# Adapting GENIVI and Android for IoT-automotive


Submitted By

**Gaurang Rathod**

**16MCEC16**




**DEPARTMENT OF COMPUTER ENGINEERING**

**INSTITUTE OF TECHNOLOGY**

**NIRMA UNIVERSITY**

**AHMEDABAD-382481**


**May 2018**

# Adapting GENIVI and Android for IOT-automotive

**Major Project**

Submitted in partial fulfillment of the requirements

for the degree of

Master of Technology in Computer Science and Engineering (CSE)


Submitted By

**Gaurang Rathod**

**(16MCEC16)**

Guided By

**Dr. Priyanka Sharma**




**DEPARTMENT OF COMPUTER ENGINEERING**

**INSTITUTE OF TECHNOLOGY**

**NIRMA UNIVERSITY**

**AHMEDABAD-382481**


**May 2018**

# Certificate

This is to certify that the major project entitled **"Adapting GENIVI and Android for IOT-automotive"** submitted by **Gaurang Rathod (Roll No: 16MCEC16)**, towards the partial fulfillment of the requirements for the award of degree of Master of Technology in Computer Science and Engineering (CSE) of Nirma University, Ahmedabad, is the record of work carried out by him under my supervision and guidance. In my opinion, the submitted work has reached a level required for being accepted for examination. The results embodied in this major project part-I, to the best of my knowledge, haven't been submitted to any other university or institution for award of any degree or diploma.

Dr. Priyanka Sharma
Guide & Professor,
CE / IT Department,
Institute of Technology,
Nirma University, Ahmedabad.

Dr. Priyanka Sharma
Professor,
Coordinator M.Tech - CSE (CSE)
Institute of Technology,
Nirma University, Ahmedabad

Dr. Sanjay Garg
Professor and Head,
CE Department,
Institute of Technology,
Nirma University, Ahmedabad.

Dr Alka Mahajan
Director,
Institute of Technology,
Nirma University, Ahmedabad

# Statement of Originality

I, **Gaurang Rathod**, **16MCEC16**, give undertaking that the Major Project entitled "**Adapting GENIVI and Android for IOT-automotive**" submitted by me, towards the partial fulfillment of the requirements for the degree of Master of Technology in **Computer Science & Engineering (CSE)** of Institute of Technology, Nirma University, Ahmedabad, contains no material that has been awarded for any degree or diploma in any university or school in any territory to the best of my knowledge. It is the original work carried out by me and I give assurance that no attempt of plagiarism has been made.It contains no material that is previously published or written, except where reference has been made. I understand that in the event of any similarity found subsequently with any published work or any dissertation work elsewhere; it will result in severe disciplinary action.

_____

Signature of Student

Date:

Place:

Endorsed by

Dr. Priyanka Sharma

(Signature of Guide)

# Acknowledgements

It gives me immense pleasure in expressing thanks and profound gratitude to **Dr.Priyanka Sharma**, Professor, Computer Engineering Department, Institute of Technology, Nirma University, Ahmedabad for her valuable guidance and continual encouragement throughout this work. The appreciation and continual support she has imparted has been a great motivation to me in reaching a higher goal. Her guidance has triggered and nourished my intellectual maturity that I will benefit from, for a long time to come.

It gives me an immense pleasure to thank **Dr. Sanjay Garg**, Hon'ble Head of Computer Engineering Department, Institute of Technology, Nirma University, Ahmedabad for his kind support and providing basic infrastructure and healthy research environment.

A special thank you is expressed wholeheartedly to **Dr. Alka Mahajan**, Hon'ble Director, Institute of Technology, Nirma University, Ahmedabad for the unmentionable motivation she has extended throughout course of this work.

I would also thank the Institution, all faculty members of Computer Engineering Department, Nirma University, Ahmedabad for their special attention and suggestions towards the project work.

**- Gaurang Rathod**

**16MCEC16**

# Abstract

The Internet of Things is breaking crisp ground for auto producers by acquainting altogether new layers with the customary idea of an auto. This update the associated, savvy auto comes as a progressive route for us to drive and keep in contact with the world around in the meantime. By offering a favor free assortment of infotainment benefits and associated auto applications for drivers, the car business can possibly turn into an IoT champion among different ventures and fuel the IoT cloud administrations reception among auto proprietors and walkers alike.Now when we talk about IoT automotive industry is the major contributor of it.Recent statistics shows that Android OS is more used in automotive.Latest Android Os for auto is more likely the concept on which i am working.Where GENIVI is the alliance which is providing open source platform for android developers.This Android project solves the problem of wireless connectivity in car's using Wi-Fi functionality and added features like RSDB.In Vehicle, Wi-Fi router providing simultaneously internet access and high bandwidth link on two different bands 2.4 GHz and 5 GHz.So users can run display sharing in 5 GHz band radio while providing uninterrupted internet access on the other band simultaneously.//

# Abbreviations

| | |
|---|---|
| **WPA** | Wireless Protected Access |
| **SCH** | Source Channel |
| **CCH** | Control Channel |
| **WAVE** | Wireless Access in Vehicular Environments |
| **DSRC** | Dedicated Short Range Communication |
| **SDIO** | Secure Digital Input Output |
| **PCIe** | Peripheral Component Interconnect Express |
| **MMC** | Multimedia Card |
| **AP** | Access Point |
| **STA** | Station |
| **AGO** | Autonomous Group Owner |
| **P2P** | Peer to peer |
| **RSDB** | Real Simultaneous Dual Band |

# Contents

# List of Figures

# Chapter 1

# Introduction

## 1.1 GENIVI Alliance

GENIVI Alliance is an open source platform for automotive in three main ways.

- Deliver a system developers can use to create software components for automotive.
- A platform focused on automotive use cases to enable developers to create applications and demos targeting the industry.
- A starter kit that can be downloaded and customized for different hardware focused in automotive use cases.[1]

In the event that we net everything out, associated vehicles serve one of three capacities. To begin with to help the driver and inhabitants of the vehicle. Also for the vehicle to have the capacity to deal with itself. Lastly, for the vehicle to fit into the bigger transportation framework and work productively with different autos and foundation. The following focus for car organizations to lift the client's involvement in autos is to create vehicles that empower themselves. In dealing with drivers and inhabitants, vehicles should act naturally coordinating. Able to do easily pleasing whatever gadgets individuals carry into autos with them.

