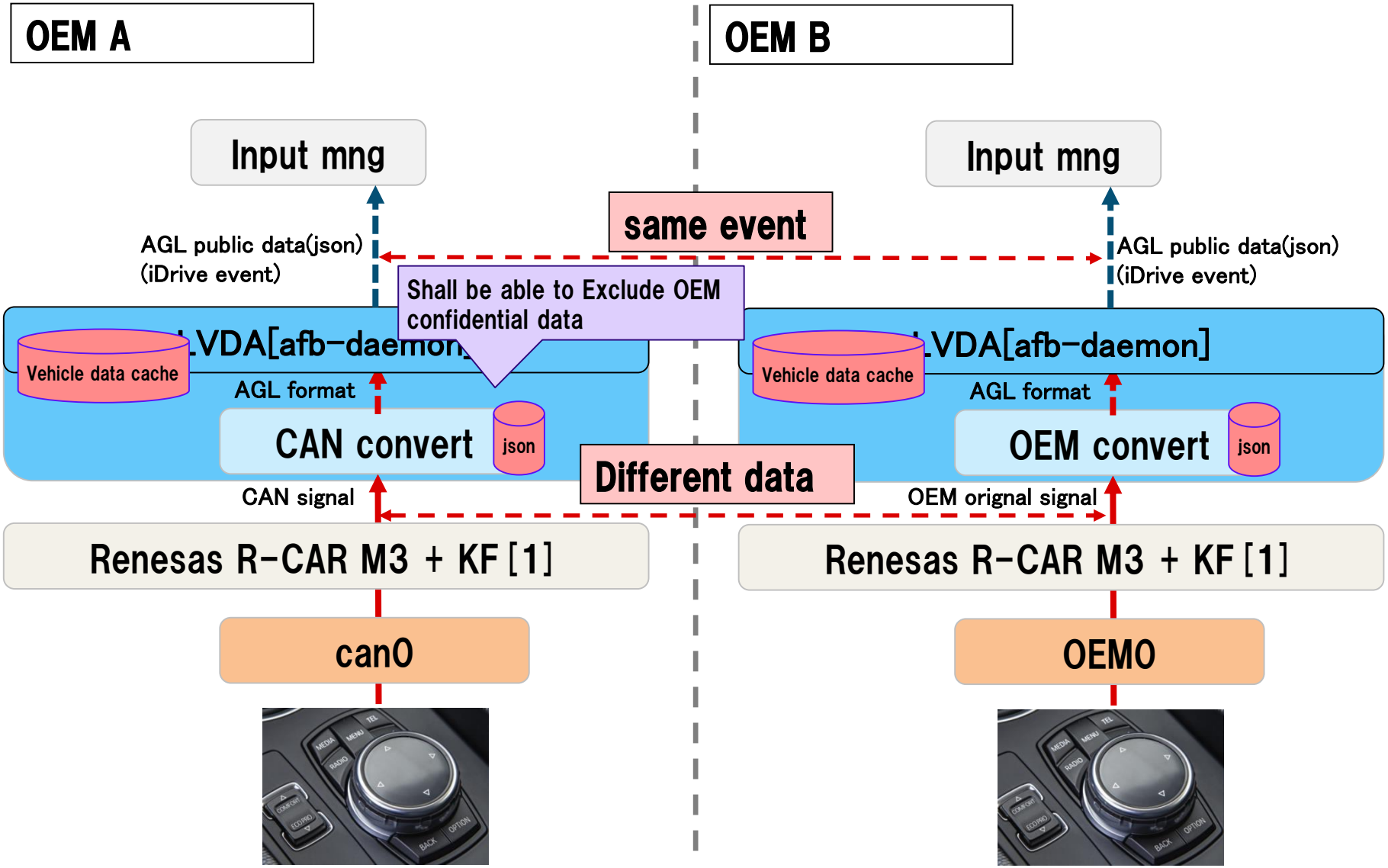
- Data Center side
  - Data Center need to real time vehicle data.
  - Data Center need to sync vehicle data when vehicle change offline to online.

Vehicle data Requirement



Example Use Cases 1

Provide to same event to Apps from different low level vehicle data.



Example Use Cases 2

Apps not depend destination requirement (For example Driver Distraction)

Destination A

VehicleData	DriverDistraction
10km/h <= Speed	ON
Speed < 10km/h	OFF

Apps

AGL public data(Driver Distraction)

HVDA(High level Vehicle Data Agent)

AGL public data(VehicleSpeed & ParkingBrake)

LVDA[afb-daemon]

Vehicle data cache

AGL format

CAN convert

json

CAN signal

Renesas R-CAR M3 + KF [1]

can0

Change destination logic

Destination B

VehicleData	VehicleData	DriverDistraction
10km/h <= Speed	ParkingBrake=OFF	ON
Speed < 10km/h	ParkingBrake=ON	OFF

Apps

AGL public data(Driver Distraction)

HVDA(High level Vehicle Data Agent)

AGL public data(VehicleSpeed & ParkingBrake)

LVDA[afb-daemon]

Vehicle data cache

AGL format

CAN convert

json

CAN signal

Renesas R-CAR M3 + KF [1]

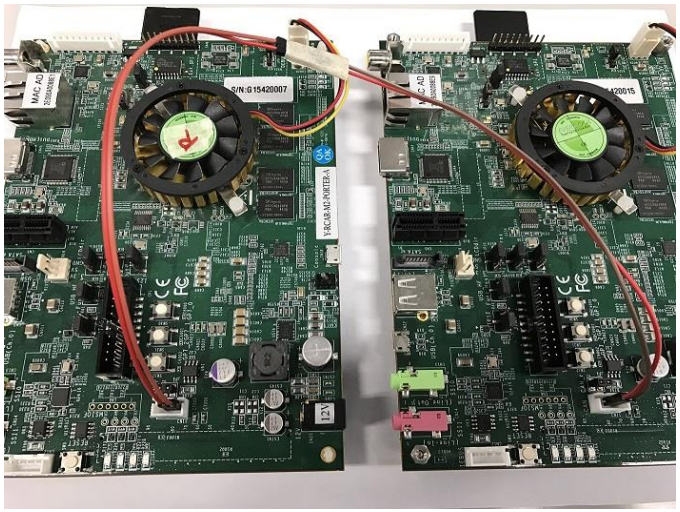
can0

Standard Linux CAN IF & OSS CAN Tool

What's CAR CAN Signal

Standard CAN Signal is Low Speed (500kbps), But High frequency (us).**

- Standard CAN Signal format(11bit).
  - Data line: D+/D-/GND(want)
  - Baud rate: 500kbps
  - CAN ID: 11bit(0x000~0x7FF)
  - Data size: 0~8byte
  - CAN Bus load: 20~75%



https://ja.wikipedia.org/wiki/Controller_Area_Network

Standard Linux CAN IF(SocketCAN)

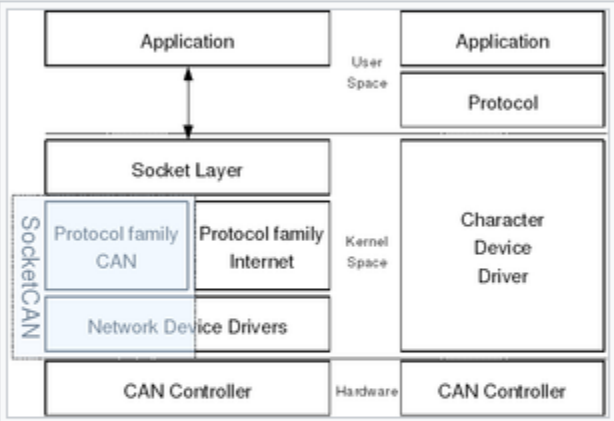
Linux kernel all ready CAN IF with Socket CAN

SocketCAN

From Wikipedia, the free encyclopedia

SocketCAN is a set of open source CAN drivers and a networking stack contributed by Volkswagen Research to the Linux kernel. Formerly known as *Low Level CAN Framework* (LLCF).

