Android & IVI systems

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Agenda

- IVI OS overview and trends
- Open Source OS, why ?
- Is it really applicable to IVI ?
- Theory to concrete example
- Example to demo

Automotive system software overview

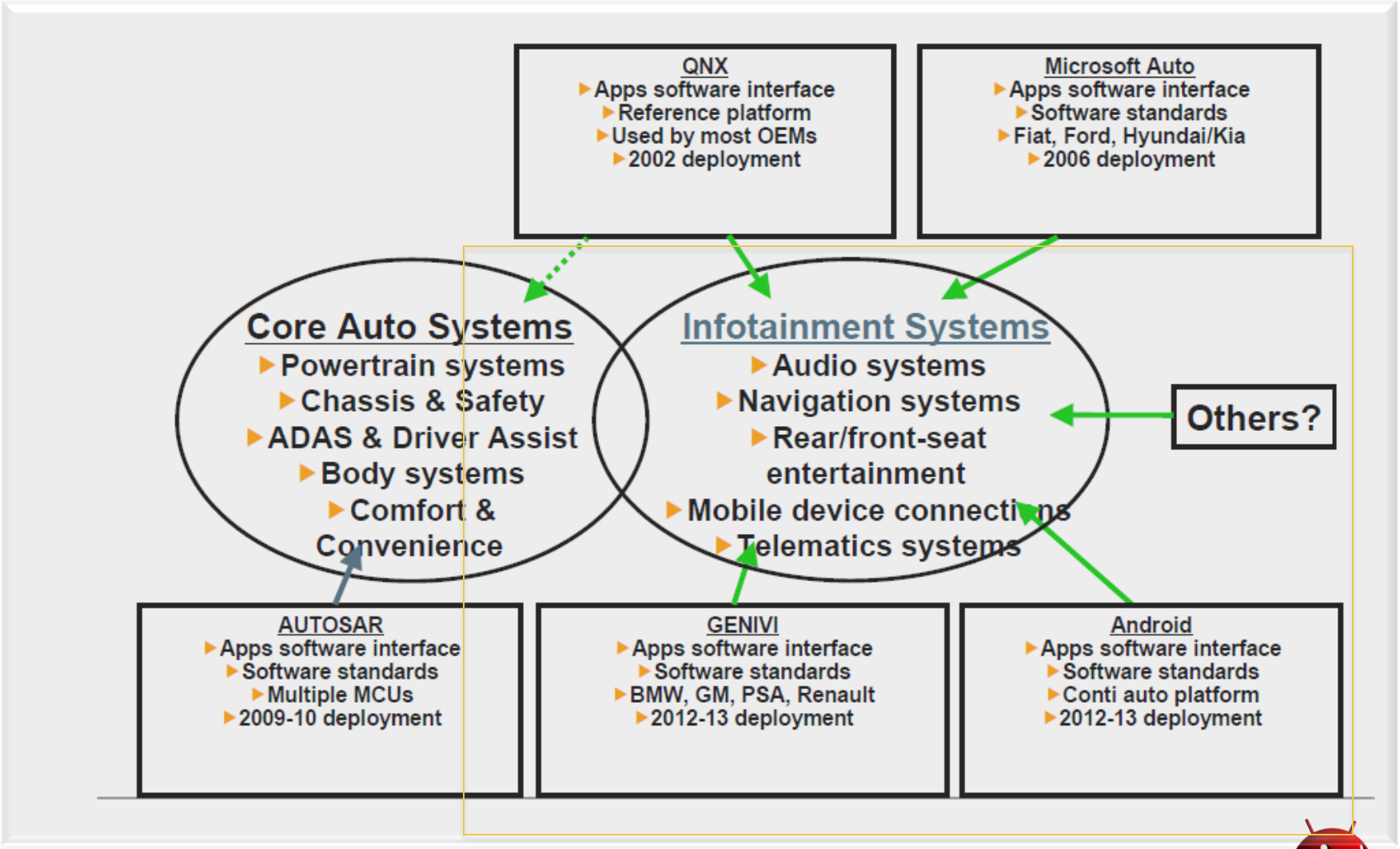