With our IoT connectivity products, Cypress will be able to provide the connectivity; the MCU, system-on-chip, module and memory technologies; and the mature developer ecosystem that IoT designers require, creating an end-to-end portfolio of embedded solutions and a single IoT design platform.[2]

## 1.2 Infotainment system with IoT

in-vehicle infotainment framework incorporate overseeing and playing sound substance, using route for driving, conveying back seat diversion, for example, motion pictures, recreations, long range informal communication, and so on., tuning in to approaching and sending active SMS instant messages, making telephone calls, and getting to Internet-empowered or cell phone empowered substance, for example, movement conditions, sports scores and climate figures.

The Internet of Things has prompted an influx of network that left no industry on the planet untouched. We have just observed that IoT is having a considerable effect on human services, farming, retail and it has just begun affecting the way we handle our autos, get them and even drive. At the point when gadgets get associated with each other through cell phones, our reality will get more quick witted than any time in recent memory. Auto Deals will Go Online There have been genuine loathsomeness stories of auto merchants getting to be noticeably wasteful and clients experiencing passionate turmoil. There has been news on online auto bargains that spare clients a considerable measure of cash (for instance, Carvana and Beepi). On the off chance that that will occur without a doubt, purchasers and venders can remove the merchant and there will be no middle person. On the off chance that there is no broker, the client can spare more than 1000 dollar in a solitary arrangement.
[2]

Infotainment Information and stimulation will meet Internet of Things to make an entirely unexpected affair for the client. Later on, vehicles will come inserted with telematic arrangements that would make driving a delight. The driver would have applications on the dashboard that would give him/her continuous trek reports, movement reports, hand motion sensors to help counteract mishaps, discourse to content usefulness to keep the burdens of writing, most recent gaming frameworks to give in-auto gaming and Wi-Fi hotspots. Conclusion At exhibit, autos like Telsa, Nissan, Audi and Jaguar are "Connected cars".

The Internet of Things is breaking new ground for auto makers by acquainting al-

together new layers with the customary idea of an auto. This update the associated, shrewd auto comes as a progressive route for us to drive and keep in contact with the world around in the meantime. By offering a favor free assortment of infotainment benefits and associated auto applications for drivers, the car business can possibly turn into an IoT champion among different enterprises and fuel the IoT cloud administrations selection among auto proprietors and walkers alike.

## 1.3 Android for IoT Automotive

On the off chance that we net everything out, associated vehicles serve one of three capacities. In the first place to help the driver and tenants of the vehicle. Besides for the vehicle to have the capacity to deal with itself. Lastly, for the vehicle to fit into the bigger transportation framework and work productively with different autos and foundation.
The following focus for car organizations to lift the client's involvement in autos is to create vehicles that empower themselves. In dealing with drivers and inhabitants, vehicles should act naturally incorporating. Prepared to do easily pleasing whatever gadgets individuals carry into autos with them.

# Chapter 2

# Literature Survey

## 2.1 IEEE 802.11 standard

802.11 represents the IEEE designation for wireless networking. Several wireless networking specifications exist under the 802.11 banner. The Network+ objectives focus on 802.11, 802.11a, 802.11b, 802.11g, and 802.11n. All these standards use the Ethernet protocol and the CSMA/CA access method.

| IEEE Standard | Frequency/Medium | Speed | Topology | Transmission Range | Access Method |
|---|---|---|---|---|---|
| 802.11 | 2.4GHz RF | 1 to 2Mbps | Ad hoc/infrastructure | 20 feet indoors. | CSMA/CA |
| 802.11a | 5GHz | Up to 54Mbps | Ad hoc/infrastructure | 25 to 75 feet indoors; range can be affected by building materials. | CSMA/CA |
| 802.11b | 2.4GHz | Up to 11Mbps | Ad hoc/infrastructure | Up to 150 feet indoors; range can be affected by building materials. | CSMA/CA |
| 802.11g | 2.4GHz | Up to 54Mbps | Ad hoc/infrastructure | Up to 150 feet indoors; range can be affected by building materials. | CSMA/CA |
| 802.11n | 2.4GHz/5GHz | Up to 600Mbps | Ad hoc/infrastructure | 175+ feet indoors; range can be affected by building materials. | CSMA/CA |

Figure 2.1: IEEE standards

STA : devices are STA, including AP Not to be confused with client" 802.11 never

uses the term client Uses associated non-AP STA

AP : Access Point Every AP is also a STA

Non-AP STA : NOT an AP, e.g.: Client of an AP IBSS member

No affiliation

BSS : An 802.11 network Infrastructure BSS = AP plus clients

Identified by BSSID = 48-bit MAC address of the AP

IBSS = no AP, just clients Identified by BSSID = 48-bit MAC address of the STA that started the IBSS