Traditional CAN drivers for Linux are based on the model of character devices. Typically they only allow sending to and receiving from the CAN controller. Conventional implementations of this class of device driver only allow a single process to access the device, which means that all other processes are blocked in the meantime. In addition, these drivers typically all differ slightly in the interface presented to the application, stifling portability. The SocketCAN concept on the other hand uses the model of network devices, which allows multiple applications to access one CAN device simultaneously. Also, a single application is able to access multiple CAN networks in parallel.



Typical CAN communication layers. With SocketCAN (left) or conventional (right).

The SocketCAN concept extends the Berkeley sockets API in Linux by introducing a new protocol family, PF_CAN, that coexists with other protocol families like PF_INET for the Internet Protocol. The communication with the CAN bus is therefore done analogously to the use of the Internet Protocol via sockets. Fundamental components of SocketCAN are the network device drivers for different CAN controllers and the implementation of the CAN protocol family. The protocol family, PF_CAN, provides the structures to enable different protocols on the bus: Raw sockets for direct CAN communication and transport protocols for point-to-point connections. Moreover the broadcast manager which is part of the CAN protocol family provides functions e.g. for sending CAN messages periodically or realize complex message filters.

Patches about CAN were added in the 2.6.25 Linux kernel. Meanwhile some controller drivers were added and work is going on to add drivers for a variety of controllers.

https://en.wikipedia.org/wiki/SocketCAN

Standard Linux CAN IF(CAN Driver)

Linux kernel all ready CAN IF with Socket CAN

```
Readme file for the Controller Area Network Protocol Family (aka SocketCAN)

This file contains

  1 Overview / What is SocketCAN

  2 Motivation / Why using the socket API

  3 SocketCAN concept
    3.1 receive lists
    3.2 local loopback of sent frames
    3.3 network problem notifications

  4 How to use SocketCAN
    4.1 RAW protocol sockets with can_filters (SOCK_RAW)
      4.1.1 RAW socket option CAN_RAW_FILTER
      4.1.2 RAW socket option CAN_RAW_ERR_FILTER
      4.1.3 RAW socket option CAN_RAW_LOOPBACK
      4.1.4 RAW socket option CAN_RAW_RECV_OWN_MSGS
      4.1.5 RAW socket option CAN_RAW_FD_FRAMES
      4.1.6 RAW socket option CAN_RAW_JOIN_FILTERS
      4.1.7 RAW socket returned message flags
    4.2 Broadcast Manager protocol sockets (SOCK_DGRAM)
      4.2.1 Broadcast Manager operations
      4.2.2 Broadcast Manager message flags
      4.2.3 Broadcast Manager transmission timers
      4.2.4 Broadcast Manager message sequence transmission
      4.2.5 Broadcast Manager receive filter timers
      4.2.6 Broadcast Manager multiplex message receive filter
      4.2.7 Broadcast Manager CAN FD support
    4.3 connected transport protocols (SOCK_SEQPACKET)
    4.4 unconnected transport protocols (SOCK_DGRAM)

  5 SocketCAN core module
    5.1 can.ko module params
    5.2 procfs content
    5.3 writing own CAN protocol modules
```

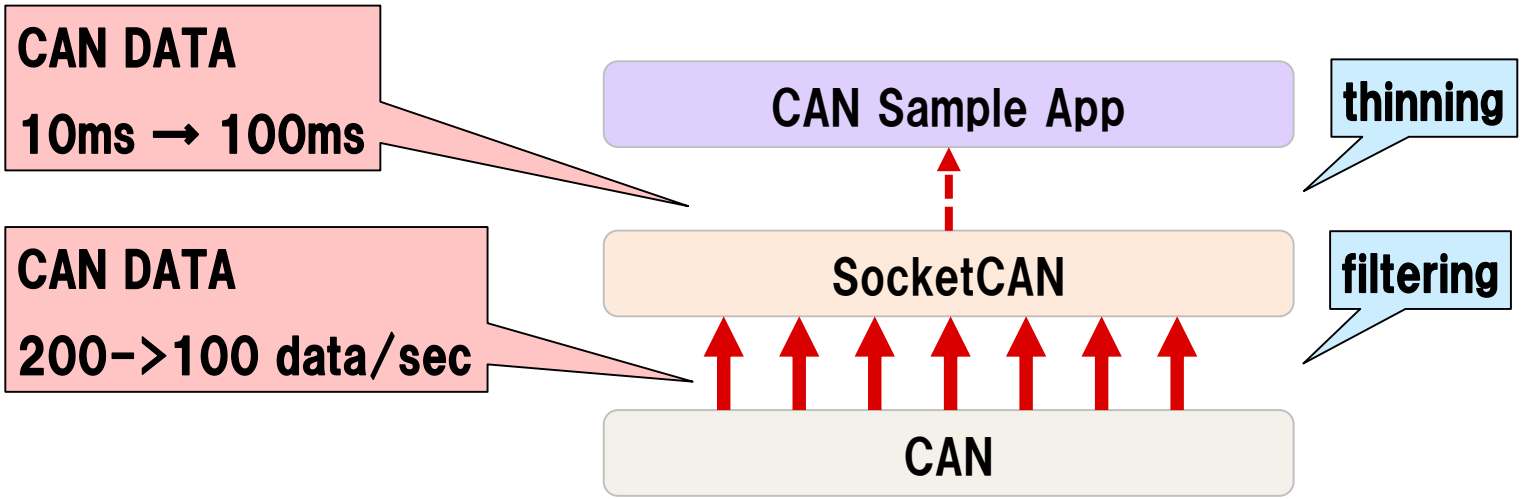
```
CONFIG_CAN=y
CONFIG_CAN_RAW=y
CONFIG_CAN_BCM=y
CONFIG_CAN_GW=y
CONFIG_CAN_RCAR=y
```

