ISSN (Online) 2395-2717

International Journal of Engineering Research in Electrical and Electronic Engineering (IJEREEE)
Vol 3, Issue 9, September 2017

Design of Payload Data Storage Block of Wi-Fi Mac Transmitter with Vhdl

[1] K Rangaswamy, [2] K. keerthi, [3] V.Sudharani
[1][2] Asst. professor, chaitanya bharathi institute of technology, proddatur, kadapa, andhra pradesh, india
[3] Asst. Professor, AITS,RAJEMPETA, Kadapa, Andhra Pradesh, India

***Abstract*: -- IEEE 802.11 is one standard for the wireless communication in radio frequency range.This 802.11b defines the Medium Access Control Layer [MAC] for wireless local area networks. Now a days wireless local area network, WLAN isused more people so that is the main reason for doing research on this project.today most of the projects going on simulation because of its effective cost.The main core of the IEEE 802.11b standard is the CSMA\CA, Physical and MAC layers. But here we are giving only MAC layer for transmitter using the VHDL. VHDL is language it is used of designs and implementing a n electronic modules. VHDLstands for Very High Speed Hardware Description LANguage.It is defined in IEEE as a tool of creation of electronics system because it supports the development verification synthesis and testing of hardware design, the communication of hardware design data and the maintenance, modification and procurement of hardware. The main purpose of the IEEE 802.11 standard is to provide wireless connectivity to devices that require a faster installation. MAC procedures are defined here for accessing the physical medium, which can be infrared or radio frequency. Here Wi-Fi MAC Transmitter module is divided in to 5 blocks i.e. Data Unit Interface block, Controller block, Pay Load Data Storage block, MAC Header Register block, Data Processing block. In this paper, we are considering only Payload Data Storage block.**

***Index Terms* — Wi-Fi, Technology, payload data storage, serializer, HEC, CRC**

I. INTRODUCTION

The major motivation and benefit from Wireless LANs is increased mobility. Untethered from conventional network connections, network users can move about almost without restriction and access LANs from nearly anywhere. The other advantages for WLAN include cost-effective network setup for hard-to-wire locations such as older buildings and solid-wall structures and reduced cost of ownership-particularly in dynamic environments requiring frequent modifications, thanks to minimal wiring and installation costs per device and user. WLANs liberate users from dependence on hard-wired access to the network backbone; giving them anytime, anywhere network access.

Each computer, mobile, portable or fixed, is referred to as a station (STA) in 802.11. The difference between a portable and mobile station is that a portable station moves from point to point but is only used at a fixed point. Mobile stations access the LAN during movement. When two or more stations come together to communicate with each other, they form a Basic Service Set (BSS). The minimum BSS consists of two stations. 802.11 LANs use the BSS as the standard building block

1.1Ad hoc mode: A BSS that stands alone and is not connected to a base is called an Independent Basic Service Set (IBSS) or is referred to as an Ad-Hoc Network.

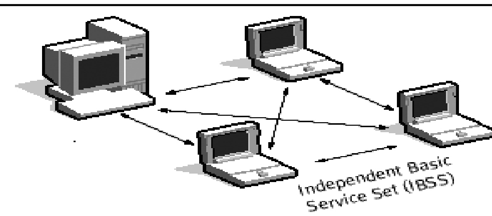


Figure:1.1

An ad-hoc network is a network where stations communicate only peer to peer. There is no base and no one gives permission to talk. Mostly these networks are spontaneous and can be set up rapidly. Ad-Hoc or IBSS networks are characteristically limited both temporally and spatially.