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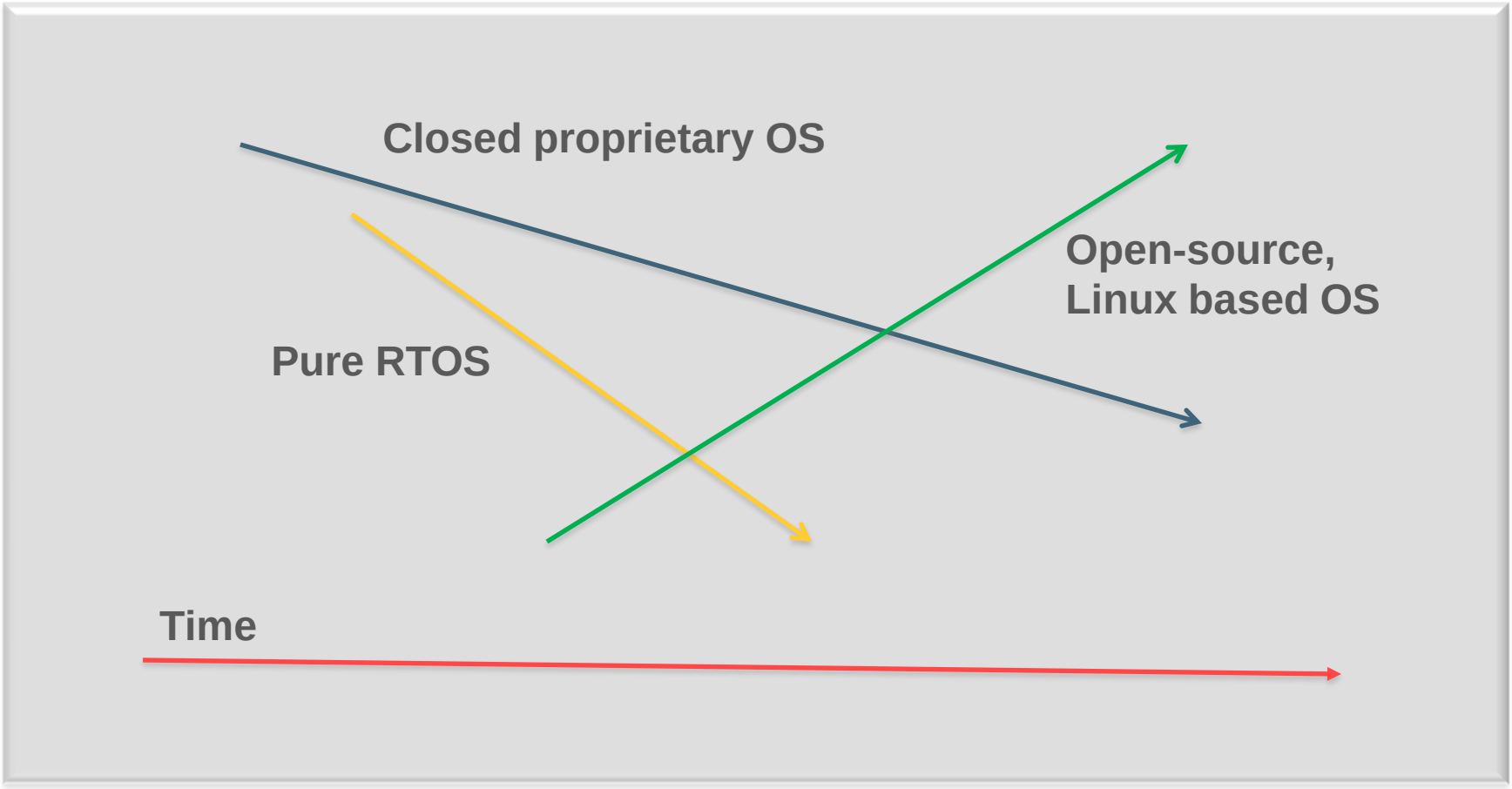
Illustration: IVI OS adoption direction



Why go open source?

1. Innovation speed

2. Ecosystem support

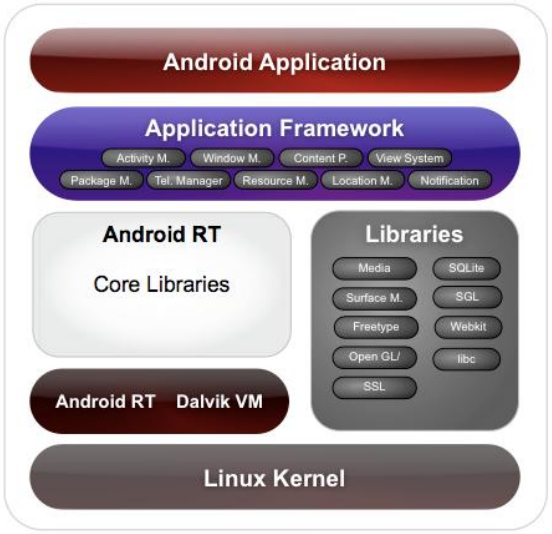
3. Cost

Why Android for a IVI system ?

