A Qt-based GENIVI Stack

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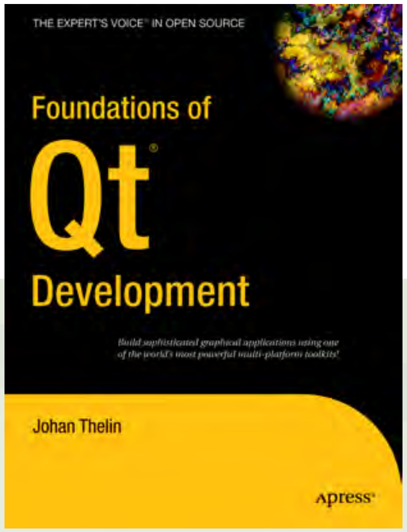
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Johan Thelin

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- Founded 2009
- Offices in Gothenburg and München

Open Source Infotainment

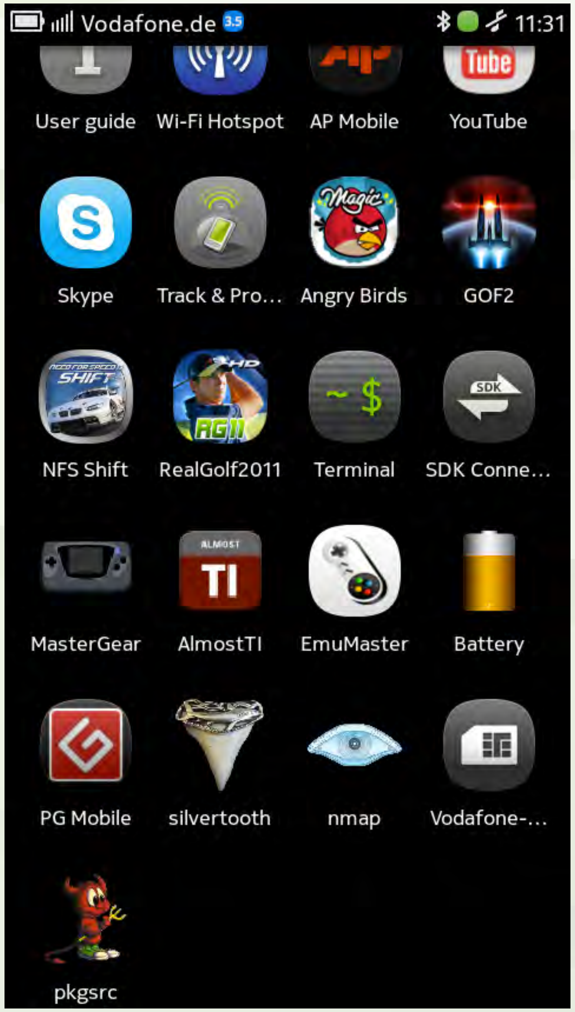
Enabling Great Design

A Changing Business

- Cost ratio hardware / software
- In the old days, a T1 sells a box with software
- Software contains much OEM specifics

- Who should owns the software?
- Who should make the software?

User Expectations



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The User

- Roaming user profiles
  - Your next car
  - Family cars
  - Rental cars
  - Car pooling
- Who owns the user?
  - Google?
  - OEM?

Selling More Stuff

- Selling vehicle functions
- Selling apps
- Selling data (maps)
- etc

Deployment

- Many screens
  - Instrument cluster
  - Heads-up Display
  - Central head unit
  - Rear-seat entertainment nodes

- Combinations

Apps

- Downloadable dynamic contents
  - A new way to make money
  - Grow platform features over time
- Scary
  - How to validate the whole system
  - Legal requirements – and indemnification
  - Who develops?

What is GENIVI?

GENIVI is a non-profit industry alliance committed to driving the broad adoption of an In-Vehicle Infotainment (IVI) open-source development platform.

The alliance aims to align requirements, deliver reference implementations, offer certification programs, and foster a vibrant open-source IVI community.

Our work will result in shortened development cycles, faster time-to market, and reduced costs for companies developing IVI equipment and software.