https://www.kernel.org/doc/Documentation/networking/can.txt

CAN key technology

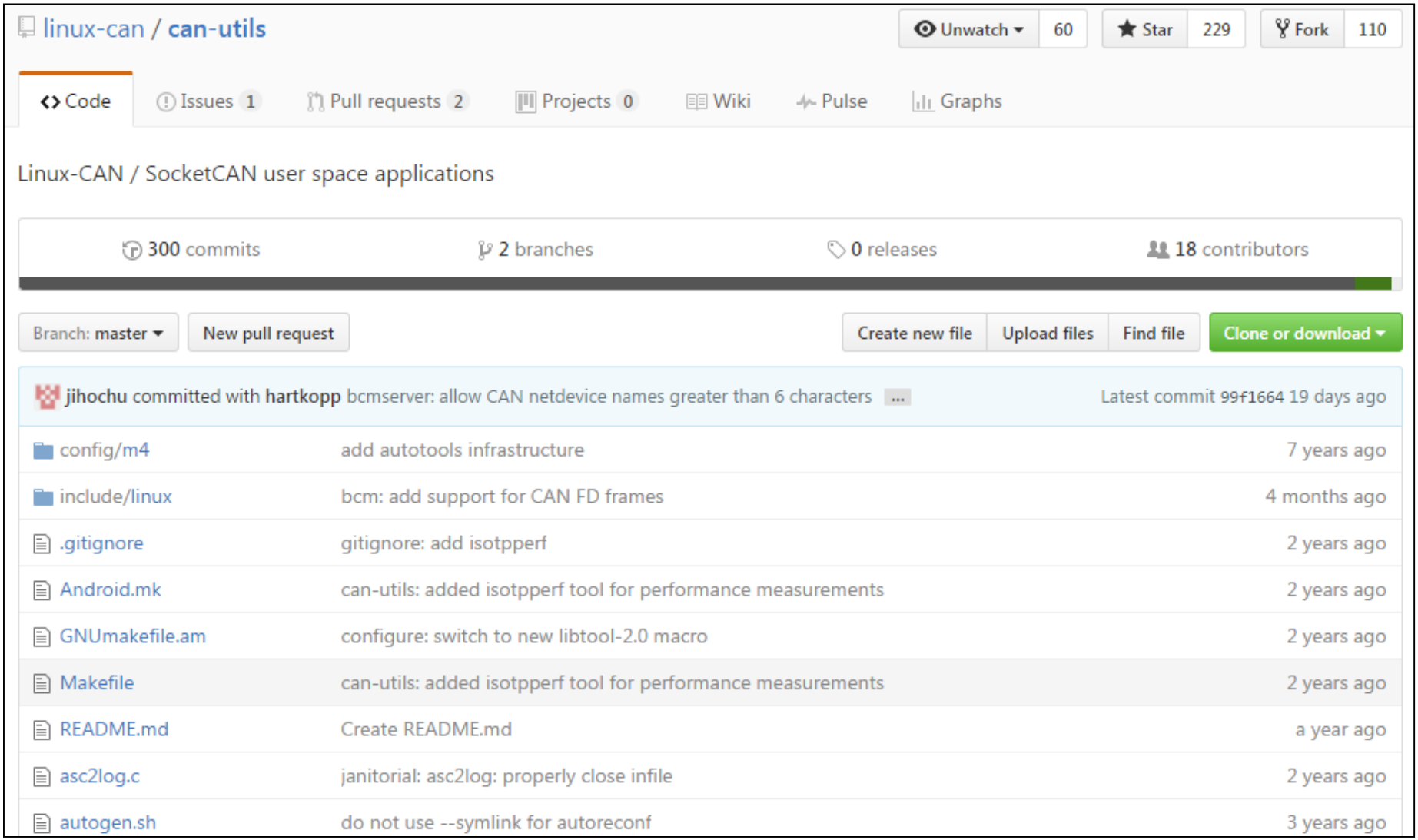
CAN ID Filtering and CAN DATA Thinning out is very important

- CAN signal filtering(setting SocketCAN)
  - CAN ID xxx -> xx
- CAN signal thinning out
  - CAN cycle xx ms -> xxx ms



OSS CAN Tool(Powerful software)

can-utils easy to debug CAN Signal (read/write/play)



https://github.com/linux-can/can-utils

OSS CAN Tool(Powerful software)

CAN data send (cansend)

ID=333(11bit), DATA=33 send=can0
# cansend can0 333#33

ID=00004444(24bit), DATA=44 send=can0
# cansend can0 00004444#44

CAN data recv (candump)

recv=can
# candump can0 -ta
root@porter:~# candump can0 -ta
(1478869757.430017) can0 344 [8] FF EE 00 00 00 00 EE AA
(1478869757.431290) can0 226 [8] E4 00 00 EE 00 EE EE 00

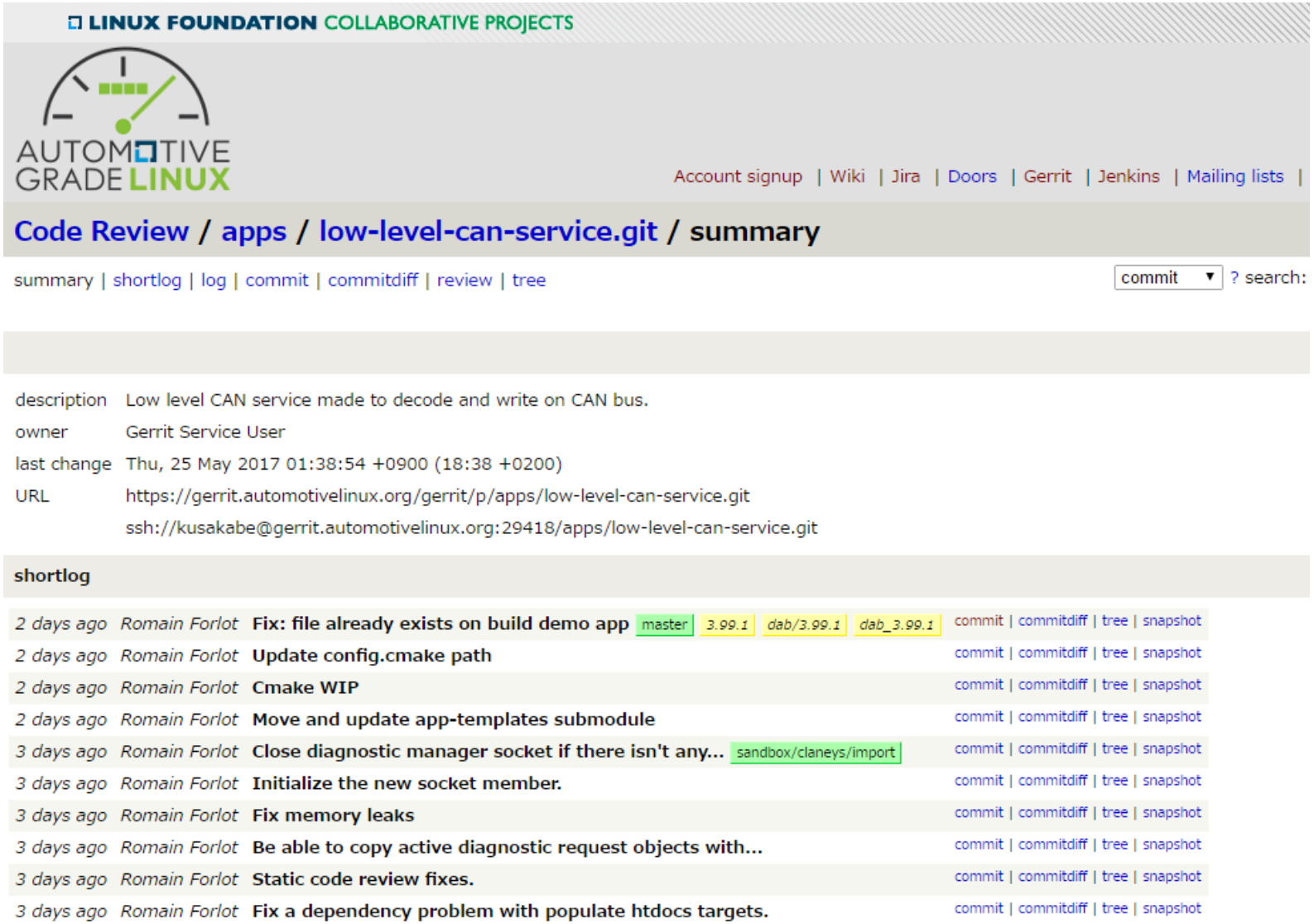
recv=all
# candump any -ta

https://github.com/linux-can/can-utils

How to use Vehicle Data to AGL

Low level CAN service

Low level CAN service made to decode and write on CAN bus



LINUX FOUNDATION COLLABORATIVE PROJECTS

AUTOMOTIVE GRADE LINUX

Account signup | Wiki | Jira | Doors | Gerrit | Jenkins | Mailing lists |

Code Review / apps / low-level-can-service.git / summary

summary | shortlog | log | commit | commitdiff | review | tree

commit ? search:

description	Low level CAN service made to decode and write on CAN bus.
owner	Gerrit Service User
last change	Thu, 25 May 2017 01:38:54 +0900 (18:38 +0200)
URL	https://gerrit.automotivelinux.org/gerrit/p/apps/low-level-can-service.git
	ssh://kusakabe@gerrit.automotivelinux.org:29418/apps/low-level-can-service.git