Finger-friendly

Ecosystem

Openness



Extensibility

And…?

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Look & Feel

Mobile

- Designed for mobile users

IVI

- Designed for drivers
- UI need to be simple, straightforward, distinguishable at the first glance
- Branding control

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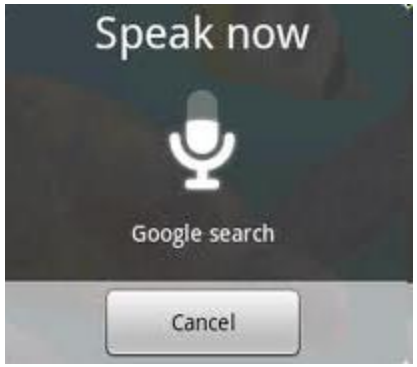
Voice Support

Mobile

- Voice search



IVI

- Voice command of basic functionality:
  - placing/receiving a call
  - controlling the navigation system
  - controlling FM Radio/CD
- Text to Speech conversion of SMS/Email
- Noise cancellation

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External Storage

Mobile

- SD Card supported

IVI

- Usually, need to support a SD Card and a USB disk
- Framework need to be changed for media access on an extra external storage

iPod Support

Mobile

IVI

- iPod management/indexing with the Apple Authentication algorithm
- Media Player support for iPod
- Video Player support for iPod

Boot-up time optimization

Mobile

- About 45 seconds

IVI

- For cold boot, ~ 10 seconds is target
- For warm boot, the unit need to be fully operational within 2 - 3 seconds
- Can be achieved using the CPU's suspend mode at the expense of approx 2mA extra backup current

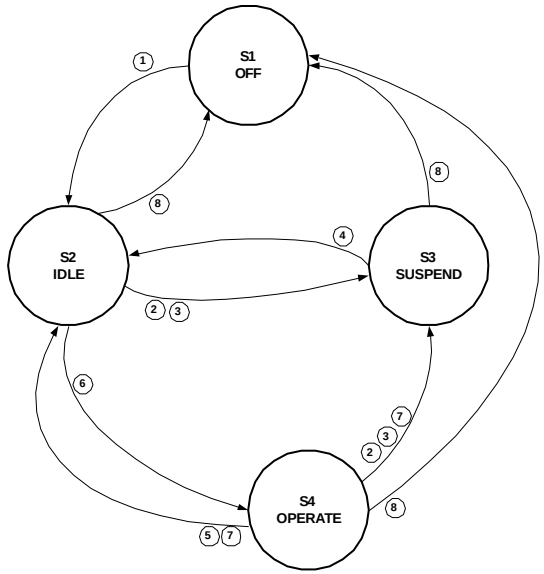
Power Management

Mobile

- The primary goal is to save the power consumption
- Applications and services request CPU/screen resources

IVI

- The primary goal is to ensure stability and usability when system is on
- To support “instant-on”



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Audio Management

Mobile

- Audio routing designed for mobile phones
- No dedicated streaming channels for Navigation

IVI

- Audio priority definition for BT HFP, Multimedia playback and Navigation
- Need to define new Android steam type (Navigation, FM Radio, external sources…) and then connect them to the hardware channel

Bluetooth management

Mobile

- PBAP, designed to be the source
- HFP, designed to be the audio gateway
- A2DP, designed to be the source

IVI

- PBAP, designed to be the receiver
- HFP, designed to be the Hand-free unit
- A2DP, designed to be the receiver

FM/AM Radio

Mobile	IVI
• No FM/AM radio	• FM/AM receiver and transmitter • New APIs of framework • A FM/AM Radio application

Hardware Diagnose Application

Mobile

- Function does not exist

IVI

- To ensure safety and usability
- Provides a set of functions helping to diagnose hardware failure: display, memory, storage, sensor, GPS…

Navigation Software Integration

Mobile

- Can have a navigation application

IVI

- Need to be integrated into system
- Part of UI/UX
- Can be manipulated through voice interface

Rear camera

Mobile

- Used for taking pictures or remote monitor

IVI

- Make sure you do not hit your dog when driving backwards
- Need to be available in 2 seconds once the car started