Expert Groups

- Automotive
- CE Connectivity
- HMI Application Framework
- Location Based Services
- Media and Graphics
- Networking
- System Infrastructure

Open Source

- Focuses on specifying a Linux based system
- Reduce fragmentation and reduce cost
- Utilize existing functionality
  - Avoid reimplementing everything for every project
- Utilize common needs with other verticals
  - Media playback, bluetooth, base os, etc

System Compliance

- An evolving compliance specification
- What components to use for what purpose
  - Placeholders – there is a need
  - Abstract – use these interfaces
  - Specific – use this component
- Priorities: mandatory or optional

- Goal: to be able to move components between platforms

...and for Apps

- Works with GENIVI
  - Work in progress!
  - Specify application dependencies and APIs
  - Make it possible to build a common eco system for applications

Adopting Components

- Selects and adopts components from the community
  - connman
  - bluez
  - systemd
  - Linux kernel
  - etc

- Cooperates with the upstream project to adapt to the use case
- Compliance usually focus on interfaces – Abstract Components

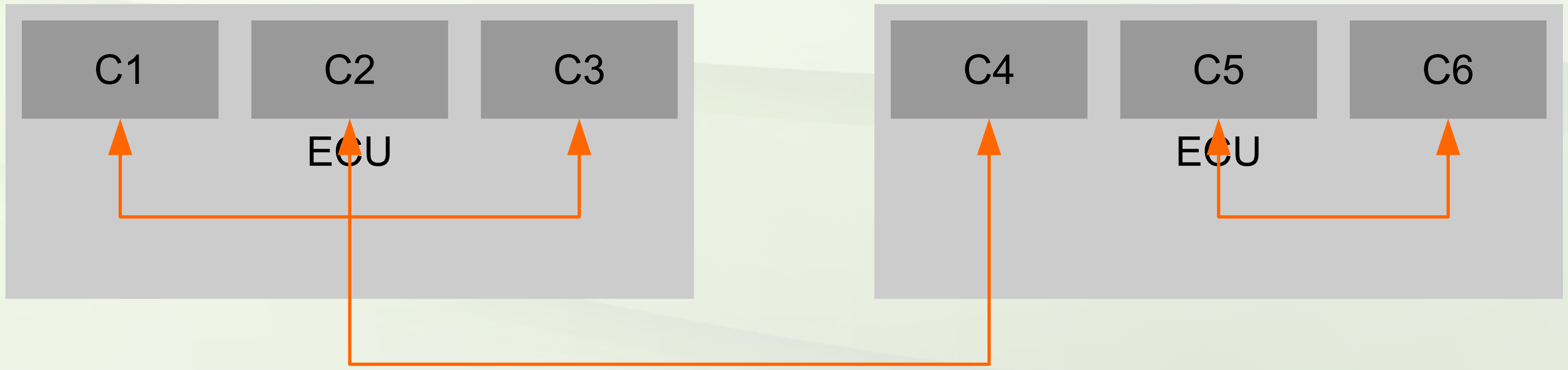
Developing Components

- Automotive middleware is not the obvious playing ground of open source hacking
  - Audio Manager
  - Diagnostic Log and Trace
  - Layer Management
  - etc
- Not only for automotive
  - d-bus optimizations – AF_BUS
  - tracker-ivi

http://projects.genivi.org/

IPC Abstractions

- Automotive loves communication buses and distributed systems
  - CAN, LIN, MOST, FlexRay, Ethernet, d-bus, etc
  - Freely move software components between ECUs

