IVI and ADAS Automotive Solutions
An Overview to Silicon Valley Automotive Open Source Group
TCS in Automotive Electronics

- Engagements with Automotive OEMs, Tier-n vendors and Equipment manufacturers, across the globe
- Alliances and tie-ups with Industry bodies and academia - GENIVI, AUTOSAR, JASPAR, ARAI
- Well established offshore infrastructure – labs and tools for automotive product design requirements, including HIL setup
- TCS eco system for product innovation - **TCS Innovation Lab Bangalore** for Solution accelerators, **TRDDC** – Software engineering, **COIN** - collaboration with external partners, Technology alliances with Semi and other partners
Electronics in Automobile today

**Infotainment**
- Multimedia
- Navigation
- Connectivity
- Audio Framework

**Body Electronics**
- Immobilizer
- Climate Control, HVAC
- Remote Keyless Entry
- Mirror and Window
- Dashboards, Clusters/

**Powertrain**
- Automatic transmission
- Gasoline EMS
- Diesel EMS
- Virtual Sensors
- Hybrid Drives

**Chassis System**
- Damper Control Systems
- Electronic Suspension Control
- Steering, Cruise Control
- Vehicle Stability Control

**HEV/EV**
- Battery Controller
- Motor Control Drive
- Charger Systems

**Platform Engg**
- Bootloaders
- CAN/LIN/Flexray protocol Stacks
- OSEK OS Implementation
- AUTOSAR components

**Diagnostics**
- DTC* management
- OBD** Modules
- ASAM, ASAP Stds
- Handheld device
- Telematics

**Safety & Security**
- Airbags,
- Seat Belts, ABS
- Occupant & Crash Sensing
- Traction Control System
- Yaw Stability Control

* Diagnostics Trouble code **On Board Diagnostics
GENIVI

- GENIVI is an industry alliance driving the open source development of **In Vehicle Infotainment Platform**. Some of the Key members of the alliance are BMW, JLR, PSA, Delphi, Visteon, Intel, ARM etc.

- TCS is a core member of GENIVI

- TCS participated in GENIVI 5\(^{th}\) AMM held in San Jose between 11\(^{th}\) to 14\(^{th}\) Oct 2011. TCS demonstrated the following solutions based on Open Source Components:
  - Configurable Digital Instrument Cluster
  - Terminal Mode
GENIVI Contributions

- TCS has been actively participating in the GENIVI activities
- Some of the key areas where TCS is contributing are:
  - Audio Manager (Media & Graphics EG*)
  - ConnMan (Networking EG*)
  - Qt Session Binding (Networking EG*)
  - Download Upload Messaging Manager (Networking EG*)

* Experts Group
TCS has played an instrumental role in the formation of India EG and is currently a key member of the group.

TCS along with other India EG members have finalized the focus areas for the India EG.

The core charter of India EG are:

- Security related specs for connected infotainment
- Electric Vehicle requirement
- GENIVI development eco system and Application Framework
**IVI HMI Framework - Salient Features**

- **HMI Framework acts as the glue logic to bind the HMI and the underlying application layers**
  - HMI framework is designed to be **agnostic of the HMI tool**. Thereby ensuring easy adaptability to new HMI developed with any standard HMI tools.
  - Facilitates quick development of HMI.

- **Portable across different platforms (Linux, QNX etc).**
  - HMI framework supports the following features to ensure the necessary **abstraction to the HMI and application layers**:
    - Screen Transition and state control.
    - Data Flow Management through defined data sharing mechanisms.
    - Data Cache support to improve performance.
    - Utility library providing generic utilities like sorting, search, Database interface (SQLite, etc), XML Interface etc.
    - Layer Management for:
      - Information Layer
      - Interrupt Layer
      - Indicator Layer – Status Bar
    - Interrupt Priority Manager (example: Pop Up)
    - Multilanguage support
    - Configuration Manager (Example: FPS for the system)
    - Application controllers for action handling
    - Animation controller (For Start/Stop of animations & configuring the Number of frames)
    - Provide Multimodal handling (Touch Screen, Gesture, Hard keys, Voice etc)
    - Load on Demand for Application controllers
    - Display Manager
    - Synchronization mechanisms
IVI HMI Framework

HMI

HMI Framework

- Event Manager
- Utility services
- Configuration Manager
- Resource Manager
- Application Controller 1
- Application Controller 2
- Application Controller 3
- Application Controller N
- Layer Manager (Optional)
- Pop up Manager
- Data Manager
- Notification Manager

Applications

TCS HMI Framework Components

Third party open source library

Third party open source optional component
**IVI Connectivity Framework (ICF) - Salient Features**

- **ICF enables rapid development and fast integration of infotainment connected applications.**

- The application issues a connect/disconnect URL command to the ICF. The ICF takes care of finding the best interface at any point in time through seamless, dynamic intelligent switching and initiates data transfer over the selected interface.

