Seamless Integration of Heterogeneous Automotive Busses into Linux
ALS 2017 - Tokyo
From Steel to Silicon

1908: Ford Model T

1980: ABS

1990: ESP/ESC

2000: OBD

Autonomous vehicles

ADAS

Electric vehicles
Vehicles Turning into Super-Computers

Percentage of total vehicle cost made up by electronics

Source: Statista
Which busses? Which purpose?

**LIN**
- Body control

**CAN / CAN-FD / FlexRay**
- Body control applications
- Safety critical functions

**MOST®**
- Infotainment
- Control / Audio / Video / IEEE 802.3

**Ethernet**
- Information backbone, ADAS, Diagnostic
- TCP/IP, UDP
Applications
Infotainment A/V
Applications
Active Noise Cancelling

Real-time Engine Data (e.g. RPM)

Head Unit with Active Noise Control
Network Capabilities Example with MOST®

- Many nodes
- Multiple types of data (video, audio, IP, control)
- All data types have their own channels
Requirements for a Seamless Integration

- Providing support for the bus
  - Low-level driver for networking IC

- Enabling easy handling of the network
  - Network & connections management software

- Enabling standard and secure applications
  - OS integration providing standard interfaces
  - Integration into an application framework
Former situation with Classical MOST®
Linux® & AGL Integration with UNICENS

- MOST® specific apps
- System Management Module (MSMM)
- NetServices (MNS)

Low level

High level

- Standard AGL apps
- AGL App Framework
- Centralised (ex. slim nodes and others)

- Linux® Driver
- Physical Layer

- Linux Driver
- Physical Layer

- UNICENS
Unified Centralized Network Stack (UNICENS)

- Centralized intelligence in root node ⇒ Easy maintenance
- From design stage to running in “a day” ⇒ Shorten development cycle
Specific Technology
Standard OS Interfaces

Character device (cdev)

Ethernet card

ALSA device

V4L2 device
Technology-Independent Applications

Non MOST® specific applications / standard programs and libs

open
read
write
close

TCP/IP
UDP
SOME/IP
etc.

ALSA mixer
std libs &
programs

ffmpeg
gstreamer
e tc.

meth0

ALSA

V4L2

MOST specific domain abstracted by Linux Driver

control
channel

Ethernet
packet channel

synchronous
channel

isochronous
channel

Physical
Layer
Seamless Integration Achievement with MOST®

- Providing support for the bus
  - Low-level driver for networking IC

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  - Network & connections management software

- Enabling standard and secure applications
  - OS integration providing standard interfaces

Integration into an application framework
„Free like Freedom“

**Linux® Driver**
- Released under GPL v2
- Source code published on GitHub
  - [https://github.com/microchip-ais/linux/tree/mld-1.5.0/mld](https://github.com/microchip-ais/linux/tree/mld-1.5.0/mld)
- Mainline since kernel 4.3

**UNICENS**
- Released under BSD-3
- Source code published on GitHub
  - UNICENS: [https://github.com/MicrochipTech/unicens](https://github.com/MicrochipTech/unicens)
- Working with AGL app framework
  - UNICENS AGL Binder: [https://github.com/iotbzh/unicens2-binding](https://github.com/iotbzh/unicens2-binding)
Corporate Overview

• Leading semiconductor provider:
  • High-performance microcontrollers, digital signal controllers and microprocessors
  • Mixed-signal, analog, interface and security solutions
  • Clock and timing solutions
  • Flash IP solutions
  • Non-volatile EEPROM and Flash memory solutions
  • Wireless and wired connectivity solutions
  • #8 in WW automotive supplier ranking

• ~ $3.5 billion revenue run rate
• ~13,000 employees
• Headquartered near Phoenix in Chandler, AZ
In-Vehicle Networking Leadership

Infotainment Network

MOST®

IEEE 802.3
Ethernet

SUPERSPEED

CERTIFIED USB

CAN FD

lin