LBS services application

Mobile

- Google Maps
- Applications downloaded from Market

IVI

- Emergency Call
- Roadside Assistance
- Information Sending on Fleet and Asset Manager request
- Vehicle Tracking
- Mobility Services

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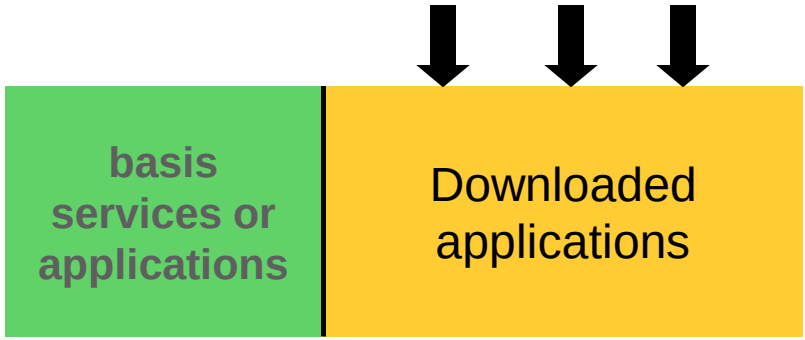
Security

Mobile

- Basic security mode to isolate applications from one another
- Users be aware of the permissions requested before installing a new application

IVI

- Need to provide a solution to segregate a downloaded service or application and the basis software of the platform
- Protecting the CAN/MOST access from malicious attacks



Global open source choices (no RTOS)

GENIVI

Or both simultaneously on a multicore and/or hypervisor based system

GENIVI vs. Android: Focus Areas

GENIVI

- Focus on Automotive by OEMs, Tier1 and Tier 2s
- Managed by GENIVI alliance
- HMI and application store by OEM or Tier1
- HMI focus on non Driver Distraction

Android

- Focus on Mobile Phone and Tablet Market
- Led by Google
- Application Store > 400.000 apps for Handsets and Tablets
- Attractive touchscreen based HMI

GENIVI vs. Android: Other considerations

GENIVI

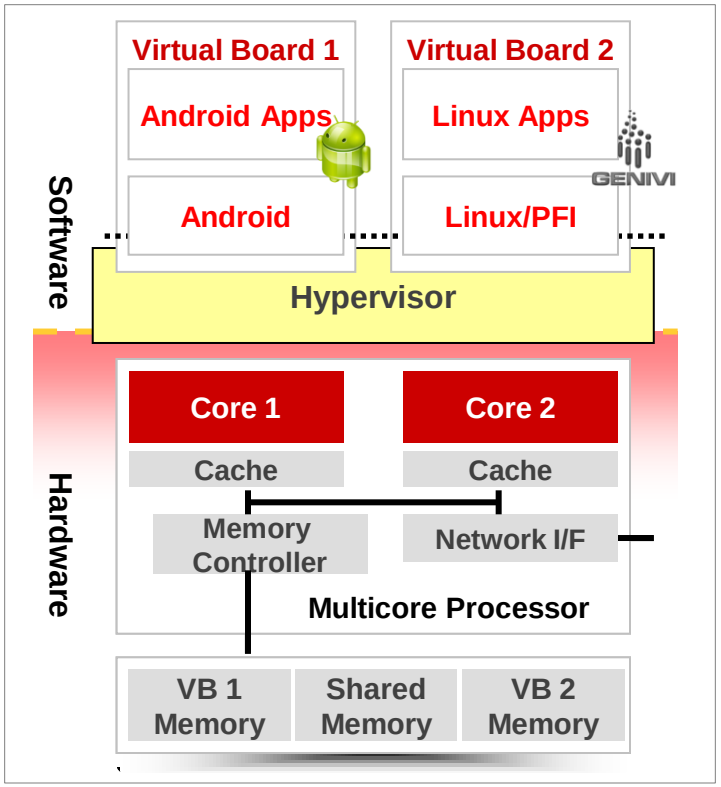
- Open Source based on standard Linux distribution
- GPL and LGPL (v2.0)
- Consideration for early use cases
- RAM & CPU footprint optimized for automotive
- Development environment through OSVs

Android

- Open Source based on Linux kernel and Google middleware
- Apache like license
- Focus on connectivity and OTA updates
- Java applications driving CPU & RAM requirements
- Rich SDK development environment

