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VHDL MODELLING OF WI-FI MAC LAYER FOR TRANSMITTER

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Abstract WiFi (Wireless Fidelity) is a wireless technology based on a cellular architecture where system is subdivided into cells. WiFi is the wireless way to handle networking. It is also known as 802.11 networking and wireless networking. The big advantage of WiFi is its simplicity. You can connect computers anywhere in your home or office without the need for wires. The computers connect to the network using radio signals, and computers can be up to 100 feet or so apart WiFi transmitter implements the Basic Service set (BSS) and controlled by the base station called access point. These access points are connected with distribution system.

Wi-Fi MAC Transmitter module is divided in to the following blocks i.e. system module control(SMC), Data Unit Interface block, Controller block , Pay Load Data Storage block , MAC Header Register block , Data Processing block. All these modules are designed here and are verified functionally using VHDL – simulated, synthesized by synthesis tool. This design of the WiFi transmitter is capable of transmitting the frame formats. The formats include all 802.11 frames. It is also capable of generating error checking codes like HEC and CRC. Thus it can handle various types of data.

Keywords:WLAN,IEEE 802.11,VHDL,Wi-FiMAClayer.

INTRODUCTION TO IEEE 802.11

Due to technology advancement in the 21St Century, wireless Communication had been most popular choices of communication. More and more people are turning to wireless due to the convenience of mobility. An 802.11 LAN is based on a cellular architecture where the system is subdivided in to cells, where each cell [called Basic Service Set or BSS] is controlled by a Base Station [calledAccess point, orin shortAP].Eventhough that a wireless LAN may be formed by a single cell, with a Single Access Point[can also work without an Access most installations will be formed by several cells, where the Access Points are connected through some kind of backbone [called Distribution Systemor DS],typically Ethernet, and in some cases wireless it self. The whole interconnected wireless LAN including the different cells, their respective Access Points and the Distribution System, is seen to the upper layers of the OSI model, as a single 802 network and is called in the standard as Extended Service Set[ESS]. The standard also defines the concept of a portal, a portal is a device that interconnects an802.11andanother802LAN [3]. However, all is not prefect in theWLAN world. Offering nominal bit rates of 11Mbps [802.1 lb] and 54Mbps(802.1la and 802.11g) the effective throughputs are actually much lower-owing to packet collisions, protocol overhead , and interference in the increasingly congested unlicensed bands at 2.4GHz and 5GHz. Further more, operation in these bands entails a strict regulatory transmit power constraint, thus limiting range and even bit rates beyond a certain distance

OVERVIEW OF MACLAYER:

The 802.11 protocol covers the MAC and physical layer, the standard currently defines a single MAC which interacts with three physical layers [all of them running at 1 and 2 Mbits\sec]i.e. Frequency Hopping Spread Spectrum in the 2.4GHz band, Direct Sequence Spread Spectrum in the 2.4GHz band and Infrared[3]. Beyond the standard functionality usually performed by MAC layers, the 802.11 MAC performs other functions that are typically related to upper layer protocols, such as Fragmentation, Packet retransmissions and Acknowledgements. The MAC layer defines two access methods, the Distribution Coordination Function [DCF] and Point Coordination Function [PCF][3].

WI-FI FEATURES:

Wi-Fi Wireless Fidelity [802.11 family of standards] for LAN. WiFi is designed for local area-networks, which are private, local (short range), but where-competing cable systems run at very high speeds. WiFi achieves greater than lOMBit/ Sec throughput for a user in many circumstances. Currently WiFi carries more user data than any other wireless technology. Evolution is to go further, faster and at lower power consumption [2] Upstart wireless LAN [WLAN] technologiesFunder the 802.11 (Wi-Fi) umbrella have leapfroggedtowards cellular and other efforts edging towards broad bandwireless [suchas802.16!WiMAX]andhaveledto the first wide spread, commercially successful broadband wireless access technology . Infact, Wi-Fi is a runaway success around the globe [5]

WLAN SYSTEMS AND THE CAPABILITIES OF STATE-OF-THE-ART

It is basically microprocessor s, an implementation based solely in

the parallel input and serial out put device. Various data microprocessors would require a large number of selected at the multiplexer are serially obtained. It occurs components and would be cost inefficient FPGAs with at every rising edge of the clock and when the serial their spatial / parallel computation style can significantly enable is high. The output bit is designated as SBit. When accelerate complex parts of WLANs and improve the all the output bits are over, then the End of Conversion i.e. efficiency of discrete components implementations[I0]. EOC goes high. The design has been synthesized using FPGA .

HECMODULE:

xilinx.TwotypesofFPGAs (FieldProgrammable Logic Array) are available i.e.i) Reprogrammable (SRAMCM___. based) from Xilinx, Altera, Lattice and Atmel ii) OneBvtClk16 BIE:COut time Programmable (OTP) from Actel, Quick logic.

FPGAs are reasonably cheap, with short design TxEIla|cycle and are reprogrammable. They are more flexible.

CONCLUSIONS:

Various individual modules of Wi-Fi Transmitter have been designed, verified functionally using VHDL simulator, synthesized by the synthesis tool .This design of the WiFi transmitter is capable of transmitting the frame formats. The formats include all 802.11 frames i.e. MAC frame, RTS frame , CTS frame and ACK frame. The transmitter is also capable of generating error-checking codes like HEC and CRC. It can handle variable data transfer

REFERENCES:

1) W.L.Pang, K.W.Chew, F.Choong, E.S.Teoh, "VHDL Modeling of the IEEE 802.1 lb DCF MAC", Procedings of the 6th WSEAS International Conference on Instrumentation, Measurment Circuits and systems, Hangzhou, China, April 15 17,2007.
2) Broadband wireless Access, Institution of Engineering and Technology Seminar, 6th Dec 2006, London,UK
3) Pabolo Brenner , "A Technical tutorial on the IEE802.11 Protocol"
4) Shambhu Upadhyaya, " Wireless Network Security,"Lecture 5, University at Buffalo, the State University ofNewyork
5) Sebastien Roy, " The Design of an FPGA Based MIMO Transceiver for Wi-Fi,"DSP Magazine, May 2006.
6) Prof. David Brooks, "Computer Science 141 Computing Hardware", Fall 2007, Harvard University.
7) Introduction to DSP Design flow, 2006 Xilinx, Inc