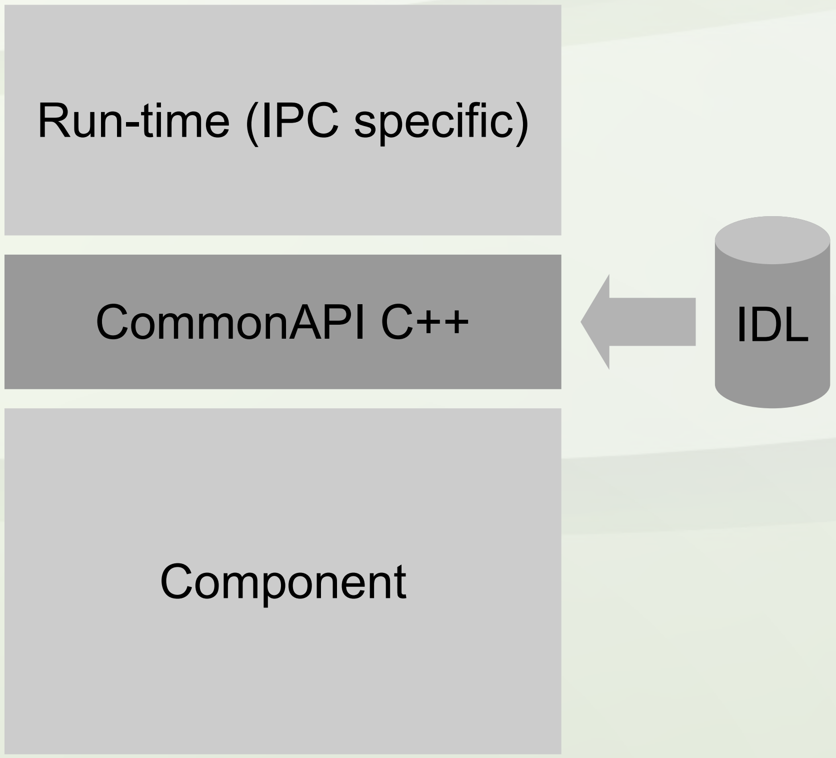


IPC Abstractions

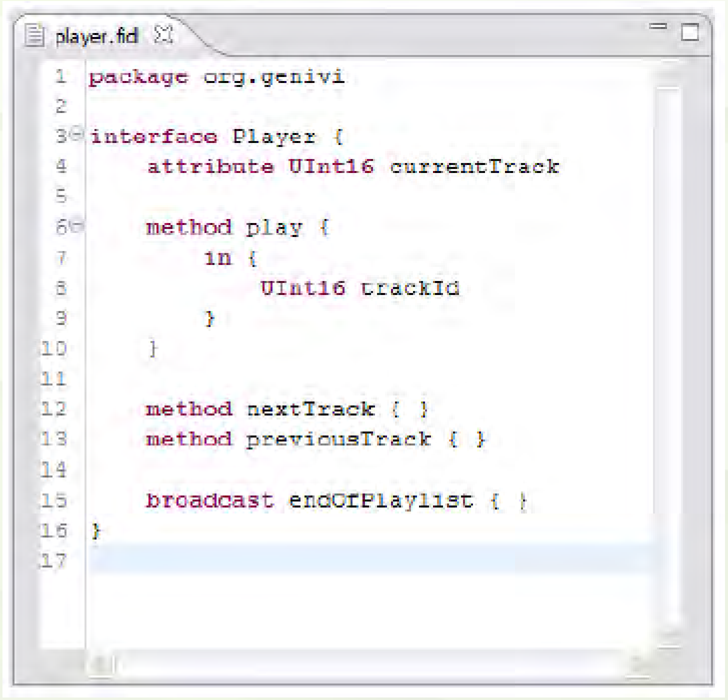
- Franca IDL
  - Describe the component interfaces
- CommonAPI C++
  - Generator and support for talking to Franca IDL interfaces (API)
  - Reference run-time based on D-Bus (ABI)