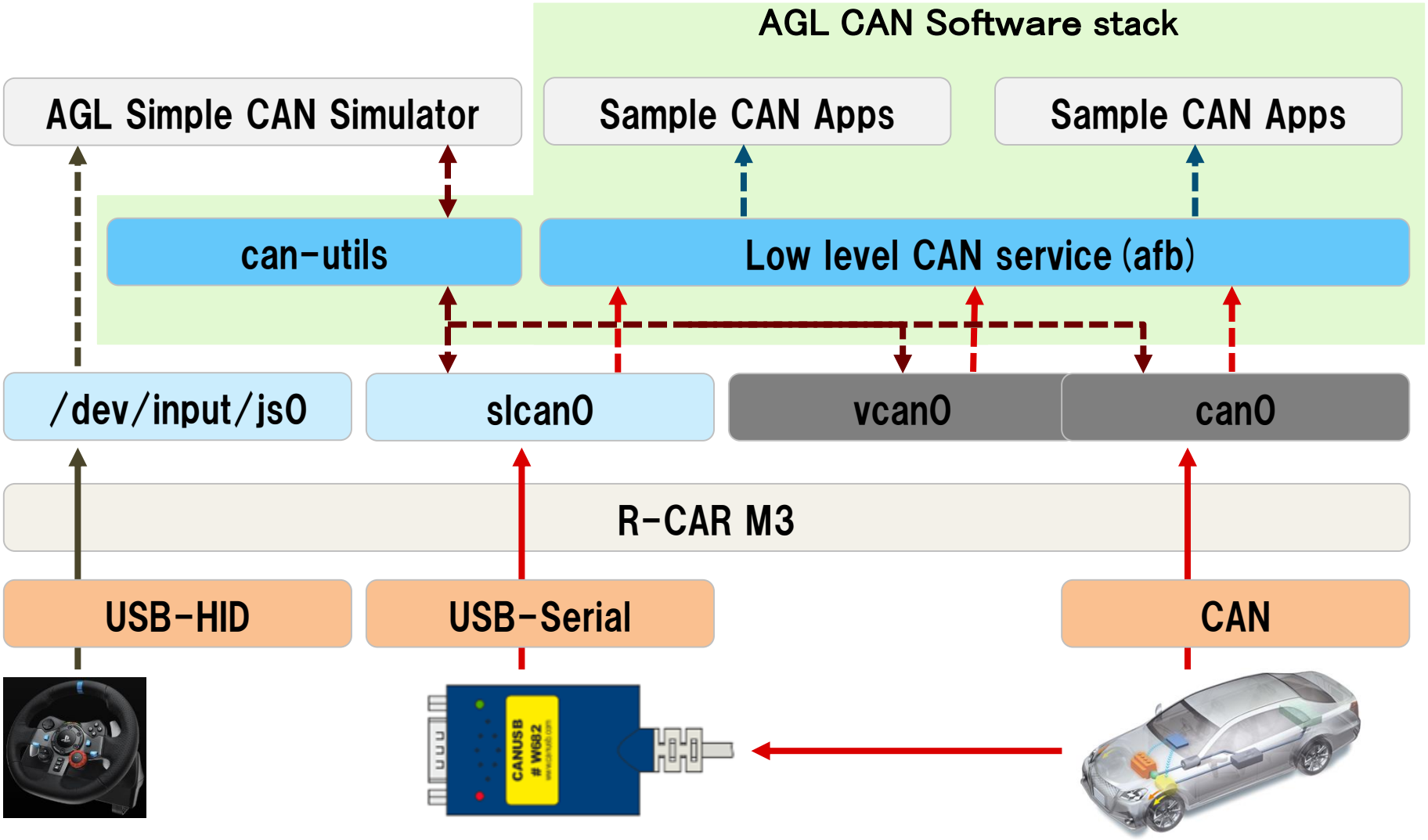
shortlog

2 days ago	Romain Forlot	Fix: file already exists on build demo app	master 3.99.1 dab/3.99.1 dab_3.99.1	commit | commitdiff | tree | snapshot
2 days ago	Romain Forlot	Update config.cmake path		commit | commitdiff | tree | snapshot
2 days ago	Romain Forlot	Cmake WIP		commit | commitdiff | tree | snapshot
2 days ago	Romain Forlot	Move and update app-templates submodule		commit | commitdiff | tree | snapshot
3 days ago	Romain Forlot	Close diagnostic manager socket if there isn't any...	sandbox/claneys/import	commit | commitdiff | tree | snapshot
3 days ago	Romain Forlot	Initialize the new socket member.		commit | commitdiff | tree | snapshot
3 days ago	Romain Forlot	Fix memory leaks		commit | commitdiff | tree | snapshot
3 days ago	Romain Forlot	Be able to copy active diagnostic request objects with...		commit | commitdiff | tree | snapshot
3 days ago	Romain Forlot	Static code review fixes.		commit | commitdiff | tree | snapshot
3 days ago	Romain Forlot	Fix a dependency problem with populate htdocs targets.		commit | commitdiff | tree | snapshot

https://gerrit.automotivelinux.org/gerrit/gitweb?p=apps/low-level-can-service.git;a=summary

AGL CAN Software stack

AGL support easy to use CAN data



CAN and vehicle signaling workshop

Transport as a plugin

We all agree on separation of the transport layer from low-level CAN binding and to load it as a plugin depending on the need of the binding.

Doing that, one can reuse the base of low-level binding and just plug a custom transport layer to be able to communicate with different protocols and devices, like LIN, OEM specific hardware, GPS, …

Transport layer should be a library loaded dynamically at binder startup. API between binding and plugin is defined based on work on CAN binding and enriched with a new proprietary transport plugin defined by Yuichi Kusakabe and Romain Forlot. Also, MRAA could be a great idea to be integrated and should be done by Brendan as he is the lead on that topic.

So far, a transport plugin only needs to implement simple functions: 'open'/'close'/'read'/'write'. Configuration has to made by sending a header message with or without can_data, just like a BCM CAN socket is configured (see [1][2]).

High level binding

Second, we need a “high” level binding that should understand signals coming from different sources. As we separate transport from binding, this is natural to think that we need to gather and be able to compose higher signals from the raw signals provided by the low level.

This make use of C functions or LUA functions callback/handler to react from subscribed signal. Callback/handler should take care of subscribing part and action to take at signal reception time. This way, we can address different low level binding with different transport layer as well as different binding like GPS. Reactive programming patterns will be probably very useful to write an efficient high level binding: some frameworks like ReactiveX could be used.