ESS : Connected set of 802.11 networks, not necessarily connected using 802.11

Identified by SSID = 32-character name, user-visible identifier

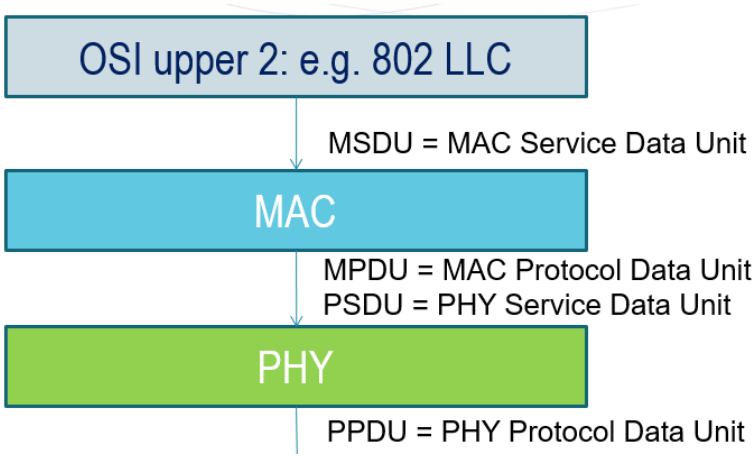



Figure 2.2: Layer represetation

## 2.2 OSI terminology

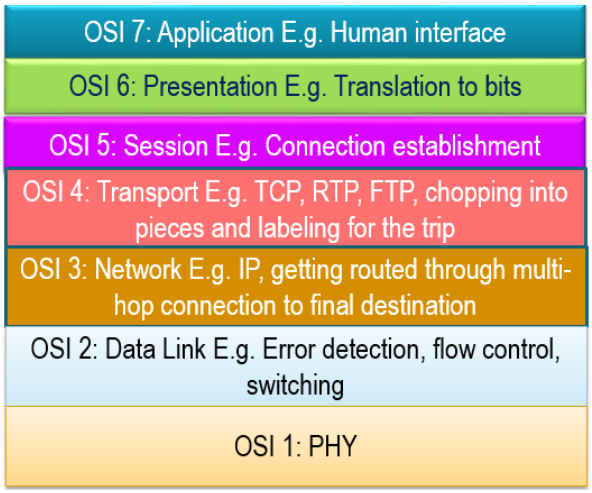



Figure 2.3: OSI teminilogy

L3 = Layer 3 eg.IP

L4 = Layer 4 eg. TCP

MAC= Lower Portion L2

## 2.3 Dongle Host Driver Architecture

In concert with the dongle itself, the job of the Dongle Host Driver is to provide a transparent connection between the host OS and the dongle media (e.g. WLAN), by presenting a network driver interface to the host OS which can be treated as though it were a locally-resident media driver (e.g. WL).

Thus at the most basic level, the Dongle Host Driver presents a network device interface to the host, and communicates with the dongle over a dongle-specific bus (USB, SDIO, PCMCIA, etc.) in order to: (a) forward transmit and receive frames between the host network stack and the dongle, and (b) pass control requests from the host to the dongle, returning the dongle responses.

The Full Dongle model is currently implemented for 4320/4328/4325. The entire wl driver runs on the dongle and 802.3 packets are passed back and forth over a USB or SDIO bus. The BDC or RNDIS protocols are used to encapsulate wlioctls on a separate logical control channel. The UMAC, LMAC and BMAC layers are all direct-linked into a

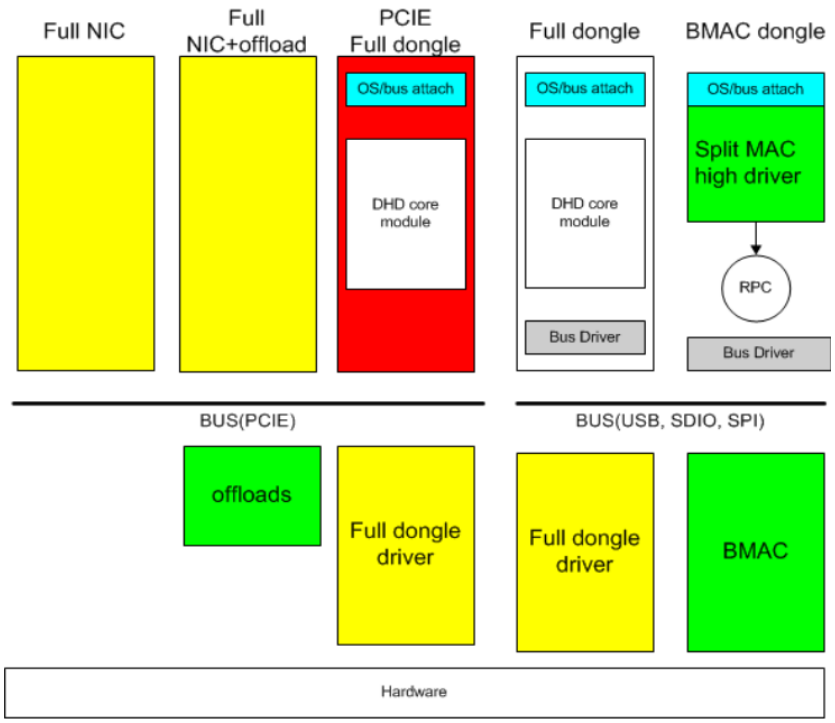



Figure 2.4: Dongle Driver Architecture

single image. The principal advantages of this model is that it's the most effective in saving power on the host (the number one concern of battery-powered embedded devices), and it's also the most effective at offloading computation, driver size and complexity from the host.

The driver communicates with the dongle over the bus, providing a control channel and a data channel to pass control messages and data messages, respectively. The actual message format uses what we have now termed the BDC protocol, though code is included to support the legacy RNDIS and CDC protocols. (From a message format point of view, BDC and CDC are identical on the control channel; but BDC includes a message header on the data channel.) The Dongle Host Driver (DHD) is intended to satisfy the following: Bus/OS-portable and modular. Bus, OS/API, and protocol specifics are partitioned to allow building DHD instances by combining interchangeable modules. Support for multiple bus types or protocols in a single load module is not required. Be chip-portable. The DHD should isolate chip-specific code so that the driver as a whole is not limited to 4328. Establish communication with the dongle. Use underlying bus access mechanisms to declare interest in and claim ownership of the BCM dongle. Forward transmit frames to the dongle. Provide flow-control where needed to avoid exceeding the buffer capacity of either the dongle or the host. Use frame priority for transmit queue ordering when

possible. Multiple instances of the driver can coexist, using different buses. It is desirable (but not required) that a single driver load module support multiple buses of the same type simultaneously. Support for multiple dongle devices on a single shared bus is bus-specific (USB yes, SDIO no). It is NOT a requirement for the driver to be able to present multiple network devices to the host OS for a single dongle (yet). Provide support for power-saving modes where possible for the bus and dongle.

## 2.4 SDIO/Sdmmc stack

With SDIO, the d11 core is no longer bus master and can no longer decide which queue to get data from. Instead, the CPU is bus master and it makes that decision. Also, SDIO is slow and the system cannot afford to wait around for each data transfer to complete. These need to be done asynchronously, such that the driver can launch the transfer and get interrupted when its done, without spinning waiting for completion.

