Untitled Essay, Research Paper

Only once in a lifetime will a new invention come about to touch every aspect of our lives. Such a device that changes the way we work, live, and play is a special one, indeed. The Microprocessor has been around since 1971 years, but in the last few years it has changed the American calculators to video games and computers (Givone 1). Many microprocessors have been manufactured for all sorts of products; some have succeeded and some have not. This paper will discuss the evolution and history of the most prominent 16 and 32 bit microprocessors in the microcomputer and how they are similar to and different from each other. Because microprocessors are a subject that most people cannot relate to and do not know much about, this paragraph will introduce some of the terms that will be in- volved in the subsequent paragraphs. Throughout the paper the 16-bit and 32-bit mi- croprocessors are compared and contrasted. The number 16 in the 16-bit microproces- sor refers how many registers there are or how much storage is available for the mi- croprocessor (Aumiaux, 3). The microprocessor has a memory address such as A16, and at this address the specific commands to the microprocessor are stored in the memory of the computer (Aumiaux, 3). So with the 16-bit microprocessor there are 576 places to store data. With the 32-bit microprocessor there are twice as many places to store data making the microprocessor faster. Another common term which is mentioned frequently in the paper is the oscil- lator or the time at which the processors ?clock? ticks. The oscillator is the pace maker for the microprocessor which tells what frequency the microprocessor can proc- ess information, this value is measured in Mega-hertz or MHz. A nanosecond is a measurement of time in a processor, or a billionth of a second. This is used to measure the time it takes for the computer to execute an instructions, other wise knows as a cy- cle. There are many different types of companies of which all have their own family of processors. Since the individual processors in the families were developed over a fairly long period of time, it is hard to distinguish which processors were introduced in order. This paper will mention the families of processors in no particular order. The first microprocessor that will be discussed is the family of microprocessors called the 9900 series manufactured by Texas Instruments during the mid-70s and was developed from the architecture of the 900 minicomputer series (Titus, 178). There were five dif- ferent actual microprocessors that were designed in this family, they were the TMS9900, TMS9980A, TMS9981, TMS9985, and the TMS9940. The TMS9900 was the first of these microprocessors so the next four of the microprocessors where simply variations of the TMS9900 (Titus, 178). The 9900 series microprocessors runs with 64K memory and besides the fact that the 9900 is a 16-bit microprocessor, only 15 of the address memory circuits are in use (Titus, 179). The 16th address is used for the computer to distinguish between word and data functions (Titus, 179. The 9900 series microprocessors runs from 300 nanoseconds to 500 ns from 2MHz to 3.3MHz and even some variations of the original microprocessor where made to go up to 4MHz (Avtar, 115). The next microprocessor that will be discussed is the LSI-11 which was pro- duced from the structural plans of the PDP-11 minicomputer family. There are three microprocessors in the LSI-11 family they are the LSI-11, LSI-11/2, and the much im- proved over the others is the LSI-11/32 (Titus, 131). The big difference between the LSI-11 family of microprocessors and other similar microprocessors of its kind is they have the instruction codes of a microcomputer but since the LSI-11 microprocessor originated from the PDP-11 family it is a multi-microprocessor (Avtar, 207). The fact that the LSI-11 microprocessor is a multi-microprocessor means that many other mi- croprocessors are used in conjunction with the LSI-11 to function properly (Avtar, 207). The LSI-11 microprocessor has a direct processing speed of 16-bit word and 7- bit data, however the improved LSI-11/22 can directly process 64-bit data (Titus, 131). The average time that the LSI-11 and LSI-11/2 process at are 380 nanoseconds, while the LSI-11/23 is clocked at 300 nanoseconds (Titus, 132). There are some great strengths that lie in the LSI-11 family, some of which are the efficient way at which the microprocessor processes and the ability to run minicomputer software which leads to great hardware support (Avtar, 179). Although there are many strengths to the LSI- 11 family there are a couple of