- ICF has multiple session support, that is, multiple applications can connect to ICF in parallel.

- ICF provides information related to the currently available bearer interfaces, signal strength, connection state etc which can be displayed by the application.

- ICF provides network statistics, viz, number of bytes transmitted/received over the interface, which can be used by applications to display network traffic graphs.

- The framework is modular and extensible allowing easy inclusion of features such as security which is critical for connected applications.
IVI Connectivity Framework

**Connected Apps**
- Internet Radio
- YouTube
- Browser
- Video on Demand

**Internet Connectivity**
Maintains ordering of available interfaces best suited for the application based on parameters such as signal strength, economy, network traffic, user preference etc.

**Download/Upload data over the selected interface**

**Seamless intelligent dynamic switching between interfaces and data transfer resumption over the best suited interface**

**Content Servers**

- Wi-Fi (Mobile hotspots)
- P2P
- Tethering
- LTE
TCS has recognized the potential of open source in Automotive industry and has been investing its efforts towards development of Solutions based on it. Some of the Key Solutions which TCS has developed are:

- In Vehicle Infotainment Platform (IVI)
- ADAS
Operating Systems

- TCS has developed its solutions based on multiple Linux based operating systems like Meego, Ubuntu etc.

- Meego IVI:
  Meego is a Linux based open source operating system designed for mobile devices, In Vehicle Infotainment Systems etc. TCS IVI platform is developed on the Meego IVI OS.

- Ubuntu:
  Ubuntu is another popular Linux based OS. TCS has developed Configurable Digital Instrument cluster based on Ubuntu OS.
In-Vehicle Infotainment Platform

Solution Key Offerings

- Connectivity Framework demonstrating Internet connectivity solutions
- GENIVI Architecture based reference platform
- HMI Framework
- Scalable IVI Architecture supporting execution of Onboard/Off board applications
- Support for Terminal Mode client

In-Vehicle Infotainment Platform

Platform
Processor: INTEL ATOM (TUNNEL CREEK)
Operating System: Meego 1.2
Internet based off-board navigation

- Address can be sent from personal PC to Car Navigation through backend server
- Browser plug-in, Backend sever module, Navigation engine module
- Connectivity Framework, Requirements and Design documents
- User interactive and animated 3D models of travel Point of Interest
- Google Satellite View with route overlay

Car Connectivity

- Useful for Tracking your friends on the map & Video Chat with friend
- GPS and GPRS for tracking Wifi for video chat
- Modules Developed: Android Porting, Follow Me Implementation, Connectivity, Video Chat
- Tools/Platform: Intel And Davinci Board, Video Stack, Encoder and Decoder (H.264)

Flash based Adaptive HMI

- Flash Based Graphics for Dash, User configurable display with touch screen
- Gesture Algorithms for Zoom in and zoom out
- Development of CAN interface, Gesture algorithm, Flash Programming and GUI
- Tools/Platform: Davinci Board with touch screen, Canalyser
Advanced Driver Assistance Solutions
Business Need

• Road safety major global health problem
  ✔ Just in Europe: 45000 deaths and 1.5 million injuries each year (info from Volvo)
• Conventional safety technologies (e.g. seatbelts, airbags) have been successful in reducing the number of fatalities
• Number of accidents is still increasing

• Conventional safety measures are reaching their limits
• New In-vehicle Information Systems (IVIS) enhancing mobility and comfort – however, they are also major distractors (for eg: Mobile phone, Video chat etc..)
• New Advanced Driver Assistance Systems (ADAS) have great potential for enhancing safety, especially for preventing accidents related to driver error
Advanced Driver Assistance Functionalities

• Challenges
  ✓ Requires reliability and robustness – Good true alarms and less false alarms
  ✓ Highly Computational intensive – Requires dedicated ASICS/FPGA

• TCS ADAS solutions
  ✓ Based on accurate and robust image recognition algorithms
  ✓ Highly optimized on general processors like Intel Atom/ARM Cortex (Doesn’t require custom ASIC)
  ✓ Cost Effective – uses low cost cameras and platforms
Overview
Detects mandatory traffic signs and alert the driver

IP/Asset
• Shape detection
• Sign Recognition
• Color Segmentation

Features
• Detects mandatory signs like speed limit
• Sign displayed on the dash board along with audio message
• Works with color camera for day light conditions
• Implemented on TI Davinci processor

Roadmap
• Integration with the Car infotainment system
• Enhancing for night conditions with night vision camera
• Integration with Locations Maps data & GPS

Solution detects traffic signs
Thank You!

Naresh Batra
Global Head HiTech Semiconductor Engg. Practice
Email: n.batra@tcs.com
D: 408-200-2958
M:408-621-4958