1.2 AP mode:

When BSS's are interconnected the network becomes one with infrastructure. Two or more BSS's are interconnected using a Distribution System or DS. This concept of DS increases network coverage. Each BSS becomes a component of an extended, larger network. Entry to the DS is accomplished with the use of Access Points (AP). An access point is a station, thus addressable. So, data moves between the BSS and the DS with the help of these Access Point. Creating large and complex networks using BSS's and DS's leads us to the next level of hierarchy, the Extended Service Set or ESS. The beauty of the ESS is the entire network looks like an independent basic service set to the Logical Link Control layer (LLC). This means that stations within the ESS can communicate or eve move between BSS’s transparently to the LLC

ISSN (Online) 2395-2717

International Journal of Engineering Research in Electrical and Electronic Engineering (IJEREEE)
Vol 3, Issue 9, September 2017

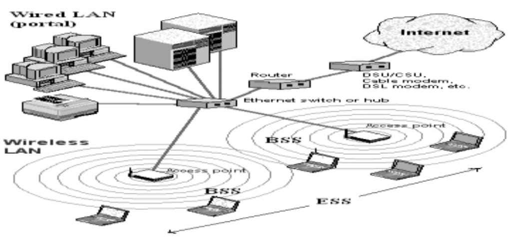


Figure 1.2

One of the requirements of IEEE 802.11 is that it can be used with existing wired networks. 802.11 solved this challenge with the use of a Portal. A portal is the logical integration between wired LANs and 802.11. It also can serve as the access point to the DS. All data going to an 802.11 LAN from an 802.X LAN must pass through a portal. It thus functions as bridge between wired and wireless. The implementation of the DS is not specified by 802.11. Therefore, a distribution system may be created from existing or new technologies. A point-to-point bridge connecting LANs in two separate buildings could become a DS.

II. HISTORY

During the mid-1920s, several inventors attempted devices that were intended to control current in solid-state diodes and convert them into triodes. Success did not come until after WWII, during which the attempt to improve silicon and germanium crystals for use as radar detectors led to improvements in fabrication and in the understanding of quantum mechanical states of carriers in semiconductors. Then scientists who had been diverted to radar development returned to solid-state device development. With the invention of transistors at Bell Labs in 1947, the field of electronics shifted from vacuum tubes to solid-state devices. With the small transistor at their hands, electrical engineers of the 1950s saw the possibilities of constructing far more advanced circuits. As the complexity of circuits grew, problems arose. One problem was the size of the circuit. A complex circuit, like a computer, was dependent on speed. If the components of the computer were too large or the wires interconnecting them too long, the electric signals couldn't travel fast enough through the circuit, thus making the computer too slow to be effective.

Kilby's idea was to make all the components and the chip out of the same block (monolith) of semiconductor material. Kilby presented his idea to his superiors, and was allowed to build a test version of his circuit. In September 1958, he had his first integrated circuit ready. Although the first integrated circuit was crude and had some problems, the idea was groundbreaking. By making all the parts out of the same block of material and adding the metal needed to connect them as a layer on top of it, there was no need for discrete components. No more wires and components had to be assembled manually. The circuits could be made smaller, and the manufacturing process could be automated. From here, the idea of integrating all components on a single silicon wafer came into existence, which led to development in small-scale integration (SSI) in the early 1960s, medium-scale integration (MSI) in the late 1960s, and then large-scale integration (LSI) as well as VLSI in the 1970s and 1980s, with tens of thousands of transistors on a single chip (later hundreds of thousands, then millions, and now billions (10^9))

III. APPLICATION AND ADVANTAGES

3.1 Applications:

- Wi-Fi intended to be used for mobile computing devices, such as laptops, in LANs, but is now often used for increasingly more applications, including Internet access, gaming, and basic connectivity of consumer electronics such as televisions and DVD players.
- In the corporate enterprise, wireless LANs are usually implemented as the final link between the existing wired network and a group of client computers, giving these users wireless access to the full resources and services of the corporate network across a building or campus setting.
- There are even more standards in development that will allow Wi-Fi to be used by cars in highways in support of an Intelligent Transportation System to increase safety, gather statistics, and enable mobile commerce IEEE 802.11p.
- Wi-Fi also allows connectivity in peer-to-peer mode, which enables devices to connect directly with each other. This connectivity mode is useful in consumer electronics and gaming applications.

3.2 Advantages:

- The main advantages of using Wi-Fi technology is the lack of wires. This is a wireless connection that can merge together multiple devices.

- Wi-Fi network is particularly useful in cases where the wiring is not possible or even unacceptable. For example, it is often used in the halls of conferences and international exhibitions. It is ideal for buildings that are considered architectural monuments of history, as it excludes the wiring cables.