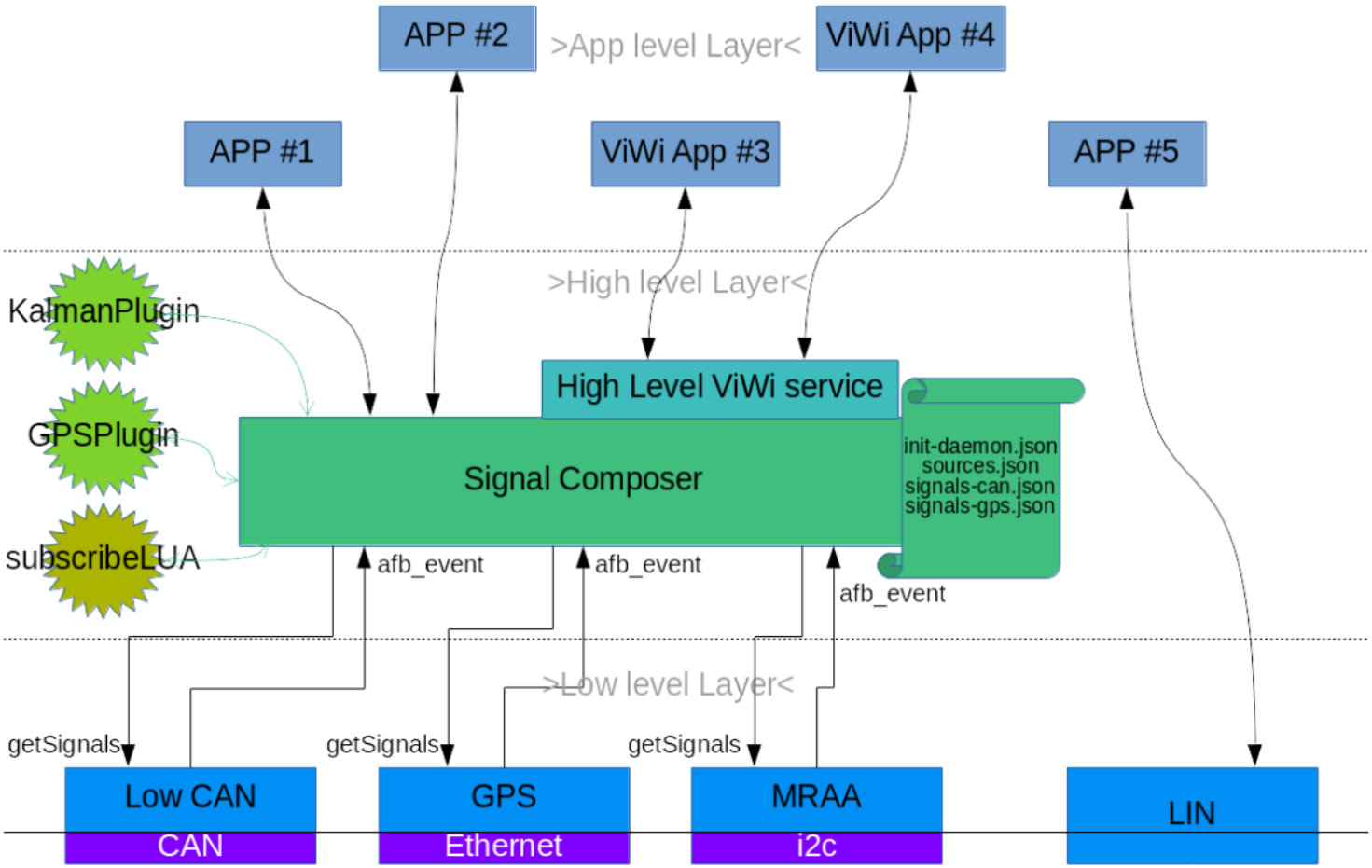
https://wiki.automotivelinux.org/agl-distro/sep2017-can-f2f

AGL New Vehicle Data Software stack

Signal Composer

Architecture

Here is a quick picture about the signaling architecture :



https://github.com/iotbzh/afb-signal-composer

Public CAN protocol(OpenXC)

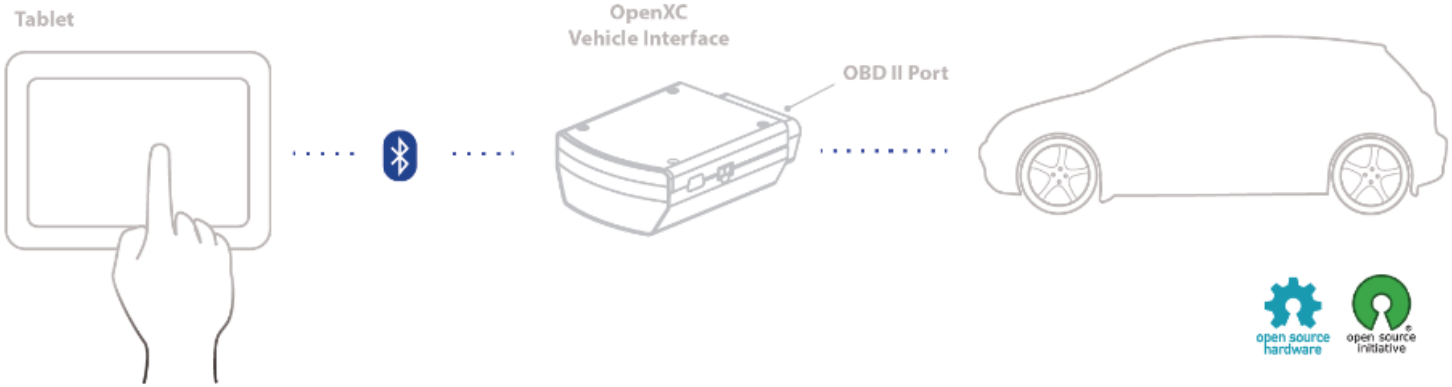
FUJITSU TEN

The OpenXC Platform

OpenXC™ is a combination of open source hardware and software that lets you extend your vehicle with custom applications and pluggable modules. It uses standard, well-known tools to open up a wealth of data from the vehicle to developers, even beyond OBD-II.

OpenXC

OpenXC is an open source hardware and software platform that lets you extend your vehicle with custom applications and pluggable modules.



What is OpenXC™?

OpenXC™ is an open source, data-focused API for your car. By installing a small hardware module, the vehicle data becomes accessible to Android or other desktop applications using the OpenXC library.

OpenXC Overview

Unlocking Rich Vehicle Data

OpenXC™ allows consumer devices, such as smart phones, to access data from any vehicle. Using OpenXC™, you can monitor many of the sensors on a vehicle, enabling new and innovative vehicle-centric applications. Some data is required by law and more can be unlocked with support from an automaker - or a little reverse engineering effort!

See the Data

http://openxcplatform.com/

Public CAN protocol(OpenXC)

Official Signals

These signal names are a part of the OpenXC specification, although some manufacturers may support custom message names.

- steering_wheel_angle
  - numerical, -600 to +600 degrees
  - 10Hz
- torque_at_transmission
  - numerical, -500 to 1500 Nm
  - 10Hz
- engine_speed
  - numerical, 0 to 16382 RPM
  - 10Hz
- vehicle_speed
  - numerical, 0 to 655 km/h (this will be positive even if going in reverse as it's not a velocity, although you can use the gear status to figure out direction)
  - 10Hz
- accelerator_pedal_position
  - percentage
  - 10Hz
- parking_brake_status
  - boolean, (true == brake engaged)
  - 1Hz, but sent immediately on change

19 CAN Data

https://github.com/openxc/openxc-message-format

Public CAN protocol(FMS)

Daimler AG
Daimler Buses - EvoBus GmbH
MAN Truck & Bus AG
Scania AB

Scania CV
Volvo Truck Corporation
Volvo Bus Corporation
Renault Trucks

Iveco SpA
DAF Trucks N.V.
VDL Bus & Coach B.V.

FMS-Standard description

Version 03

14.09.2012

http://www.fms-standard.com/Truck/down_load/fms_document_ver03_vers_14_09_2012.pdf

Public CAN protocol(FMS)