- Possible to change IPC mechanism by replacing the run-time shared object

- We do a Qt wrapper generator based on Franca IDL / CommonAPI C++



Franca IDL to QObject

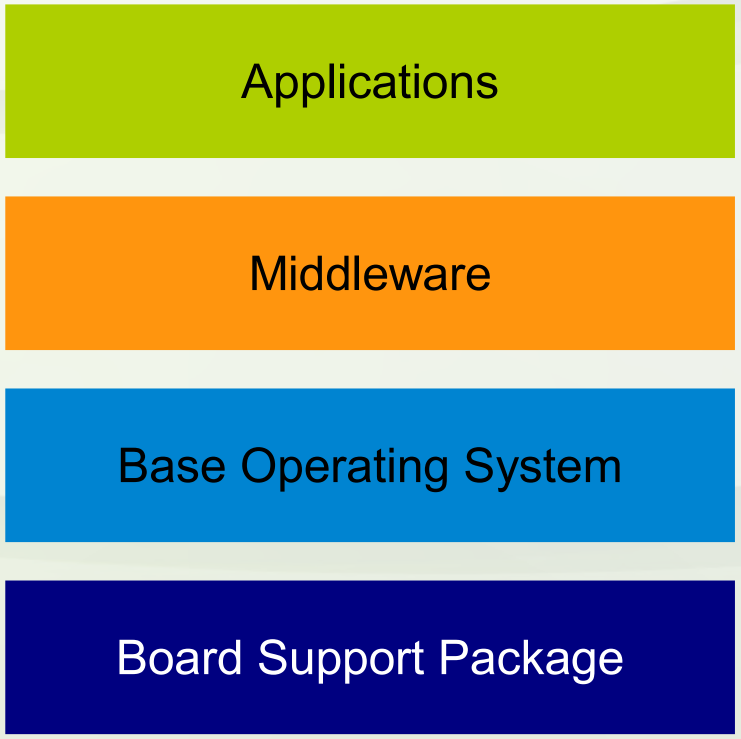

player.fidl

```
package org.genivi

interface Player {
      attribute UInt16 currentTrack

      method play {
          in {
              UInt16 trackId
          }
      }

      method nextTrack { }
      method previousTrack { }

      broadcast endOfPlaylist { }
}
```

```
class ... : public QObject {
    Q_OBJECT


   Q_PROPERTY(quint16 currentTrack
     READ currentTrack
     WRITE setCurrentTrack
     NOTIFY currentTrackChanged)

public:
   Q_INVOKABLE play(quint16 trackId);
   Q_INVOKABLE nextTrack();
   Q_INVOKABLE previousTrack();


signals:
   void endOfPlaylist();
};
```