IFERP
connecting engineers... developing research
ISSN (Online) 2395-2717
International Journal of Engineering Research in Electrical and Electronic Engineering (IJEREEE)
Vol 3, Issue 9, September 2017

IV. 802. 11 LAYER DESCRIPTION

The 802.11 standards focus on the bottom two levels the ISO model, the Physical Layer and Data Link Layer.

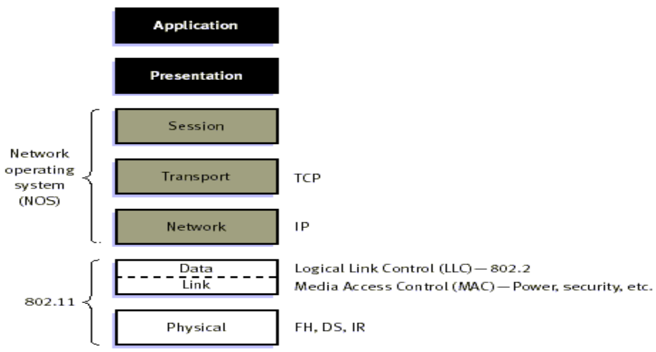


Figure:4.1

The data link layer within 802.11 consists of two sub layers:

- Logical Link Control (LLC).
- MediaAccess Control (MAC).

V. BASIC MAC LAYER SERVICES

While the implementation for the DS is not specified, 802.11 does specify the services, which the DS must support. Services are divided into two sections

- Station Services (SS).
- Distribution System Services (DSS).

5.1There are four services provided by the DSS:

- Association.
- Reassociation.
- Disassociation.
- Distribution and Integration.

The first three services deal with station mobility. If a station is moving within its own BSS or is not moving, the stations mobility is termed No-transition. If a station moves between BSS's within the same ESS, its mobility is termed BSS-transition. If the station moves between BSS's of differing ESS's it is ESS transition. A station must affiliate itself with the BSS infrastructure if it wants to use the LAN. This is done by **Associating** itself with an access point. Associations are dynamic in nature because stations move, turn on or turn off. A station can only be associated with one AP. This ensures that the DS always knows where the station is.

Association supports no-transition mobility but is not enough to support BSS-transition. Enter **Reassociation**. This service allows the station to switch its association from one AP to another. Both association and reassociation are initiated by the station. **Disassociation** is when the association between the station and the AP is terminated. Either party can initiate this. A disassociated station cannot send or receive data. ESS-transition is not supported. A station can move to a new ESS but will have to reinitiate connections.

Distribution and **Integration** are the remaining DSS's. Distribution is simply getting the data from the sender to the intended receiver. The message is sent to the local AP (input AP), and then distributed through the DS to the AP (output AP) that the recipient is associated with. If the sender and receiver are in the same BSS, the input and out AP's are the same. So the distribution service is logically invoked whether the data is going through the DS or not. Integration is when the output AP is a portal. Thus, 802.x LANs are integrated into the 802.11 DS.

5.2 MAC frame formats:

Each frame consists of the following basic components:

a) A MAC header, which comprises frame control, duration, address, and sequence control information;
b) A variable length frame body, which contains information specific to the frame type;
c) A frame check sequence (FCS), which contains an IEEE 32-bit cyclic redundancy code (CRC).

5.3 General frame format: The MAC frame format comprises a set of fields that occur in a fixed order in all frames, the fields Address 2, Address 3, Sequence Control, Address 4, and Frame Body are only present in certain frame types.

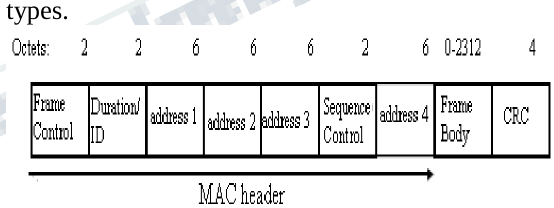


Figure:5.1

<u>Frame Control field</u>: The Frame Control field consists of the following sub fields: Protocol Version, Type, Subtype, To DS, From DS, More Fragments, Retry, Power etc.,

VI. PAYLOAD DATA STORAGE BLOCK

This is one of the main block in WI-Fi MAC transmitter module.payload data storage block is responsible for some important functions such as data storing,error checking and correcting,data sending etc., Each function can be done by its own separate module;that is error checking and correcting can be done by CRC and HEC modules,data is stored in FIFO module,and it has serializer and data length counter.

