ENVISIONING MY FUTURE: COMPUTER ENGINEERING

A 2000 word essay to clarify and reinforce my career goals

Colbert, Patrick
s5270031

Contents

Intro

Computers and their systems have helped advance society into a technologically advanced time, to which we have only seen the beginning of how powerful they can become. Computer hardware and software are consistently being innovated upon within the industry, influenced by problems in the world that require technological solutions. Computer engineering, which is thought to be the backbone of the IT industry, and is the leading field within the industry, creating innovation and improvement with current and new technology. Internally, computer engineering is split up into hardware engineering and software engineering. Hardware engineering is the field that works with developing and improving computer hardware, which can include the redevelopment of silicon chip hardware, while software engineering works within the programming world of computing and is heavily focused on implementing new AI technology within cloud computing to improve effectiveness of commercial products, and to allow companies to externally access the benefits of AI. Both fields innovating on leading technology within the world, leading to be essential in any large technology company (Christopher McFadden, 2020).

Body

IT Job Industry – Computer Engineering

The information technology industry is expansive and expanding and is constantly looking for innovation that will advance technology above what is thought possible. Within the industry the computer engineers can be split up into two jobs within the IT industry, hardware engineer, and software engineer. Both careers base their work around computer hardware, but, while the hardware engineers work to build and engineer the hardware from foundation, the software engineer allows users to interact with the computer through developing software and application, working closely with data manipulation through algorithms and data structures (Ashley Eneriz, 2019). Both careers are high paying and industry leading jobs, developing hardware and software technology that becomes the norm within the industry.

Computer engineer primarily work within the manufacturing, research, and development side of IT, and requires skills to understand, and work within the backbone of computing. These skills include, like many jobs in the IT industry, technical skill with devices, as well as an understanding of programming languages, which is required for both the development of hardware and software. Furthermore, critical thinking, and problem-solving skills are a major part of computer engineering, which creates more reliable, and effective solutions to problems. Most of the time, computer engineers work in teams to develop solutions, and this requires a good communication skill to be able to convey important information to one another in the team, with either communicating progress on software projects, or to relay important hardware designs to one another, it is an

important requirement (Indeed, 2021). Hardware engineers mostly work with technology that adhere to computing technology, to design, build, and test hardware and systems, and this primarily includes interaction with, and requires good knowledge of, microprocessors, integrated circuit boards, networking systems, and other hardware components that make up a computer (O*NET, 2022). On the other hand, software engineering can be broken up into two parts, a systems developer, and an application developer, where one works on back-end software, and the other develops front end software respectively. Both groups work together to create useful and working software applications that are useful and fulfil requirements by the user (Coursera, 2022).