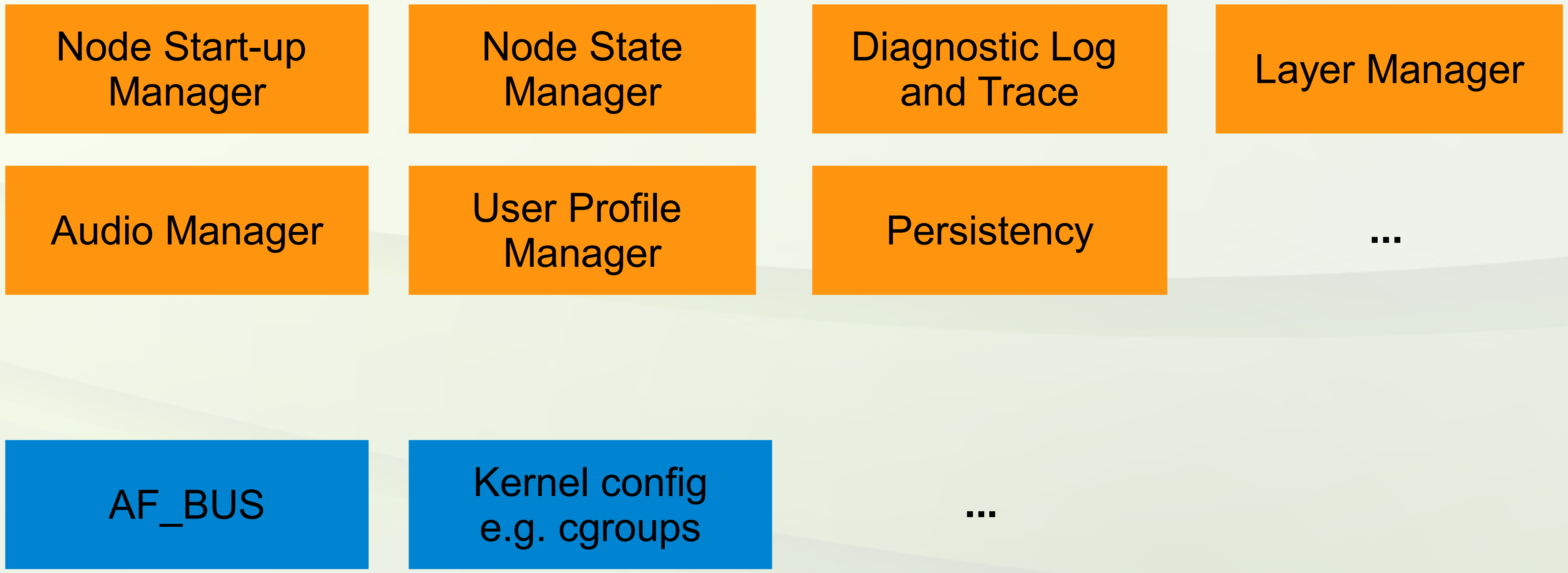
The GENIVI Stack

- Focusing at the platform
  - No apps
  - Middleware focus
  - Some OS adaptations
  - No BSP



Components

- Examples from GENIVI



Yocto

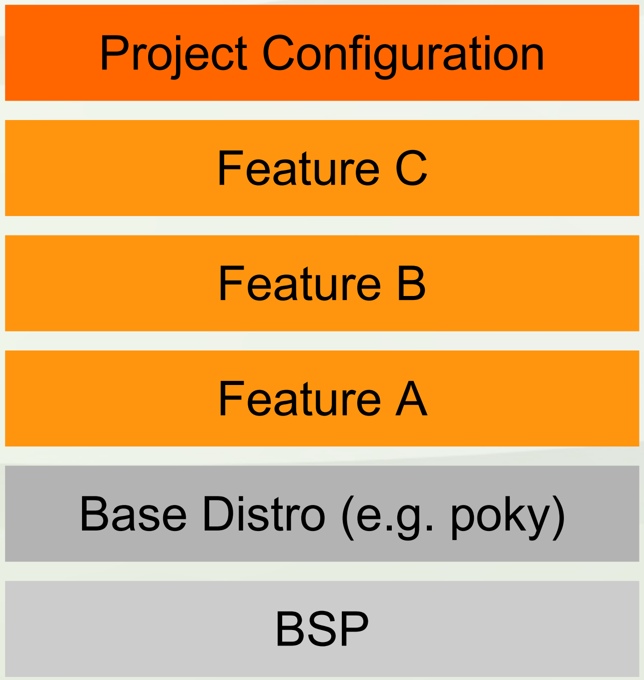
- GENIVI has two base lines Yocto and Baserock
- We work with Yocto
  - Based on OpenEmbedded
  - Recipies
  - Builds rootfs image, sysroot, cross compiler, etc

https://www.yoctoproject.org/

Layers

- Yocto works with layers
  - Recipies (.bb)
  - Patches (.bbappend)
  - Are prioritized for patch order

- You build an image recipie with top level items, and the rest gets pulled in as dependencies



meta-ivi

- Layer for Yocto with IVI components
- Based on GENIVI compliance
- Makes it easy to get started

http://git.yoctoproject.org/cgit/cgit.cgi/meta-ivi

Qt?

- Where does Qt fit?
  - Everywhere!

Qt?

- Where does Qt fit?
  - Everywhere!
- More specific?
  - Applications
  - Compositor
  - Services

Qt for Applications

- Qt and QtQuick rocks for building graphical applications!

- We can generate service proxies from Franca IDL
- Simply wrap in models / proxys for ease of use from declarative

Qt as Compositor

- Build a Wayland compositor using QtWayland

- But, layer manager?
  - Needs support for the layer-manager extension
  - Available as weston-ivi, but needs to be reimplemented through Qt

Qt for Services

- It is dead easy to write services using Qt
- Using the Qt D-Bus bindings
  - Expose QObject instances
  - We're working on doing the same from Franca IDL