ISSN (Online) 2395-2717

International Journal of Engineering Research in Electrical and Electronic Engineering (IJEREEE)
Vol 3, Issue 9, September 2017

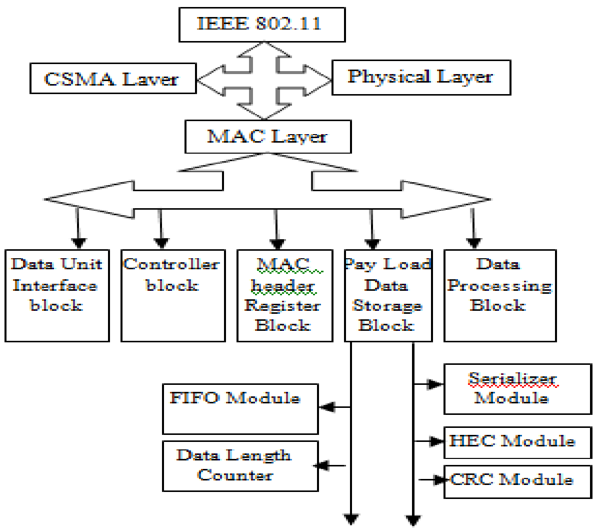


Figure 6.1

6.1 FIFO:

The FIFO serves the purpose of storing the data temporarily before being retrieved for transmission. The FIFO consists of a set of 32 registers each of length 8 bits. It has two clocks one which is used to write the data and the other to retrieve; similarly it has two enables.

Initially all its internal registers are initialized to null. For every rising edge of the SysCLK, when the FIFORdEna is high the data from the DataBus is read into the registers in a sequential manner. Similarly with every rising edge of the CLK signal when the FIFO Ena is made high the stored data is retrieved through the FIFO_Out.In addition to the above-mentioned pins there are two more pins called the FULL and EMPTY pins, which are used to say whether the FIFO is completely filled or empty.

6.2 CRC:

The function of the HEC block is to check the PLCP header for any possible errors. What it does is, it calculates the CRC code for the data at the BIT input and appends this data at the end of the PLCP header data, so that the receiver can check the data for its reliability by verifying the 16-bit CRC code.

The module is synchronized with the rising edge of the CLK signal. When the HEC_CAL is made high (HEC_CAL = '1') the module starts calculating the CRC code for the data coming at the BIT input pin. At this stage there is no output from this module, it begins to transmit only when the HEC_Tx is made high (HEC_Tx = '1') the module transmits the 16-bit code that it calculated in the meantime

6.3 DATA LENGTH COUNTER:

The data length counter is a simple device that counts the length of the incoming data. We know that data is transmitted using packets and the amount of data each packet can carry is called its payload and it is a fixed value. So using this module we can control the number of bytes being transmitted.

It consists of a ByteCLK, which is synchronous with the time taken to transmit one byte of data. The MaxNo consists of the information regarding the length of the data to be transmitted. It is initialized to the amount of data that we want to send then when the DataEna is made high (DataEna = '1') the counting of the number of bytes takes place. When the required number is reached the DataCntOver is made high (DataCntOver = '1').

6.4 SERIALIZER:

The function of the serializer is to convert the incoming data bytes into bits, for this purpose the serializer is synchronized with a clock, which is of a shorter period than the system clock.

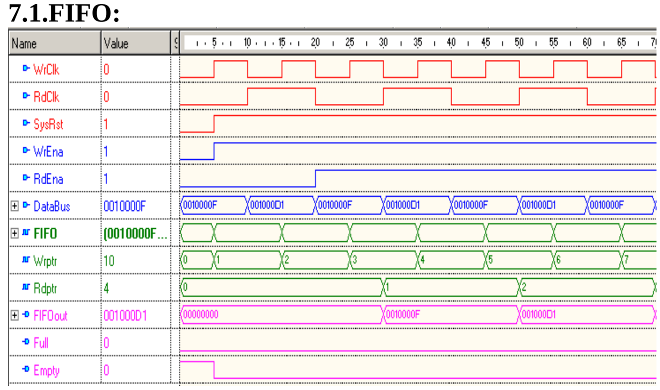
With every rising edge of the CLK the module is being synchronized. Whenever the LD_ENA is made high (LD_ENA = '1'), the data is loaded into the internal register of the module. Similarly whenever the SER_ENA is made high (SER_ENA = '1'), the data byte is converted into a stream of bits and is given out on the BIT pin.