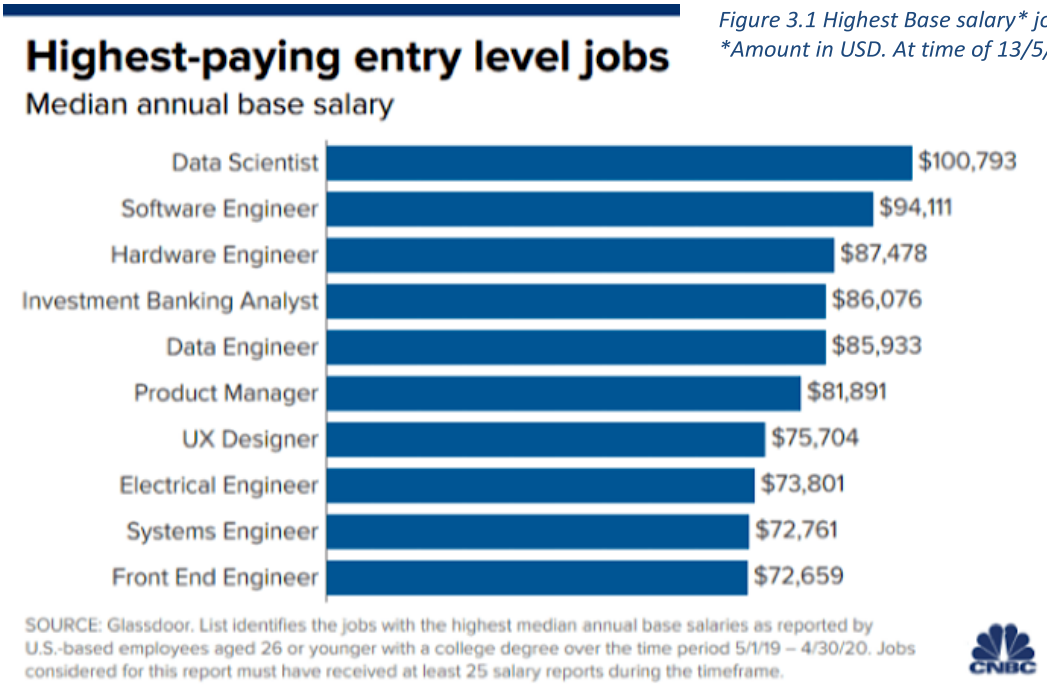


Figure 3.1 Highest Base salary jobs in the US (Glassdoor, 2020)*
**Amount in USD. At time of 13/5/21, $1 USD equals $1.45 AUSD*

The industry is heavily reliant on computer engineering, with both hardware and software engineers earning some of the highest annual base salaries in the United States and earning over $95,000 as a base rate in Australia (indeed, 2022), with demand for software engineering increasing significantly more than any other job within the industry. This is due to the increased growth in software technology, and competition between companies being a major contributor (indeed, 2021). Competition with software has always been relevant within the industry and is the reason why users can find many different applications executes the same thing, but contains different functions (Richard Harris, 2022). Unfortunately, hardware does not follow the same demand structure, as, the hardware industry is significantly more difficult to enter and requires much more investment to compete with current brands, causing job demand growth rise at a slower pace than other jobs within the industry.

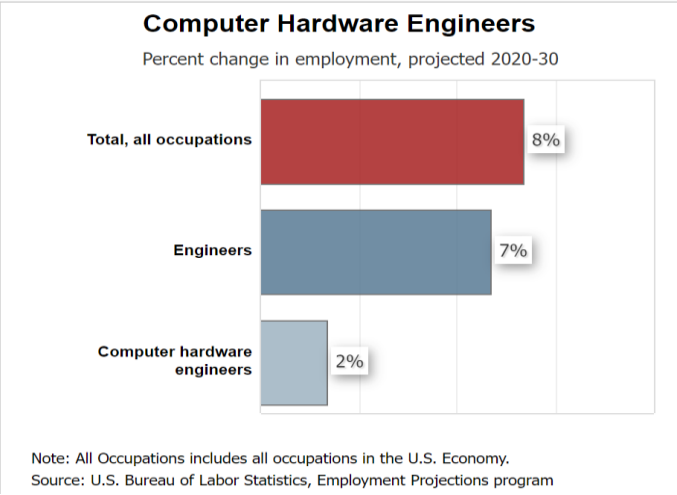


Figure 3.2 (BLS, 2020) Employment growth in general vs Engineers and Computer Hardware Engineers

Although, this could change with the new direction computing will be going, due to the end of Moore's law in silicon computing, but most certainly will never reach the industry demand of software engineers (bls, 2022).

Current and Future of Computer Engineering Technology

Computing technology is a competitive market, one that is ever evolving, and constantly improved upon through innovative designs and development methods. Current prevalent technology in the computer hardware and software industry are essentially technology that has been theorized and researched back when computers were first being introduced to the mainstream, and this can be seen with influential technology, such as silicon technology coupled with Moore's law, and cloud computing, with both technologies being realized and researched at around the 1960s (Shohini Ghose, 2020). These technologies are now extremely prevalent today, with both earning the industry billions of dollars every year, giving companies the mindset of innovation (Yahoo! Finance, 2021). Within the next decade, innovations will be realized, and new technology will begin to take over current technology, as is how the fast-moving IT industry works, creating new norms in hardware and software technology (Daphine Leprince-Ringuet, 2021).