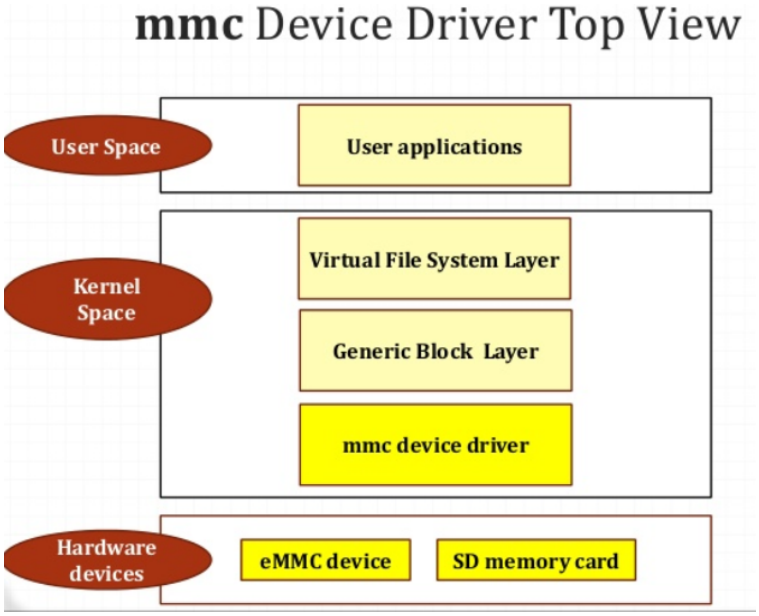



Figure 2.5: SDIO/mmc stack

The BCM SDIO host controller core, commonly referred to as bcmsdioh, is available locally in an FPGA card and has also been included in the BCM1161 and BCM6338 chips. This host controller predates the SDIO Host Standard specification from SDCARD and implements a proprietary HW API that meets the SDIO 1.1 protocol spec. The term SDIO WLAN alludes to the SD-Card interface augmentation called SDIO in the usefulness variation WLAN (remote LAN). This techonlogy can be accustomed to convey remote systems administration to existing TI processors running Linux or Windows CE (WCE) or Windows Mobile (WM) in a generally straight forward attachment and-play way.

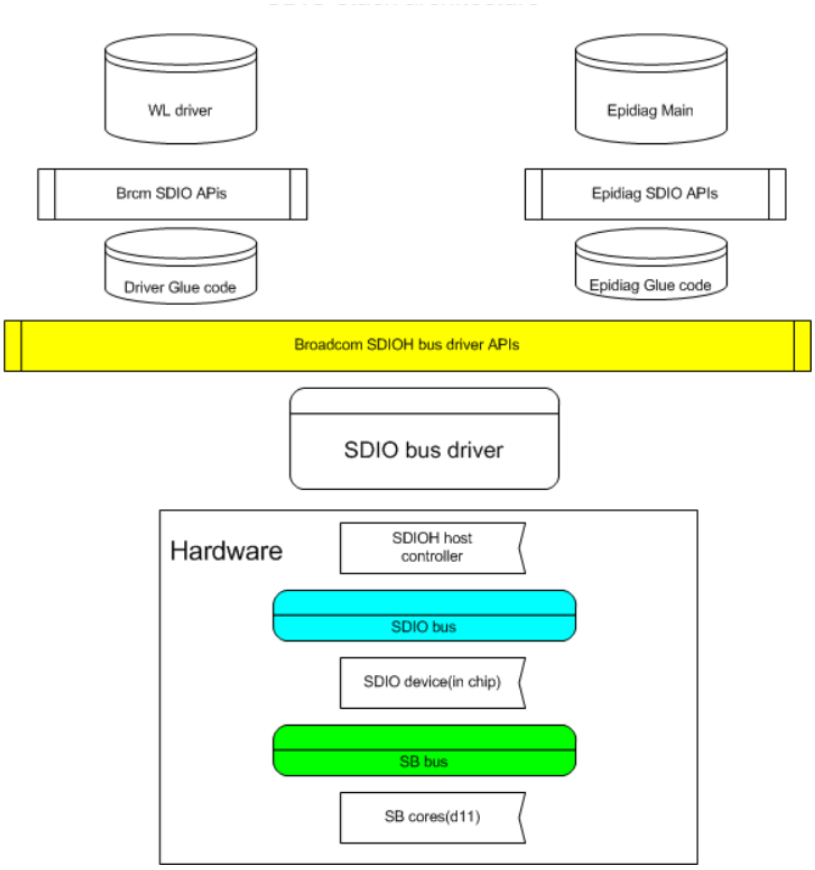



Figure 2.6: SDIO Stack

# Chapter 3

# Software Architectures

## 3.1 WPASupplicant Architecture

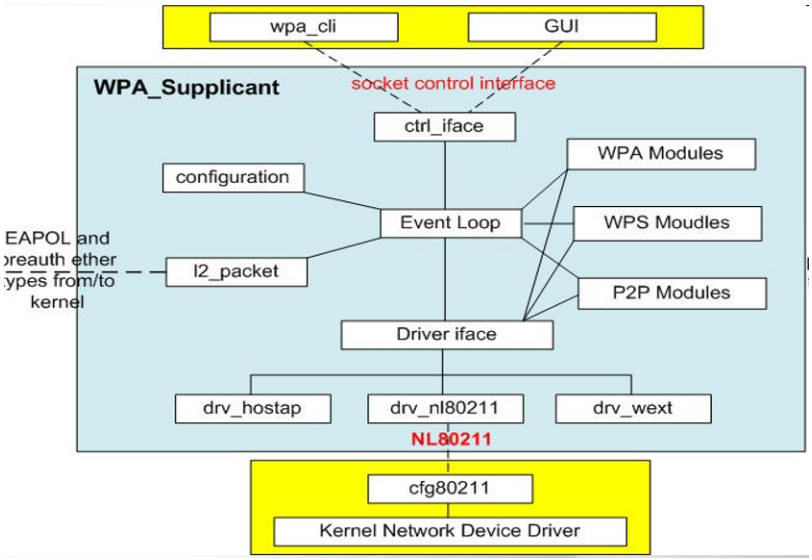



Figure 3.1: WPA supplicant architecture

Wpasupplicant is a WPA Supplicant for Linux, BSD and Windows with help for WPA and WPA2 (IEEE 802.11i/RSN). Supplicant is the IEEE 802.1X/WPA segment that is utilized as a part of the customer stations. It executes key arrangement with a WPA Authenticator and it can alternatively control wandering and IEEE 802.11 verification/relationship of the wlan driver.[3] The plan objective for wpasupplicant was to utilize equipment, driver, and OS free, convenient C code for all WPA usefulness. The source code is isolated into partitioned C records as appeared on the code structure page. All equipment/driver particular usefulness is in isolated documents that execute an all