page	PGN	SPN	(signal) name e.g. milage, fuel consumption	Mandatory Truck only	rep. rate in ms	remarks / comments	
Truck AND Bus Section			Truck AND Bus Section	Truck AND Bus Section		Truck AND Bus Section Truck AND Bus Section	Truck AND Bus Section Truck AND Bus Section
7	65257	250	Engine total fuel used		1000	4 bytes, 0 to +2 105 540 607,5 L	Might be set to "not available" if SPN 5054 is available
8	65276	96	fuel level 1	X (worldwide)	1000	1 Byte	-
9	61444	513	Actual Engine – Percent Torque	X (worldwide)	20	1 % / Bit, -125 % offset	-
9	61444	190	engine speed	X (worldwide)	20	2 Byte, 0-8031,875 rpm	-
10	65253	247	Engine total hours of Operation	X (worldwide)	1000	4 bytes, 0 to 210 554 060,75 h	Counter is Engine running dependant
11	65260	237	vehicle identification number	X (worldwide)	10000	variable, max 200 char.	Will be sent every 10 sec
12	64977	2806	SW-version supported	X (worldwide)	10000	Indicator for SW version supported	-
12	64977	2804	Diagnostics supported	X (worldwide)	10000	indicator for diagnosis session support	-
12	64977	2805	Requests supported	X (worldwide)	10000	indicator for request supported	-
14	65217	917	High resolution total vehicle distance	X (worldwide)	1000	4 bytes, 0 - 21 055 406 km; without TCO	Resolution may be not within the SAE values
15	65132	1611	Vehicle motion	X (EU)	20/50	With digital tachograph	rep. rate tacho dependant
15	65132	1613	driver 2 working state	X (EU)	20/50	With digital tachograph	rep. rate tacho dependant
15	65132	1612	driver 1 working state	X (EU)	20/50	With digital tachograph	rep. rate tacho dependant
15	65132	1614	Vehicle overspeed		20/50	With digital tachograph	rep. rate tacho dependant
15	65132	1617	Driver 1 time rel. states		20/50	With digital tachograph	rep. rate tacho dependant
15	65132	1618	Driver 2 time rel. states		20/50	With digital tachograph	rep. rate tacho dependant
15	65132	1615	Driver 1 card	X (EU)	20/50	With digital tachograph	rep. rate tacho dependant
15	65132	1616	Driver 2 card	X (EU)	20/50	With digital tachograph	rep. rate tacho dependant
15	65132	1619	Direction indicator		20/50	With digital tachograph	rep. rate / availability is tachograph dependant.
15	65132	1620	Tachograph performance	X (EU)	20/50	With digital tachograph	rep. rate tacho dependant
15	65132	1621	Handling information	X (EU)	20/50	With digital tachograph	rep. rate tacho dependant
15	65132	1622	System event	X (EU)	20/50	With digital tachograph	rep. rate tacho dependant
15	65132	1624	Tachograph vehicle speed	X (EU)	20/50	With digital tachograph - 2 bytes	rep. rate tacho dependant/might differ from the wheel based speed
17	65262	110	engine coolant temperature	X (worldwide)	1000	-40° to 210°	-
18	65269	171	Ambient Air Temperature	X (worldwide)	1000	0.03125 °C / Bit gain	- 273 °C offset
19	65131	1625/1626	Driver 1 / Driver 2 Identification	X (EU)	10000	If a driver ID is available the message is sent with a Broadcast Announce Message (BAM)	Diff. to SAE: broadcast instead of on request
20	65266	183	Fuel rate	X (worldwide)	100	0.05 L/h per bit, 0 to 3,212.75 L/h	Calculated values given as indications, not as contractual
20	65266	184	Instantaneous Fuel Economy	X (worldwide)	100	1/512 km/L per bit, 0 to 125,5 km/L	Calculated values given as indications, not as contractual
21	65198	1087	Service Brake Air Pressure Circuit #1	X (worldwide)	1000	8 kPa/Bit, 0 offset	
21	65198	1088	Service Brake Air Pressure Circuit #2	X (worldwide)	1000	8 kPa/Bit, 0 offset	
22	64777	5054	High resolution engine total fuel used		1000	0.001 L/bit, 0 to 4,211,081.215 L	Is implemented if technical possible
23	65110	1761	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Level		1000	0.4 %/bit, 0 % offset	
24	64893		FMS Tell Tale Status	X (worldwide ,EU) Not all tell tales	1000		4 blocks => Rep.rate for each tell tale status is 4 sec
Truck only Section			Truck only Section	Truck only Section		Truck only Section Truck only Section	Truck only Section Truck only Section
27	65265	84	wheel based speed		100	may differ from TCO1	-
27	65265	598	clutch switch		100	two bit status	in trucks with automatic gear => send as not available
27	65265	597	Brake switch		100	two bit status	-
27	65265	595	cruise control active		100	two bit status	in trucks with no cruise control => send as not available
27	65265	976	PTO state		100	Either SPN 3948 (PTODE) or SPN 976 is sent	SPN 3948 (PTO DE) message is preferred
29	61443	91	accelerator pedal position 1	X (worldwide)	50	1 Byte	-
29	61443	92	Engine Percent Load At Current Speed	X (worldwide)	50	1 % / bit, 0 to 125 % operational range	-
30	65258	928	Axle location		1000	-	If info of more axles available it will be updated with each repetition
30	65258	928	Tire location		1000	-	-
30	65258	582	Axle weight		1000	-	-
32	65216	914	Service distance		1000	-	-
33	64932	3948	At least one PTO engaged		100	Either SPN 3948 or SPN 976 (CCVS) is sent	SPN 3948 (PTO DE) message is preferred
34	65136	1760	Gross Combination Vehicle Weight		10000	0 to 642,550 kg	Diff. to SAE: broadcast instead of on request
35	61440	900	Retarder Torque Mode		100	16 states/4 bit, 0 offset	-
35	61440	520	Actual Retarder - Percent Torque		100	1 %/bit, -125 % offset	-
35	61440	1716	Retarder Selection, non-engine		100	0.4 %/bit, 0 % offset	The value is related to the drive line retarder

56 CAN Data (include Bus)

http://www.fms-standard.com/Truck/down_load/fms_document_ver03_vers_14_09_2012.pdf

Define AGL Public Vehicle Data

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Collaborate with the Reference Hardware System Architecture Expert Group

Sample

AGL Public Vehicle Data

Reference to

https://rawgit.com/w3c/automotive-bg/master/snapshots/data_spec_snapshot_latest.html

				AGL Reference Data			
No	Data label(Apps side)	value	AGL Reference IF	ID	Length	Data	cycle(ms)
1	VehicleSpeed	unsigned short	CAN	0x010	2	**,**	16
2	GearPosition	unsigned char	CAN	0x100	1	**	64
3	LightStatus	unsigned short	CAN	0x200	2	**,**	100
4	Seatbelt;	unsigned short	CAN	0x300	2	**,**	200
5	FuelInterface	unsigned short	CAN	0x400	2	**,**	1,000
6	EngineSpeed	unsigned long	CAN	0x011	4	**,**	16

Reference to w3c, OpenXC and FMS Vehicle data

Hardware and Demonstration details

Target Hardware spec

AGL reference Hardware to Renesas R-CAR M3

CPU	R-Car M3搭載 • ARM®Cortex-A57 (ARMv8) 1.7 GHz dual core、with NEON/VFPv4、L1 cache I/D 48K/32K、L2 cache 2MB • ARM Cortex-A53 (ARMv8) 1.3 GHz quad core、with NEON/VFPv4、L1 cache I/D 32K/32K、L2 cache 512K • memory controller for LPDDR4 2GB in 2 channels、 each 32-bit wide
	• three-dimensional graphics engines • video processing units • 3 channels display output • 6 channels video input • SD card host interface • USB3.0 and USB2.0 interfaces • CAN interfaces • Ethernet AVB • PCI Express Interfaces
メモリ	• internal 384KBytes system RAM • 64 MBytes HyperFlashTM (512 Mbits) • 16MBytes QSPI flash(128 Mbits)1 header QSPI module • 8 GBytes eMMC • microSD card slot

http://elinux.org/R-Car/Boards/

R-CAR Gen3 Expansion board

R-CarスタータキットがAutomotive Grade Linuxの標準リファレンスプラットフォームに採用、次世代コネクテッドカーのIVI開発を加速

～最新のUnified Code Base（UCB）3.0の64ビットソフトウェア環境に対応～

2017年05月24日
ルネサス エレクトロニクス株式会社

R-CarスタータキットがAGLの標準リファレンスに採用

ルネサス エレクトロニクス株式会社（代表取締役社長兼CEO：呉 文精、以下ルネサス）は、このたびR-Carスタータキットが、Linuxベースの車載情報機器のオープンソースプロジェクトAutomotive Grade Linux（AGL）のソフトウェア開発用標準リファレンスプラットフォームの1つに採用されたことを発表しました。これにより、同プロジェクトが開発したソフトウェアを動かすハードウェア環境を容易に入手可能となり、コネクテッドカー時代に向けて、IVI（In-Vehicle Infotainment）用アプリケーションソフトウ
Carスタータキットは、すでにAGLプロジェ
Unified Code Base（UCB）3.0に対応して
来の32ビット環境に比べて、コンテナ技術
シームレスに車載向けへ応用可能となる最