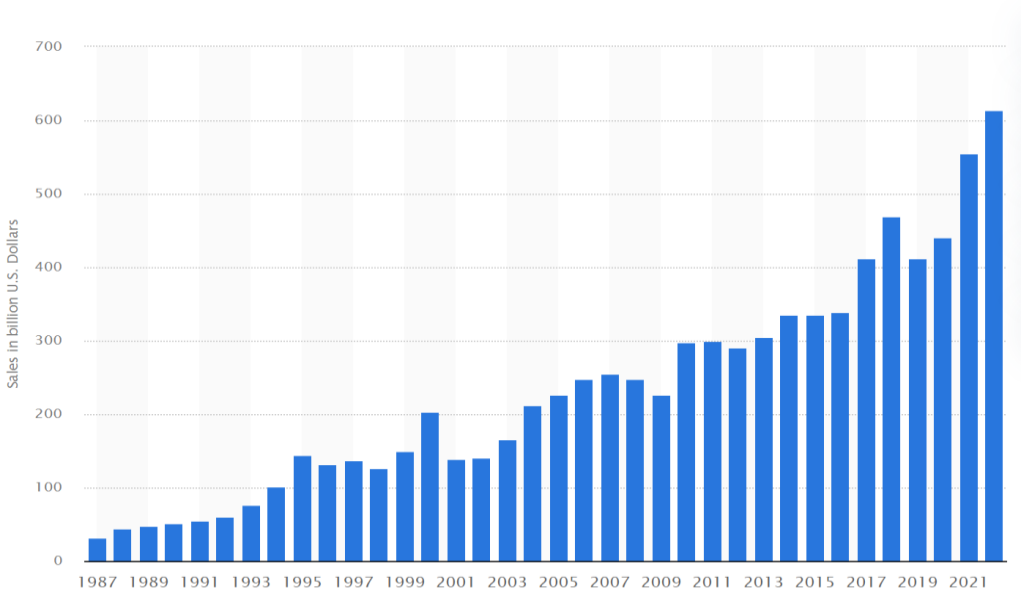
Computer Hardware Engineering with Silicon Computing

Current Technology

Since the beginning of commercial computers, silicon has been used to build computer microchips due to its low conducting resistance, and for being one of the most common elements on earth. Silicon based microchips contain billions of transistors, that are so small, that they are measured in nanometers, and each one, a switch for electrical currents, used to redirect electrical signals, and complete logical operations within a processor (ASML, 2022). Every two years, the number of transistors that can fit onto a silicon microchip doubles, and in-turn the processing power of the microchip double,

which has been consistent since the over fifty years, due to the predictions of- Moore's law. This consistent increase in power has kept computing relevant in society, every expanding the possibilities, which, in turn, has seen a consistent rise in growth within the industry's market and job demand the last thirty years, and has kept the microchip, or "semiconductors" market, at the top of the industry (Statista, 2022).

Figure 1.1 (Statista, 2022)
The market Growth of semiconductors (microchips) from 1987 to 2021. *Amount in USD*



Innovation within the semiconductors industry has been swift, with large companies delving into different branches of computing technology, with the largest brands including Intel, Nvidia, and Samsung, where their approach to use of silicon microprocessors is different form one another, but all use the current technology of 7nm transistor silicon chips (IC Insights, 2021). Intel specializes in Central Processing Units (CPU) of computers, where the microprocessor acts to control processes within a computer and execute instructions that operate the computer. Nvidia specializes in Graphical Processing Units (GPU), where the microprocessor completes algorithms within the computer to display multimedia, and output displays within a monitor. Most CPUs contain integrated GPUs but is unable to meet the same standards of dedicated GPUs that are developed by Nvidia (Jolene Dobbin, 2019). Finally, Samsung develops their own mobile phone microprocessor, that are less powerful, but are industry leading processors in the mobile phone market, using 7nm transistor architecture (Robert Triggs, 2021).

Future Technologies

Within the IT industry, there is a deadline for mid 2020s to early 2030s, forcing companies to figure out a new way to build more powerful silicon computer chips that do not require transistors to get smaller. This is primarily due to the limitations that Moore's law sets upon silicon engineering, as, the law states that every two years, transistor size will be halved. Unfortunately, due to the laws of physics, there is a limit to how small transistors can get, and this requires hardware engineers to figure out a solution to this issue. This has brought on a new technology called "3D Stacked Transistors". This technology essentially stacks silicon nanosheets, containing transistors, vertically, using

space between layers as efficiently as possible, which is estimated to allow for a 30-50% increase in transistor population within a square millimeter (James Morra, 2021). This new technology is set to become the new standard in microprocessors, as most companies are now in development of their own version of 3D microprocessors and will become the new generation of silicon processors within the industry, with a set date of 2024 for the technology to start manufacturing and will see a commercial release within the next decade.