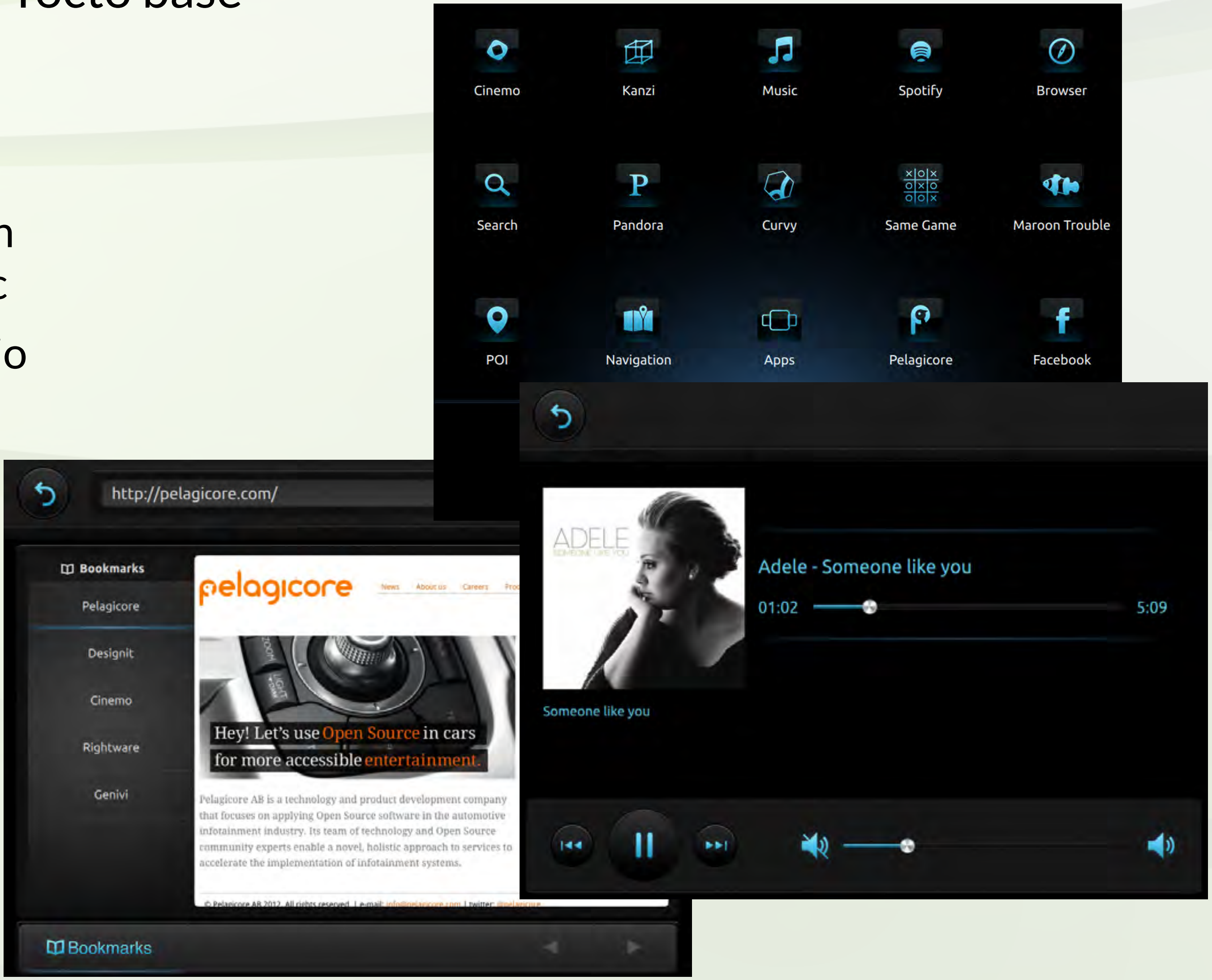
The Pelagicore Stack

Qt Developer Days 2013

- We build on a GENIVI / Yocto base

- Adding
  - Services, e.g. Application Manager, tracker-ivi, etc
  - Configurations, e.g. audio routing rules, etc
  - Application run-time environments
  - Applications

- Mostly using Qt!



Hey! Let's use Open Source in cars for more accessible entertainment.