また、このたびR-Carスタータキットと組み合わせて使用するIVI開発用拡張ボード2種類（シマフジ電機社製）が7月より発売されます。拡張ボードのスタンダードモデルは、マルチディスプレイや各種ネットワーク用インタフェースを搭載、さらにアドバンスドモデルは、最大8チャンネルのカメラ入力や高速/大容量のストレージを拡張できるインタフェースを装備しています。

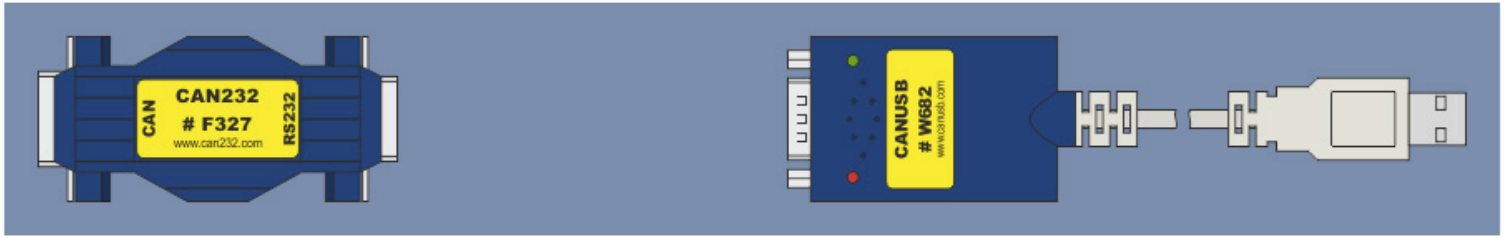
https://www.renesas.com/ja-jp/about/press-center/news/2017/news20170524.html

Target Hardware spec

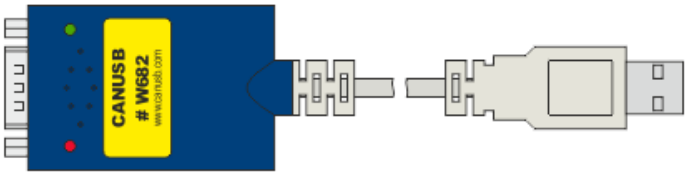
CANUSB easy connect CAN IF

CAN Tools

Home News Products Projects Downloads Where to Buy? About



CANUSB



General Information:

CANUSB is a very small dongle that plugs into any PC USB Port and gives an instant CAN connectivity. This means it can be treated by software as a standard COM Port (virtual serial RS232 port) with the FTDI USB drivers which eliminates the need for any extra drivers (DLL) or by installing a direct driver DLL (D2XX) together with our CANUSB DLL for faster communications and higher CAN bus loads. Sending and receiving can be done in standard ASCII format.

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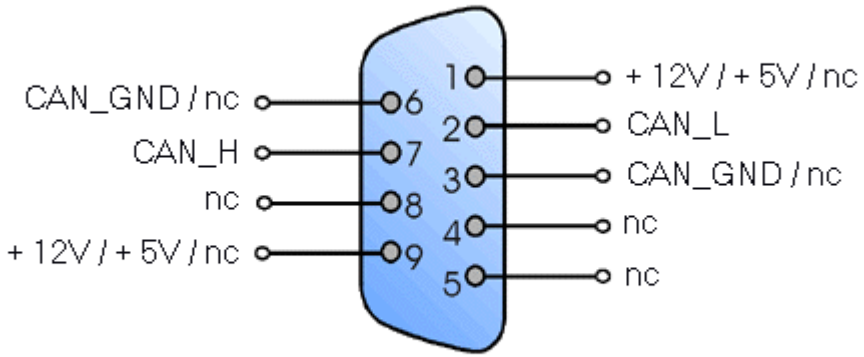
http://www.can232.com/?page_id=16

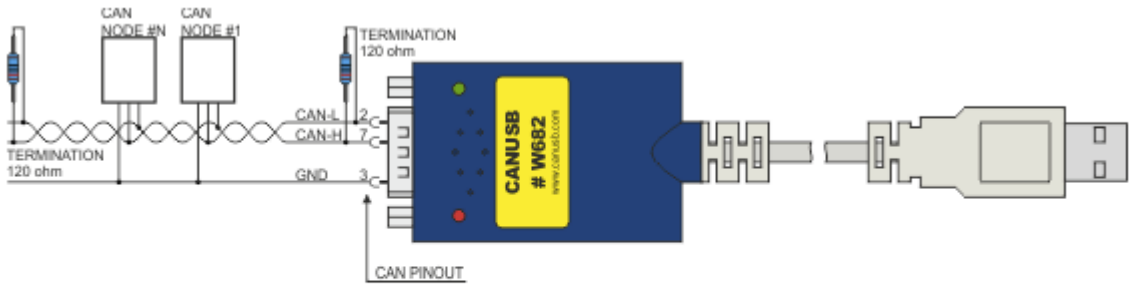
Target Hardware spec

CANUSB connected CAN IF simple Hardware

CAN Pin assignement:



Pin assignement according to CiA recommendations DS102-1.
The CANUSB is powered from USB port, so no need to connect external power on pin 9. Use only CAN_L (pin2), CAN_H (Pin7) and CAN_GND (pin3).



The picture above shows how to connect the CANUSB (click here for a larger view). No external power is needed, the CANUSB uses 5VDC/100mA from USB.

http://www.can232.com/?page_id=16

Software setup

Add Kernel defconfig CAN driver and CANUSB

```
CONFIG_CAN=y
CONFIG_CAN_VCAN=y
CONFIG_CAN_RCAR=y  <- Renesas board only
CONFIG_CAN_SLCAN=y
CONFIG_USB_SERIAL=y
CONFIG_USB_SERIAL_FTDI_SIO=y
```

Add rootfs “can-utils” and “iproute2”

```
yocto local.conf
IMAGE_INSTALL_append = “ can-utils iproute2”
```

Setup CAN and CANUSB

```
CAN0
ip link set can0 type can bitrate 500000
ip link set can0 up
```

```
CANUSB
slcand -o -s 6 -t hw /dev/ttyUSB*
ip link set slcan0 up
```

Software setup

Start Low level CAN service (afb-deamon)

```
./afb-daemon --token=${AFB_CANIVI_TOKEN} --ldpaths=. |
--port=${AFB_CANIVI_PORT}- |
--rootdir=. ${SERVICE_VERBOSE}
```