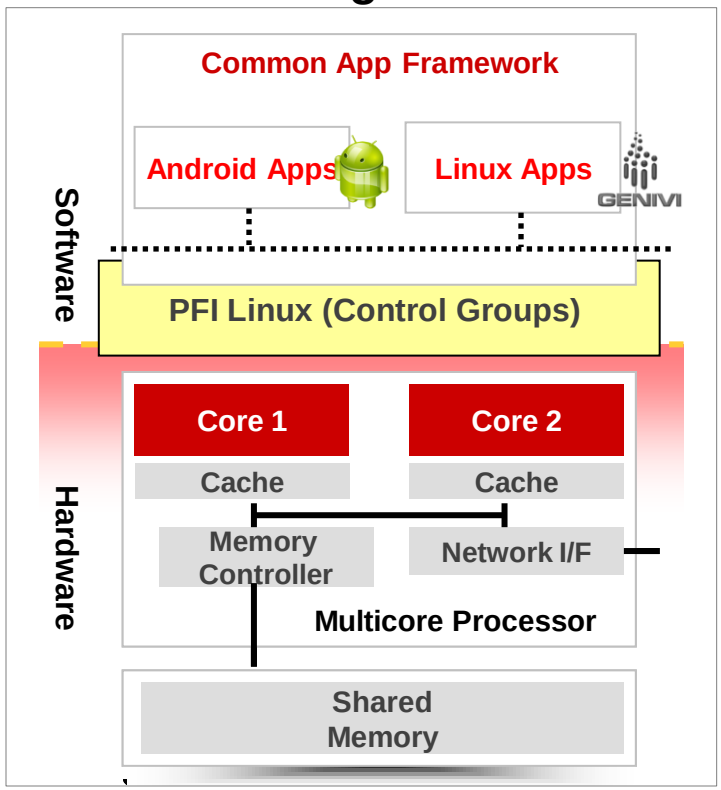
GENIVI/Android: Combinations possible

Virtualized



Virtualized model uses Wind River Hypervisor to isolate Android and Linux environments.

Embedding



Embedding model uses Linux Control Groups to isolate Android and Linux applications. Both use a common OS framework.

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Android for IVI market growth

Where is the data?

- Traditional Android market research:
  - Smart phones (CAGR 37%) – acc. RBC Dominion Securities Inc.
  - Tablets (CAGR 65%) – acc. To IDC
  - Digital TV plus set up boxes (CAGR 79%) – acc. MarketResearch.com

- Informal market momentum data
  - A number of publicly announced systems/concepts
  - 300+ attendees @ GENIVI Android workgroup meeting
  - Wind River winning Android IVI projects worldwide

In-market: Android Production IVI system

- Roewe 350 running Android 2.1 (China)
  - SAIC (Shanghai Automotive Industry Corporation)
  - Real time traffic reports, web access, chat online
  - Texting, email, GPS, agenda
  - Stock market graphs
  - Using Inkanet cellular network

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In-market: Android After Market IVI system

- Dynavin E46 Navigation system for BMW Aftermarket
  - Single DIN mounting chassis
  - OEM bezel to allow a "OEM" look
  - Motorized touchscreen multimedia AV player
  - OSD touchscreen function
  - SD card slot and mini-USB port
  - Full iPod function control
  - 45Watts x 4 sound output
  - DVD,DVD-R,DVD-RW,DIVX,MPEG4,CD,CD-DA,CD-R,CD-RW,MP3,WMA,VCD and SVCD support
  - Electronic and mechanical Anti-Shock System
  - Video system: Auto ,NTSC and PAL TV receiver function with PAL;PAL N;PAL M;NTSC and SECAM
  - Screen: 7-inch Digital LCD (16:9)
  - Horizontal resolution: 800x480
  - Four preset EQ settings
  - Rear monitor video output (rear camera not included)
  - 4-CH RCA line out for headrest monitor
  - 30 FM/AM preset stations (AM 12 /FM 18)
  - Full-function remote control
  - Built-in Bluetooth function
  - Built-in Navigation(GPS)system
  - Built-in RDS function
  - Running Android 2.2

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Concepts: Android Production IVI system

- Saab's "IQon" [General Motors, concept]
  - On Saab 9-5 series
  - 3G cellular connection
  - Intends to make the API available for developers
    - Telematics: 500 signals from car sensors (speed, location, direction of travel, yaw, steering wheel angle, engine RPM and torque, inside/outside temps, barometric pressure, and the sun's position)
    - **New apps will be "vetted" by Saab and released in the Saab IQon store**