Pelagicore AB is a technology and product development company that focuses on applying Open Source software in the automotive infotainment industry. Its team of technology and Open Source community experts enable a novel, holistic approach to services to accelerate the implementation of infotainment systems.

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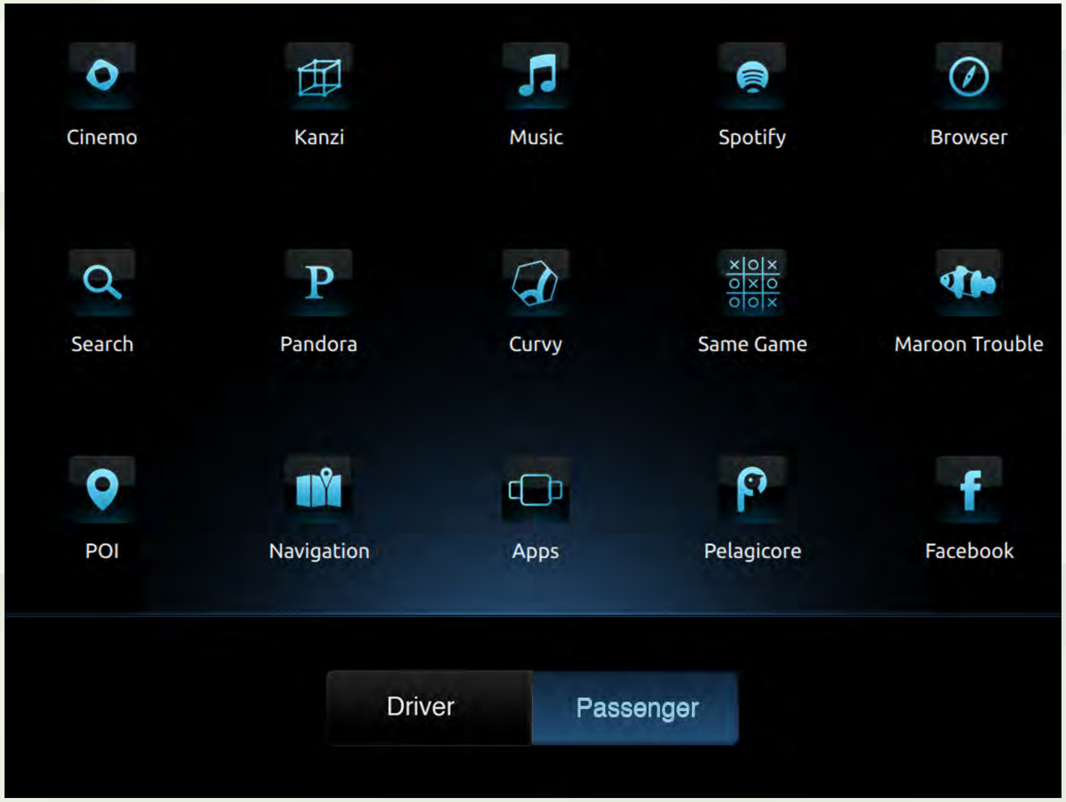
Application Manager

- Built using Qt
- The Wayland compositor
- Provides information for
  - audio focus
  - access arbitration of shared resources
  - etc
- Launching applications in various run-time environments
- Installing and updating applications