Computer Software Engineer with Cloud Technology

Current Technology

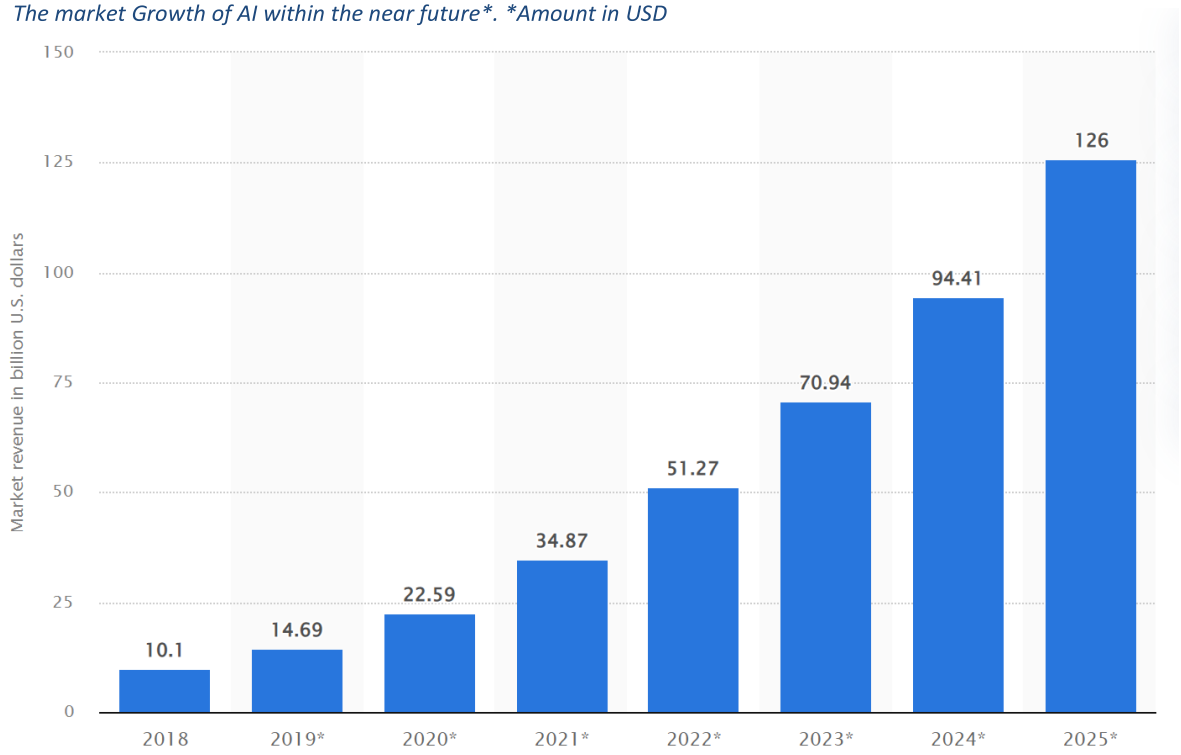
Cloud Technology computer software that allows users to access data and information from an external server, or devices. Cloud technology is commonly identified as cloud storage, due to popular services such as Microsoft's OneDrive, or Google's Google Drive, but is just a "Cloud Service", and falls under the umbrella term of Cloud Technology (The Coding Hands, 2017, medium). For the consumer, cloud technology can be split up into three categories, Software as a Service (SaaS), which is what cloud storage would fall under, and provides the customer with a software, or ready to use applications that requires no installation on the customer's part, but either requires the creation of an account, and sometimes a monthly cost to use. Common software that falls into this service can include, email services, adobe creative cloud, and social media. Infrastructure as a Service (IaaS) is a hardware subscription service, where customers can rent out physical servers that are located externally and are managed by the providers. This service is very useful for companies that either, do not have enough space, find servers too expensive, or the customer has the inability to manage a server. This service is very useful for startup business that require the use of servers to launch their product, as it is affordable and easy to use, as the provider manages the servers and provides customer service. Platform as a Service (PaaS) can be seen as a combination of the previous two. PaaS give the access to software that the user to use, but also gives access to the hardware required by the user. Both the hardware and the software acts as tools for the user, allowing them to build the service they require, rather than the restricted function created by the provider (IBM, 2021). Cloud technology has significantly influenced the industry since it was introduced, and has become the fasted growing market, with many multi-billion-dollar companies around the work using cloud technology to their advantage (Shelby Hiter, 2021).