- Continental "AutoLinQ" (USA, concept)
  - 3G cellular connection
  - Listen to streaming music, download Twitter feed
  - InRIX's Traffic Pro system predicts traffic and changes route
  - Take any signal from the CAN bus (throttle position or engine speed) and use as input. Track data and post to Facebook.
  - NAVTEQ Network for Developers

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Future play: Android for E-Car IVI systems

- Tesla (USA, concept)
  - 17” NVIDIA Infotainment system
  - Cell, navigation, etc.
  - Android marketplace apps

- Tieto (Concept Car)
  - Electric car
  - tablet computer
  - Dynamic battery management app
  - Directions towards the next available charging station
  - Car-sharing related information
  - Install private apps
  - **Links the vehicle to the cloud with a front-end client while the application logic runs on a remote server in the cloud**
  - Using TI hardware dual core

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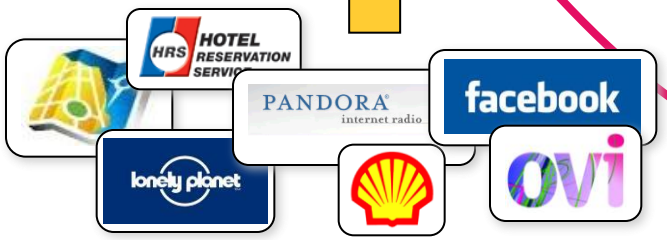
MirrorLink/Terminal Mode



Bridging mobile device and automotive system

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Mobile automotive applications

1. Standard with many automotive OEM brands

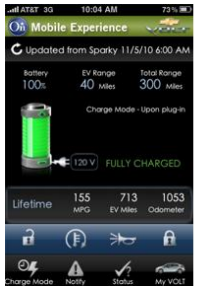
2. Apple and Android focus
   - Legacy mobile OS support is slim

3. ‘1.0’ release use cases
   - Security
   - HVAC
   - LBS
   - SNS integration
   - Production system only

CONTROL
&
COMMUNICATION

Automotive applications (US)

- Chevrolet's MyLink [General Motors]
  - In Equinox and Volt cars
  - Apps stored on tethered iPhone, Blackberry or Android device
  - Pandora and Stitcher apps present
  - OnStar system
  - **Mobile app allows:**
    - **Remotely start vehicle**
    - **Monitor charge**
    - **Lock/unlock doors**
    - **Control temperature**
    - **Honk horn and flash lights**



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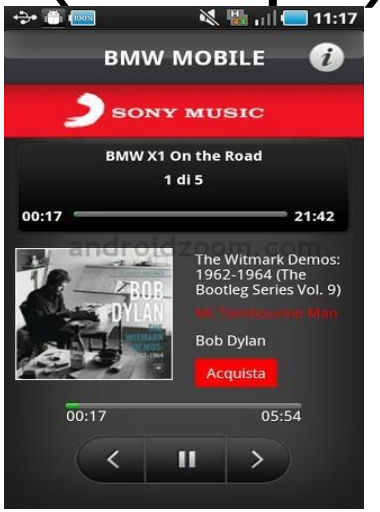
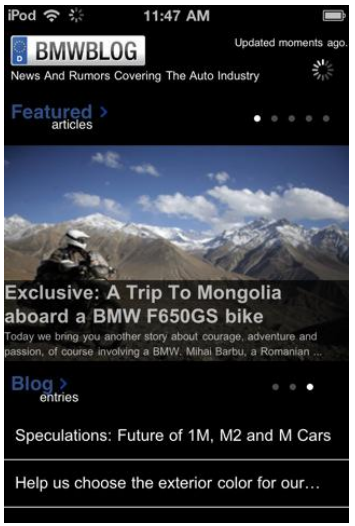
Automotive applications (Europe)

- BMW connected
  - Last mile navigation
  - Board Computer
  - Calendar usable in car
  - Internet radio
  - News
- BMW Blog
- My BMW Remote (+Assist)
  - Remote door lock/unlock
  - On/off independent car heater
  - Horn blow
  - Flash light
  - Google local search + transfer
  - Vehicle finder (LBS integration)





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Automotive applications for E-cars

- Nissan Leaf (USA)
  - Electric car
  - Application for Android platform
  - Start charging car
  - Check the status of the battery
  - Find out the estimated driving range
  - Launch the HVAC controls before the driver gets in the car

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Conclusions: Android for IVI

- Merging world, keeping specificity
- Benefits from mobile world
- Several systems in the market already
- Helping in costs and timeframe
- Ecosystem