around characterized driver API. Data about porting to various target sheets and working frameworks is accessible on the porting page. EAPOL (IEEE 802.1X) state machines are executed as a different module that connects with EAP peer usage. Notwithstanding programs went for ordinary generation utilize, wpasupplicant source tree incorporates number of testing and improvement instruments that make it less demanding to test the projects without having to setup a full test setup with remote cards. These instruments can likewise be utilized to execute programmed test suites. wpasupplicant executes a control interface that can be utilized by outer projects to control the operations of the wpasupplicant daemon and to get status data and occasion notices. There is a little C library that gives partner capacities to encourage the utilization of the control interface. This library can likewise be utilized with C++. WPAsupplicant contains configuration files that you can modify according to your changes in the code.There is wpasupplicant.conf file which could be contain control interface to which the wl utility will communicate.Other .conf file exist upon the architecture that you want to follow.

## 3.2 802.11p WAVE

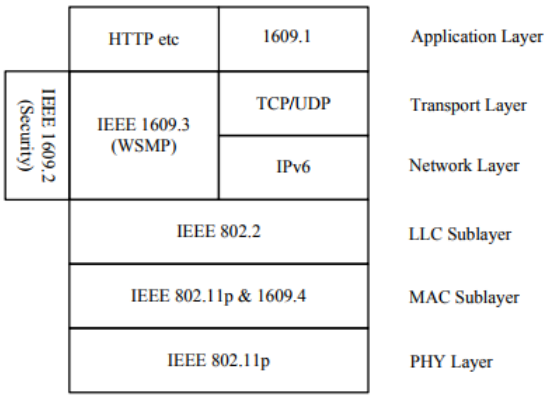



Figure 3.2: WAVE protocol stack

The operation process for building a correspondence connect in light of customary IEEE 802.11 incorporates guide checking, different handshaking and third party referencing, which is by one means or another excessively confounded for street vehicle condition. As in interstate condition, a vehicle will past a particular region served by a particular RSU quickly, so the association task process should be done well away, and that requires snappy data exchanging limit of IEEE.Additionally, IEEE 802.11p has displayed WAVE BSS (WBSS) a brisk moving vehicle can transmit a reference point fit as a fiddle a WBSS

which fuses every one of the information that can be given by it and all the course of action information required to twist up perceptibly a person from it. Other vehicle can pick whether to join the WBSS after it gets the reference point. The whole strategy has immensely diminished the outsider referencing time by excepting the frameworks of connection and approval. After a WBSS has been produced, all the part vehicles are identical, which infers that the WBSS will regardless exist paying little mind to whether the vehicle who develops the WBSS exits from it. The WBSS will vanish only if there are no part vehicles in it.[4]

As discussed above, as a tradition stack, WAVE is a technique for task used by IEEE 802.11p device all together to work in the dedicated short range correspondence (DSRC) band. The WAVE system consolidates IEEE P1609.1, IEEE P1609.2, IEEE P1609.3, IEEE P1609.4 and IEEE 802.11p itself, and it portrays the outline, correspondence models, organization structure, security and physical access features for road vehicle[5]

### 3.2.1 Enviornment

To be particular, IEEE 802.11p has assembled the standard in media get to control (Macintosh) and physical (PHY) layer in light of IEEE 802.11 (IEEE, 2010), though IEEE P1609 convention suite which have manufactured the standard in application, transport, system and information connect layer and asset and security administration, are going about as conventions in higher layer in view of IEEE 802.11p.[6]

### 3.2.2 Mission

The WAVE standards enable the development of interoperable low-latency, low overhead WAVE devices that can provide communications in support of transportation safety, efficiency and sustainability, and that can enhance user comfort and convenience.[6]

### 3.2.3 WAVE device configuration

WAVE Networking Services support wireless communications between any and all WAVE devices. These devices may be mobile, portable, or stationary. The mobile devices include vehicles operating at high speeds on open highways. A common characteristic of WAVE systems is the need for extremely low communications latency (measured in milliseconds) from initially encountering a device that provides services to completing a set of data transfers.This standard is consistent with the vehicle-to-roadside and vehicle-to-vehicle

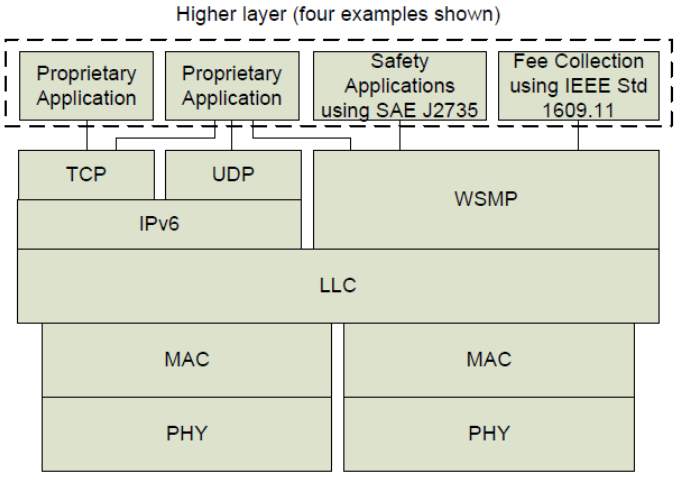



Figure 3.3: WAVE config

communications needs of various ITS architectures. Its intent is to enable interoperability and robust safety/public safety communications among these WAVE devices.[5]

There is two different channels Control channel(CCH) and Service channel(SCH) which operates in two different frequency bands.Both channels are used for different purposes.CCH is used for broadcast communication,short,high-priority,data and management frames,and safety critical communication with low latencies.

SCH : There is two way communication between RSU and OBU(V2I) or between OBUs(V2V).And it is used for specific applications eg.tolling and internet access and for general purpose IPV6 data.