weaknesses, they have limited memory and the slow- ness of speed at which the LSI-11 processes at (Avtar, 179). The next major microprocessors in the microcomputing industry were the Z8001 and Z8002, however when the microprocessor entered into the market the term Z8000 was used to mean either or both of the microprocessors (Titus, 73). So when describing the features of both the Z8001 and the Z8002, they will be referred to as the Z8000. The microprocessor was designed by the Zilog Corporation and put out on the market in 1979 (Titus, 73). The Z8000 are a lot like the many other previous micro- processors except for the obvious fact that it is faster and better, but are similar be- cause they depend on their registers to function properly (Titus, 73). The Z8000 was improved by using 21 16-bit registers, 14 of them are used for general purposes opera- tions (Titus, 73). The difference with the Z8001 and the Z8002 is the Z8002 can only address 65K bytes of memory, which is fascinating compared to the microprocessors earlier in time but is greatly inferior to the Z8001 which can address 8M bytes (8000K) of memory (Titus, 73). The addressing memory between the two otherwise very simi- lar microprocessors is drastically different were as other functions of the microproces- sors seem to be quite the same. An example of this is the cycle time. The cycle time is 250 nanoseconds and the average number of cycles that occur per instruction are be- tween 10 and 14 for both microprocessors (Avtar, 25). The next microprocessor that will be discussed is the 8086. This microproces- sor is the best in my opinion, out of all the 16-bit microprocessors. Not only because the speeds of processing are tremendous, but because it simply paved the way to the 32-bit microprocessors using various techniques that will be discussed later. The 8086 was the second Intel microprocessor (being preceded by the 8080) (Avtar, 19). The 8086 was introduced in early 1978 by Intel (Avtar, 19). Like so many of the other processors the 8086 is register oriented with fourteen 16-bit registers, eight of which are used for general processing purposes (Avtar, 19). The 8086 can directly address 1MB (1,048,576 bytes) which is used only in accessing Read Only Memory. The ba- sic clock frequency for the 8086 is between 4MHz and 8MHz depending on the type of 8086 microprocessor that is used (Avtar, 20). Up until this point in the paper there have been common reoccurring phrase such as a microprocessor containing 14 16-bit registers. At this time in the evolution of microprocessors come the 32-bit register, which obviously has double the capacity to hold information for the microprocessor. Because of this simple increase of the register capacity we have a whole different type of microprocessor. Although the 16- bit and 32-bit microprocessors are quite different (meaning they have more compo- nents and such), the 32-bit microprocessors will be described in the same terms as the 16-bit microprocessors were. The remainder of the paper will discuss the 32-bit microprocessor series. The external data bus is a term that will be referred to in the remainder of the paper is. The data bus is basically what brings data from the memory to the processor and from the processor to the memory (Givone, 123). The data bus is similar to the registers located on the microprocessor but are a little bit slower to access (Givone, 123). The first 32-bit microprocessor in the microprocessor industry that will be dis- cussed is the series 32000 family and was originally built for main-frame computers. In the 32000 family all of the different microprocessors have the same 32-bit internal structure; but may have external bus values such as 8, 16, or 32 bits (Mitchell, 225). In the 32000 family the microprocessors use only 24 of the potential 32 bit addressing space, giving the microprocessor a 16 Mbyte address space (Mitchell, 225). The 32- bit registers are set up so there are six 32-bit dedicated registers and then in combina- tion there are two 16-bit dedicated registers (Mitchell, 231). Each dedicated register has its own type of specific information that it holds for processing (Mitchell, 232). The microprocessors oscillator (which now comes from an external source) runs at 2.5 MHz, but due to a ?divide-by-four prescaler? the clock frequency runs at 10MHz. There have been many new ideas put into practice to improve the 32000 series micro- processor generally and thus making it run faster and more efficient. The next family of microprocessor which was fabricated for the microcomputer is the MC68020 32-bit microprocessor which is based on the MC68000 family. The other microprocessors