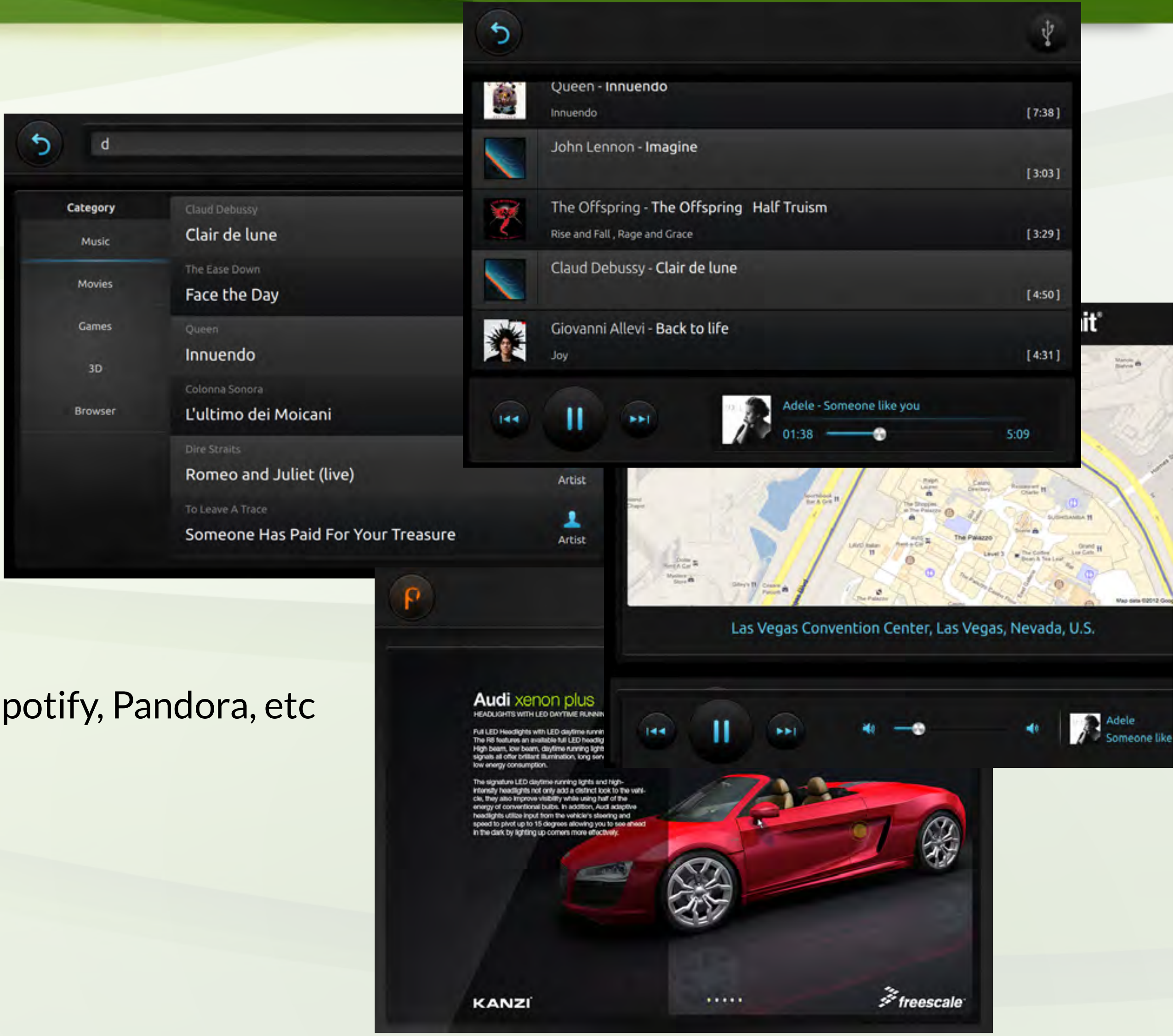


Run-times

- Native code
  - Can be run in a container
- QtQuick with access to the platform services
  - Provide a common set of QML plugins for platform access
  - Possible to pre-load the run-time to reduce start-up times
- HTML5 apps
  - Using Qt ~~WebKit~~WebEngine
  - Vehicle data APIs are specified by GENIVI
  - Platform access and toolkit bindings are needed

Applications

- Core set of applications
  - Home screen
  - App store
  - Settings
  - System wide search
  - Browser
  - Music player
  - Video player
  - Games
  - Tuner
  - Integrated streaming services, e.g. Spotify, Pandora, etc
  - Navigation
  - 3D vehicle status view
  - etc



Automotive

- Conservative niche
  - Legal requirements
  - Standards compliance
  - Development processes
- The value change and ownership is changing
  - User expectations
  - Cost of software
- Qt fits here
  - Both in apps and system software

Qt and GENIVI

This is what is happening right now!

Thank you!

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www.pelagicore.com