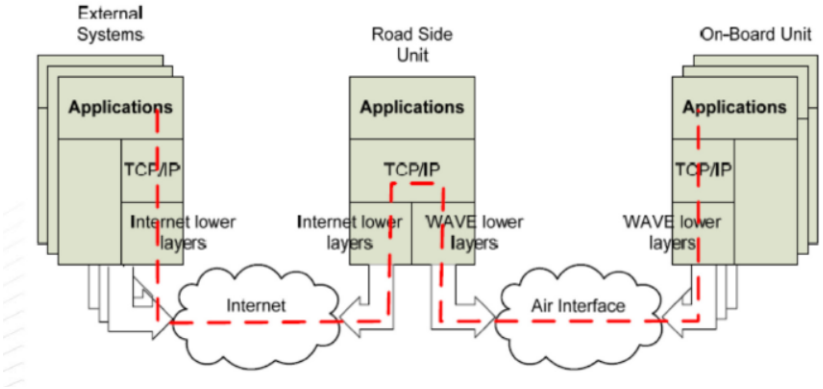



Figure 3.4: WAVE ip access

This is figure defines that this wave device used self-assigned IPV6 address register on neighbour catch.It is not uses DHCP.It will use linklocal IP address. This device normally works on MAC layer and all the functionalities are implemented with respect

to MAC layer. The services provided by this standard are used to manage channel coordination and to support MAC service data unit (MSDU) delivery. Both data plane and management plane features are specified.

Data plan services :

Channel coordination : The MAC sublayer coordinates channel intervals so that data packets are transmitted on the proper RF channel at the right time.

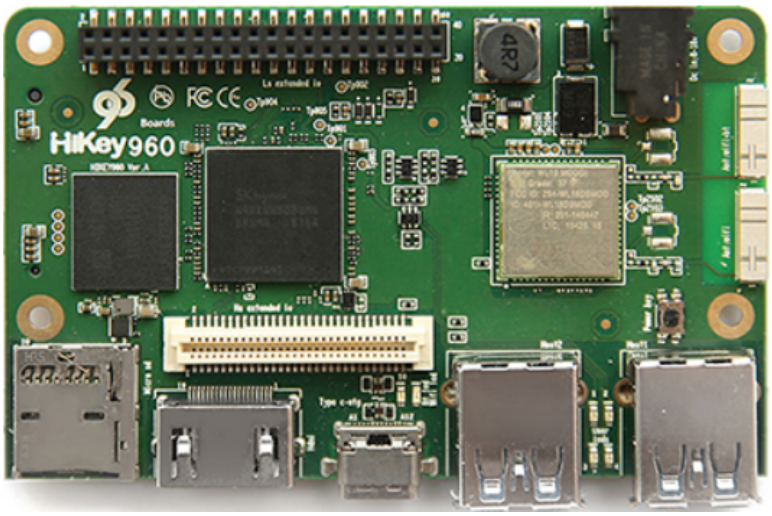
Channel routing : The MAC sublayer handles inbound and outbound higher layer data. This specification includes routing of data packets from the LLC to the designated channel, and setting parameters (e.g.,transmit power) for WAVE transmissions.

User priority : WAVE supports a variety of safety and nonsafety applications with up to eight levels of priority as defined in IEEE Std 802.11. The use of user priority (UP) and related access category (AC) supports quality of service using enhanced distributed channel access (EDCA) functionality specified in IEEE Std 802.11.

# Chapter 4

# Android Oreo on Hikey960

## 4.1 Hikey960 Device




## 4.2 Hardware Requirements

A 64-bit condition is required for Gingerbread (2.3.x) and fresher forms, including the ace branch. You can assemble more seasoned forms on 32-bit frameworks. No less than 100GB of free plate space to checkout the code and an additional 150GB to construct it. On the off chance that you lead numerous forms or utilize ccache, you will require significantly more space. On the off chance that you are running Linux in a virtual machine, you require no less than 16GB of RAM/swap.

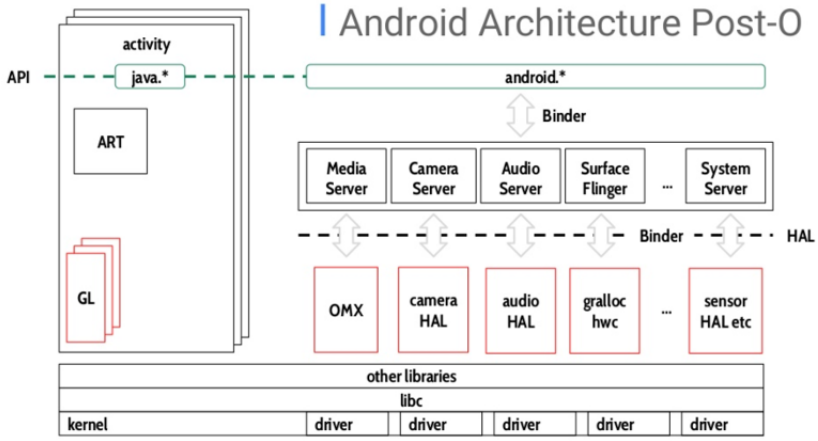
This hikey960 platform is the product of huawei that we are using it as a reference board for our SDIO,PCIe broadcom chip.On which we will do our driver loading and validation

for client requirement.This reference board is like panda and imx board which we also using it for our driver validation.[7]