that are included in this family are the MC68000, MC68008, MC68010 and the MC68012 (Avtar, 302). Before going into the types of components that this microprocessor contains, it should first be know that the making of the MC68020 has been the product of 60 man-years of designing including the manufac- turing of the High-density Complementary Metal Oxide Semiconductor giving the mi- croprocessor high speed and low resistance and heat loss (Avtar, 302). Because of all the work that was put into the MC68020 and its other related microprocessors, it is an extremely complex microprocessor. The MC68020 operates in two modes, these are the user mode(for application programs) or the supervisor mode (the operating system and other special functions) (Mitchell, 155). The user and supervisor modes all have there own specific registers to operate their functions. The user programming has 17 32-bit address registers, and an 8-bit register (Mitchell, 155). Then the supervisor pro- gramming has three 32-bit, an 8-bit and two 3-bit registers for small miscellaneous functions (Mitchell, 155). All of these registers within the two modes are split up into different groups which would hold different information as usual, but this set up of registers gives the microprocessors a 20 32-bit information storing capacity. The next family of microprocessor is Intel?s 80386 and 80486 families. The 80386 and 80486 were mostly over all better then the other microprocessors being made by the different companies in the industry at this time, simply because Intel is now the leading microprocessor producer in today?s market. The 80386 was a product that evolved from Intel?s very first microprocessor, the 8-bit 8080 (Mitchell, 85). Then next came the earlier mentioned 16-bit 8086. The reason why Intel did so well in the market for microprocessors was because every microprocessor that they made was compatible with the previous and future (Mitchell, 85). This means that if a piece of software worked on the 8080 then it worked on the future microprocessors and vice-a- versa. Not only did Intel look forward but they looked back. The main difference between the 80386 and the other 32-bit microprocessors is the added feature of a bar- rel shifter (Mitchell, 88). The barrel shifter allowed information to switch places mul- tiple times in the registers within a single cycle (Mitchell, 88). The microprocessor contains 8 general purpose 32-bit registers, but with the barrel shifter that is increased to the equivalent of a 64-bit microprocessor. For the most common 20MHz 80386 microprocessor the run time for each cycle is 59 nanoseconds, but for a 33MHz mi- croprocessor the cycle time is reduced to 49 nanoseconds. The next 32-bit microprocessor in market are AT&T?s WE32100 and 32200 (Mitchell, 5). These microprocessors also needed six peripheral chips in order to run, these are termed: Memory Management Units, floating point arithmetic, Maths Accel- eration Units, Direct Memory Access Control, and Dynamic Rand Access Memory Control (Mitchell, 5). These microprocessors apart from the microprocessors all work an important part of processing the data that comes through the microprocessor. The difference from this microprocessor and the others is because the WE32200 address information over the 32-bit range with the help of a disk to work as a slow form of memory (Mitchell, 9). The WE32200 microprocessor runs at a frequency of 24MHz (Mitchell, 9). The 16-bit and 32-bit microprocessors are a mere page in the great book of processor history. There will be many new and extremely different processors in the near future. A tremendous amount of time and money have been put into the making and improving of the microprocessor. The improving and investment of billions of dollars are continually going toward the cause of elaborating the microprocessors. The evolution of the microprocessor will continue to evolve for the better until the time when a much faster and more efficient electronic device is invented. This is turn will create a whole new and powerful generation of computers. Hopefully this paper has given the reader some insight into the world of microprocessor and how much work has been put into the manufacturing of the microprocessor over the years. The Evolution of The Microprocessor November 25, 1996 Bibliography Mitchel, H.J. 32-bit Microprocessors. Boston: CRC Press. 1986,1991 Titus, Christopher A. 16-Bit Microprocessors. Indiana: Howard W. Sams & Co., Inc. 1981 Aumiaux, M. Microprocessor Systems. New York: John Wiley & Sons. 1982 Givone, Donald D.; Rosser, Robert P. Microprocessors/Microcomputers. 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