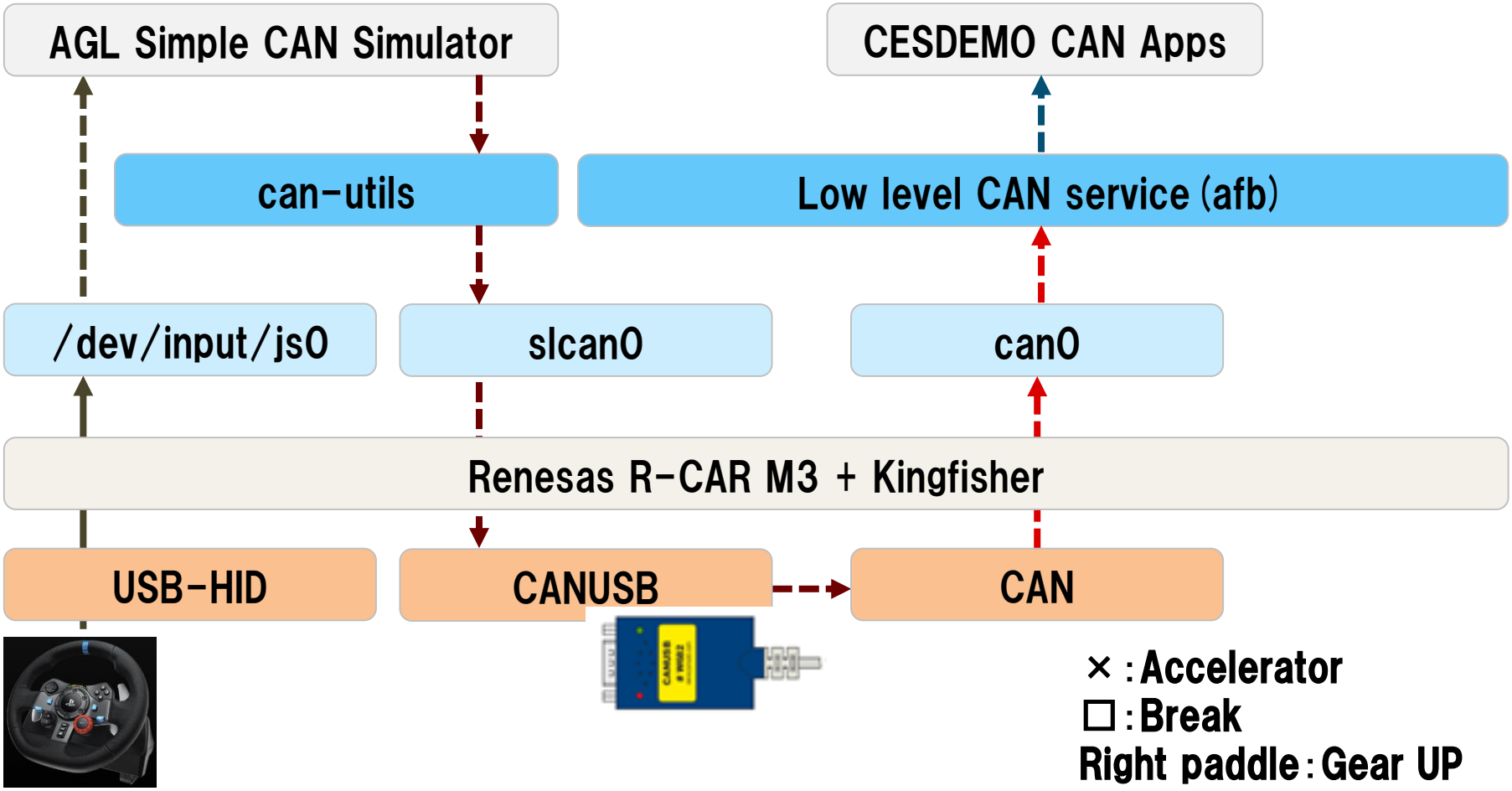
Setting CAN data receive

```
./afb-client-demo ws://localhost:5555/api?token=3210

low-can subscribe { "event" : "*" } <- receive all data

low-can subscribe { "event" : "VehicleSpeed" } <- receive Vehicle Speed only
```

AGL Vehicle CAN Demonstration

FUJITSU TEN

R-CAR M3 board running AGL CAN Simulator and Low level CAN service (afb)



Performance measurement result

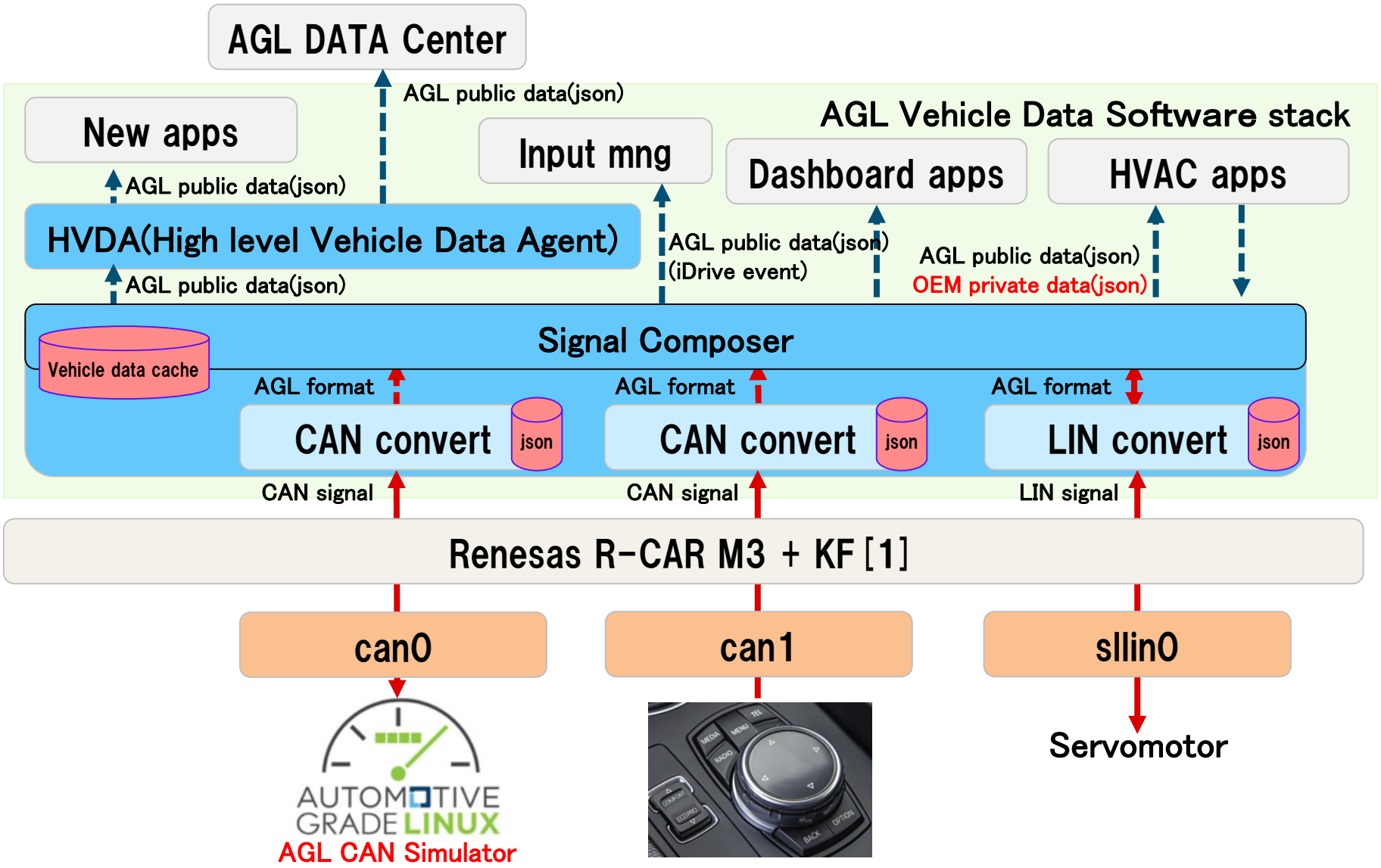
- Data used for measurement
  - logtime = 1122 sec,
  - CAN ID cnt = 129, datacnt = 1042673
  - can load ave= 19.04%, min = 18.82%, max = 37.89%
  - cyc ave[us] = 929, min = 8, max = 8565
- Support CAN ID 42, Thinning out time ** -> 100ms

	AFB (websocket)	
	Process name	CPU load(%)
Service	afb-daemon	1.34
Client(App)	afb-client-demo	0.82
CAN Sim	canplayer	1.51
Total	*	3.67

Next step

[RFC]2018CES demo plan

FUJITSU TEN



KF[1]
http://elinux.org/R-Car/Boards/Kingfisher

Conclusion

- Linux Kernel all ready use to vehicle CAN IF
- OSS CAN Tool “can utils” is good software
- AGL support easy to use Vehicle CAN data
- Next step
  - Define AGL public Vehicle CAN data format
    -> With the cockpit architecture team
  - AGL simple CAN simulator provide
  - Support all in-vehicle communication

Thank you!!!

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