## 4.3 Software Requirements

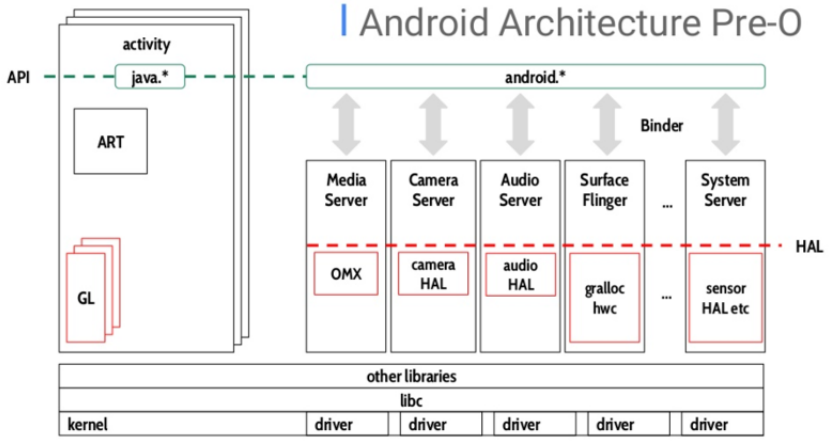
We are using linux (Ubuntu)platform for this reference board.First we are supposed to compile the android O source code which is available in open source.Then compile the kernel according to the android API level and platform requirement.Initially this hikey board is having inbuilt TI wifi-chip. If you are developing against the AOSP master branch, use one of these operating systems: Ubuntu 14.04 (Trusty) or Mac OS v10.10 (Yosemite) or later with Xcode 4.5.2 and Command Line Tools. It is preferred to have Minimum 4 GB RAM in your machine otherwise there may face some serious issues while compilation. [7]

## 4.4 Android Oreo Architecture




## 4.5 Hardware Abstraction Layer

A HAL characterizes a standard interface for equipment sellers to actualize, which empowers Android to be freethinker about lower-level driver executions. Utilizing a HAL enables you to actualize usefulness without influencing or altering the more elevated amount framework. This interface enables the Android framework to stack adjust renditions of your HAL modules reliably. A HAL interface comprises of two segments: modules and gadgets. You can fabricate your modules by making Android.mk records for every




one of your HAL executions and indicating your source documents.[8]

### 4.5.1 HAL types

Binderized HALs : In a Binderized HAL, the Android framework and HALs communicate with each other using binder inter-process communication (IPC) calls.

Passthrough HALs : A HIDL-wrapped conventional or legacy HAL. These HALs wrap existing HALs and can serve the HAL in binderized and same-process (passthrough) modes. Devices upgrading to Android 8.0 can use passthrough HALs.

Legacy HALs are interfaces that predate conventional HALs. A few important subsystems (Wi-Fi, Radio Interface Layer, and Bluetooth) are legacy HALs.[8]

## 4.6 HAL Interface Definition Language (HIDL)

HIDL is an interface depiction dialect to indicate the interface between a HAL and its clients. It permits indicating sorts and strategy calls, gathered into interfaces and bundles. HIDL is a system for communicating between codebases that may be compiled independently.[8] HIDL is intended to be used for inter-process communication (IPC). The objective of HIDL is that the structure can be supplanted without rebuilding HALs. The issue with Nougat and more established form of Android, is that there's no division between the merchant's low level equipment code and the larger amount AOSP working framework code that Google keeps up. In Android 7.x and prior, no formal merchant interfaces existed, implying that gadget producers needed to refresh vast segments of the

Android code with each refresh. This incorporates looking out for equipment sellers, for example, SoC makers, to give their code to guide equipment into the new OS. [8]

## 4.7 Implementation

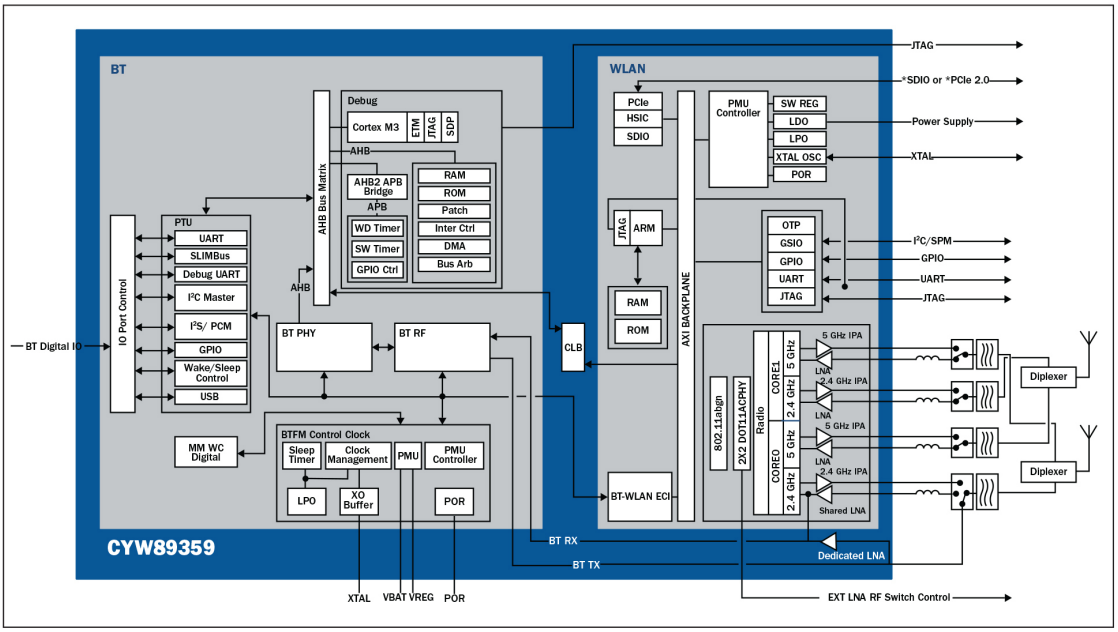
As this board is having the TI wifi-chip,but we are supposed to use our boardcom wifi chip for further implementation.We can disable the TI wifi chip support during the kernel compilation by disabling the macros and flags related to the TI chip and have to add the Macro and flags related to broadcom chip.Then you can compile the kernel source which will create the Image.gz according to the specifications that has been enable in the kernel configuration file. Next copy that kernel iamge to the android oreo source and compile the android source code which will create the boot image and system image.By using this images you can flash the hikey platform I am using 89459(4359) PCIE chip for implementation.Now on this PCIE chip we will try to our load our driver(DHD) and run the supplicant over it and then testing all the usecase for all possible wifi usecases. Now comes supplicant which needs to be run to drive our firmware on this board.This supplicant is also different for WAPI security and non-WAPI security checks.Supplicant sources needs to be compiled on this android Oreo source code.Compiled supplicant for non-wapi and wapi both the scenarios have to run for talking to the upper layer system calls with lower layer drivers.Supplicant runs in the background as deamon which will act as a communication medium via we can run our WLAN usecases like AP+AP, AP+STA, AGO+AGO.

