Ethernet (Ieee 802.3) Card – Architeture And Control Essay, Research Paper

I. Introduction (A)Problem Statement- The problem consists of designing and simulating the behavior of an actual Ethernet card of IEEE 802.3 standard,using Structural and Behavioral design methods. The Ethernet card and its mechanisms are to perform various tasks specific to those criteria given. The purpose of the card and it s mechanisms are to detect packet arrival, ignore line noise, discard corrupted packets, and detect TCP/IP protocol under the given criteria. (B).Overview – A general, yet detailed, description of the project and the Ethernet are provided in the following sections. Background information is introduced in Section two (II). It is here that an overview on the Ethernet is introduced, as well as a briefing on the project statement. In section three (III), a description of the project is established, along with the approach to the project and the overall procedure. Section four (IV) introduces the design and the design methods used in creating the architecture and controller portions of the card. Finally, Section five (V) states the reliability and results of our designed card and a debriefing of the overall project. II. Background Information (A). Overview of the Ethernet- The term Ethernet refers to the family of local area network (LAN) implementations that includes three (3) principal categories:1)Ethernet and IEEE 802.3 – LAN specifications that operate at 10Mbps over coaxial cable. 2)100-Mbps Ethernet -A single LAN specification (Fast Ethernet) that operates at 100Mbps over twisted cable 3) 1000-Mbps Ethernet – A single LAN specification (Gigabit Ethernet)that operates at 1Gbps over fiber and twisted-pair cables. i). Invention of the Ethernet

Ethernet is a baseband LAN specification that operates at 10Mbps using carrier sense multiple access collision detect (CSMA/CD) to run over coaxial cable (Figure 1). The Ethernet, a system for local communication among computing stations, was invented in the 1970 s by Robert M. Metcalfe and his colleagues at Xerox Corporation. It was in 1972 that the team developed the first experimental Ethernet system to interconnect the Xerox Alto, which was a personal workstation with a graphical user interface. In addition, the experimental Ethernet was used to link the Altos to servers and laser printers. The signal clock for the experimental Ethernet interface was derived from the Alto s system clock. Metcalfe s first experimental net was called the Alto Aloha Network, and in 1973 he realized that he could improve on the Aloha system of arbitrating access to a shared communications channel. He developed a new system that included a mechanism that detects when a collision occurs (collision detect). The system also includes “listen before talk”, in which stations listen for activity (carrier sense) before transmitting, and supports access to a shared channel by multiple stations (multiple access).The IEEE 802.3 specification was developed in 1980 based on the original Ethernet technology. Ethernet was designed to serve in networks with sporadic, occasionally heavy traffic requirements. The name “Ethernet” was chosen to make it clear that the system could support any computer not just Altos, and to point out that Metcalfe s new network mechanisms had evolved far beyond the Aloha system.Each Ethernet-equipped computer, also known as a station, operates independently of all other stations on the network: there is no central controller. All stations attached to an Ethernet are connected to a shared signaling system, also called the medium. Ethernet signals are transmitted serially, one bit at a time, over the shared signal channel to every attached station. To send data, a station first listens to the channel, and when the channel is idle the station transmits its data in the form of an Ethernet frame, or packet.After each transmission, all stations on B). Project Information – This project focuses on the design and architecture/control partnership of the Ethernet card. The problem statement, design specifications, and the approach to designing of the Ethernet card from its architecture and controller are presented in the following sections. Analysis of the given information and design methods (which allow us to design and simulate the behavior of an actual Ethernet IEEE 802.3 card) are also made apparent. IV. Design – A)Architecture-The architecture is divided into VHDL (Very High Speed Integrated Circuit Hardware Description Language) coding and hardware segments. VHDL is the language used that will actually allow us to simulate the functionality of our designed Ethernet card. The VHDL segment is sub-sectioned into Behavioral and Structural Methods2, respectively. The VHDL coding is compiled and simulated to test the functionality of the card s components . Careful analysis of the problem statement was taken in order to determine what hardware was required, as well as the respective quantity. It was decided that, in order to make this Ethernet card function as required, we need shift registers (11), Multiplier (4), counters (2), zero checkers (2), and registers (4).B).Controller- The purpose of the controller is to “tell” the architecture what to do. This is done by designing an Algorithmic State Machine (ASM). In order to construct the ASM, we had to get a visual image of what it is that the Ethernet card is actually doing. Then, by a method of hierarchy, a visual ASM design is produced in relative sequence to the functionality of the card C). Testing – After the VHDL code was derived, the coding was tested using a programming language compiler called Max+plus II. The compiler is used to test each individual component in the architecture to make sure that it function without error and, more importantly, as required. V).Conclusion – A. Summary

Ethernet is a branching broadcast communication system for carrying digital data packets among locally distributed computing stations. Its system consists of three basic elements: a physical medium that carries signals between computers, a set of medium access control rules, and an Ethernet frame. The primary purpose of the Ethernet is to allow communication between computers that share the same channels. This project allowed for the design and simulation of the actual behaviors of an Ethernet IEEE 802.3 standard card using various design methods, such as the Behavioral and Structural methods. Development of theses methods were the most time-consuming aspect of the project. Once the final design had been agreed upon, implementation occurred rapidly. By analyzing the functionality of the Ethernet card in the description, we were able to derive an ASM that logically followed the sequential behaviors of the card. From this ASM design, output equations were derived. By analyzing the requirements of the card, we were able to come up with the components needed to ensure that the card performed as specified. Each of these components had to be assigned VHDL programming logic, and was tested using the Max+plus II compiler. It was found that our final VHDL coding was logical as well as valid, as it compiled and simulated without errors. The final package was compiled (all components together) and simulated for further surety of our design. Testing of the completed project required the least amount of time, overall. We determined that there were no errors capable of significantly affecting the function of the card adversely. B)System Flexibility -A system of this design can have many applications and can be expanded to perform more complex requirements. This is quite apparent as the Ethernet card has evolved since its experimental stage. As long as the components remain as a great driving force of the Ethernet card, new features can always be added without actually disrupting the overall functionality of the system. However, being an already complex-designed structure, addition of extra features will greatly challenge the designer further.