6.5 HEC:

The function of the HEC block is to check the PLCP header for any possible errors. What it does is, it calculates the CRC code for the data at the BIT input and appends this data at the end of the PLCP header data, so that the receiver can check the data for its reliability by verifying the 16-bit CRC code. The module is synchronized with the rising edge of the CLK signal. When the HEC_CAL is made high (HEC_CAL = '1') the module starts calculating the CRC code for the data coming at the BIT input pin. At this stage there is no output from this module, it begins to transmit only when the HEC_Tx is made high (HEC_Tx = '1') the module transmits the 16-bit code that it calculated in the meantime

VII. RESULTS

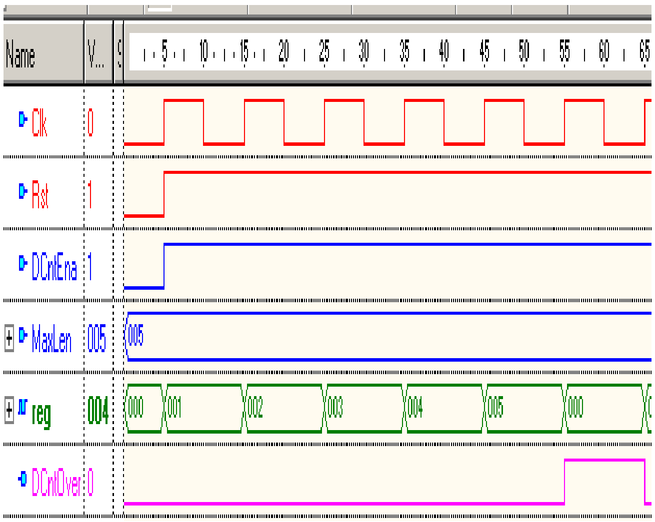
7.1.FIFO:



ISSN (Online) 2395-2717

International Journal of Engineering Research in Electrical and Electronic Engineering (IJEREEE)
Vol 3, Issue 9, September 2017

7.2.DataLenCntr:



VIII. CONCLUSION

Various individual modules of Wi-Fi Transmitter have been designed, verified functionally using VHDL-simulator, synthesized by the synthesis tool, and a final net list has been created. This design of the Wi-Fi Transmitter is capable of transmitting all token, handshake and data packets. Entire IN transaction has successfully been transmitted. This transmitter is also capable of generating error-checking codes like HEC16 and CRC32. It can handle variable data transfers, i.e. 1024 bytes of data can be transmitted for asynchronous transfers and 64 bytes for other transfers.

REFERENCES

[1] Dr. M.S. Sutaone "Performance Evaluation of VHDLCoding Techniques for Optimized Implementation of IEEE 802.3" IEEE transaction on communication, pp-287-293, Jan 12, 2008

[2] Fedrico Cali, Marco Conti, and Enrico Gregori "IEEE 802.11 protocol: design and pe rformance evaluation ofan adaptive Back off mechanism" IEEE journal on selected areas in communications, vol18.No.September 2000, pp1774-1778.

[3] Goyal M, Rohm D, Xie W, et al. A stochastic model for beaconless IEEE 802.15.4 MAC operation. Computer Communication, 2011, 34(12): 1460−1474

[4] Tien-Shin Ho, Kwang-Cheng Chen Performance Analysis of IEEE 802.11 CSMA/CA Medium Access Control Protocol, 0-7803-3692-5/96, IEEE, 1996.

[5] IEEE 802.11, Wireless LAN MAC and Physical Layer Specifications. Editors of IEEE, June 1997.

[6] The Editors of IEEE 802.11, "Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications," July 1995, IEEE P802.11 02.0.