### 4.7.1 Real Simultaneous Dual Band(RSDB) Feature

### 4.7.2 Why RSDB ?

Individuals today have turned out to be accustomed to living inside remote reach of the web each moment of consistently. At home, at the working environment, or when out by walking or on open transport, the internet is in a flash available to anybody conveying a cell phone. So for what reason not in the car also?

Present day vehicle plans today effectively offer Bluetooth remote availability as a standard element for without hands calling and sound music gushing from got cell phones, and also information administrations for telephone directory access, informing and vehicle data transfers. Applications for the in-vehicle Wi-Fi network exhibit important




differences from typical uses in the home. At home, a Wi-Fi router only does one thing: it provides a pipe to the internet for multiple devices. In the vehicle, the Wi-Fi router will simultaneously be offering internet access, and providing a high-bandwidth link between a smartphone and the head unit for CarPlay, Android Auto or similar services, and checking the manufacturers cloud servers for software updates, and downloading them when necessary.

### 4.7.3 Functionality

New system functions can also derive huge value from the high data transfer rates and standards-based connectivity that a Wi-Fi network provides. Two such functions in particular are exciting vehicle systems designers:

- Smart over-the-air upgrades  increasingly, a vehicles functions will become updateable and regularly improved. Just like smartphone apps, a vehicles systems will be supported by the manufacturer through regular online security and functional updates. By providing these updates over-the-air, the vehicle manufacturer avoids the need to call the vehicle to a service center.

- Display sharing  administrations, for example, Apple's CarPlay, Android Auto and MirrorLink show the driver's cell phone screen and capacities to the vehicle's infotainment show. This enables the driver to utilize a cell phone's applications and substance while driving, getting to them by means of the touchscreen show or through voice orders.

CarPlay, for example, gives the driver a chance to utilize Apple's Siri voice acknowledgment programming to control cell phone applications, for example, content informing while at the same time keeping the two hands on the guiding haggle out and about. Today, show sharing is a component gave in top of the line autos, or a costly choice in mid-go vehicles utilizing USB. Progressively, notwithstanding, show sharing will utilize Wi-Fi availability and will be sent at the low end of makers' reaches too, since it enables them to execute capacities, for example, route by means of the driver's cell phone. This empowers them to abstain from coordinating a committed route framework into the vehicle itself, sparing expense and streamlining the car's plan.[9]

Customary Wi-Fi chips utilize a solitary Media Access Controller (MAC) to switch crosswise over channels and groups, and their execution turns out to be extremely constrained when various applications and numerous groups are required. The arrangement is to give two separate Wi-Fi associations at the same time and in various recurrence groups, from a similar Wi-Fi get to point chip. A radio framework on-chip for car frameworks from Cypress Semiconductor, the CYW89359, offers two separate MACs to empower an element for simultaneous task called Real Simultaneous Dual Band (RSDB). The single-chip CYW89359 incorporates a double band, double MAC radio, empowering concurrent task at both 2.4GHz and 5GHz. Each radio has a different MAC and physical layer interface (PHY) to its own reception apparatus. This implies in an ordinary car usage, a vehicle can run a show sharing administration on the 5GHz radio while giving a continuous web association with client gadgets on the 2.4GHz radio.[9]

# Chapter 5

# Conclusion and Future work

## 5.1 Conclusion

This project concludes how important android platform is for Automotive industry with respect to WLAN usecases.This project helps automotive industry to solve many problems by WLAN usecases.The main goal of this project is to integrating wireless internet access into the vehicles user interfaces, the car maker can also enable the driver to safely use many internet applications and functions while driving.RSDB feature allows you to run two systems concurrently like smart over-the-air-upgrades and display sharing.This functionality allows two Wi-Fi connections simultaneously and in different frequency bands from the same wifi chip which is plugged into your infotainment system.

## 5.2 Future work

In future we are focusing on the connected cars concept where our latest chips will be used with all the new features.Here we will be doing work on the concept called Andriod auto which will leads the automotive industry to the next level. When we talk about connected cars ,Connected vehicles must have the capacity to comprehend their drivers, their propensities, and even their emotions while in the driver's seat and afterward minister an exceptional, customized understanding for their clients. Vehicles additionally should have the capacity to give data, experiences and proposals to clients progressively. At last, engineers need to associate with advanced twins of their vehicles through their life cycle to have the capacity to analyze and settle issues considerably quicker, and in addition to refresh them with new abilities and administrations.It will be more towards the Android

Auto which is the subsystem in the latest cars like BMW,Audi,Tesla.There is still a lot connectivity issues which can be resolved by WLAN chips.Android has dependably been a people's most loved working framework on account of its easy to understand UI and included Play Store for downloading a large number of free well known apps.Due to driving an innovatively associated life, through cell phones, tablets and other keen gadgets, the buyers bring a similar desire for driving knowledge in cars.

# Bibliography


[1] "Genivi alliance(url: https://www.genivi.org/)."

[2] "Automotive industry for future(url: https://www.cabotsolutions.com/2016/02/future-iot-automobile-industry/)."

[3] "(url: https://w1.fi/wpa_supplicant/devel/)."

[4] "Key indices analysis of ieee 802.11p based vehicle to infrastructure system in highway environment (url: http://www.sciencedirect.com/science/article/pii/S1877042813021514/pdf?md5=cbbca611feffa452e58196d517b86a2b&pid=1-s2.0-S1877042813021514-main.pdf)."

[5] "Ieee standard for wireless access in vehicular environments (wave) – networking services(url: http://standards.ieee.org/findstds/standard/1609.3-2016.html)."

[6] "Ieee guide for wireless access in vehicular environments (wave) - architecture(url: http://ieeexplore.ieee.org/document/6755433)."

[7] "Android o source and hikey960 specification(url: https://source.android.com/setup/requirements)."

[8] "Android hal: (url: https://www.androidauthority.com/)."

[9] "Wi-fi in the car : Concurrent need of multiple systems and applicantion (url: http://www.eenewsautomotive.com/design-center/wi-fi-car-how-meet-concurrent-needs-multiple-systems-and-applications)."