Future Technologies

The future of cloud technology is one that is quite vague, but is one that adapts quickly to the world, and its surroundings. Due to this, it is hard to specifically understand what will be new in the future of cloud computing, and instead, it is easier to understand improvements that can occur in cloud computing (Roshna Fingnent, 2022). One improvement that is set to become mainstream soon, is AI. AI is currently a minor part of cloud computing but is set to become more relevant, with AI being implemented within

the cloud services market, to both, allow users to access and use AI remotely for commercial and business use with IaaS and PaaS. Furthermore, a commonly used method by SaaS organizations, is to use AI to learn trends in customer habits and patterns to offer better experiences and products, in hopes of increased income. Through AI improvement and innovation within these models, AI market growth is set to significantly increase within the next decade, allowing AI to become more mainstream in software technology (Devanshi Sharma, 2022, esds).

Figure 2.1 (Statista, 2022).
The market Growth of AI within the near future. *Amount in USD*



Although AI is mostly set to help the industry, there is still concern with AI, as they require significant amounts of data and information from user, which has caused privacy issues in the past, especially within the SaaS model, which has been the major concern with AI, which has significantly set back development (Joydip Kanjilal, 2021). With the right technology and procedures put into place, AI can become the future of cloud technology, and its ever-growing market growth show that AI will only become more releveling within the industry.

Conclusion

The IT industry is constantly innovating technology, and with the changing technology, the computer engineering industry will be its lead. With new and exciting technologies being developed by the largest companies in the industry, new possibilities will open, allowing new ideas, and research to shine through competition, progressing forward technology. Both AI and the silicon architecture are both industry leading example of

technology that will advance towards success and working in the fields that allow for this to happen will put people on the forefront of technological evolution. Computer engineering will be the lead into the future and following that is a great way to see the industry at its finest, and to see the future of society.

References

ASML. (Updated 2022). *The basics of microchips*. Retrieved from ASML: https://www.asml.com/en/technology/all-about-microchips/microchip-basics

Coursera. (Updated 2022, April 30). *What Does a Software Engineer Do?* Retrieved from Coursera: https://www.coursera.org/articles/software-engineer

Dobbin, J. (2019, Feburary 24). *GPU vs CPU: What Matters Most for PC Gaming?* Retrieved from HP: https://www.hp.com/us-en/shop/tech-takes/gpu-vs-cpu-for-pc-gaming#:~:text=The%20graphics%20processing%20unit%20(GPU,CPU%20to%20perform%20other%20tasks.

Eneriz, A. (2019, May 07). *Computer Science vs. Computer Engineering: What's the Difference?* Retrieved from Northeastern University: https://www.northeastern.edu/graduate/blog/computer-science-vs-computer-engineering/#:~:text=Computer%20science%20focuses%20mostly%20on,designing%20hardware%20and%20software%20interfaces

Fingent, R. (2022, April 15). *How cloud computing has changed the future of internet technology*. Retrieved from Venture Beat: https://venturebeat.com/2022/04/15/how-cloud-computing-has-changed-the-future-of-internet-technology/

Ghose, S. (2020, September 17). *Are You Ready for the Quantum Computing Revolution?* Retrieved from Harvard Business Review: https://hbr.org/2020/09/are-you-ready-for-the-quantum-computing-revolution

Harris, R. (2022, Janurary 18). *Software industry competition predictions*. Retrieved from App Developer Magazine: https://appdevelopermagazine.com/software-industry-competition-predictions/

Hiter, S. (2021, August 27). *Cloud Computing Job Market 2022*. Retrieved from Datamation: https://www.datamation.com/careers/cloud-computing-job-market/#:~:text=The%20global%20cloud%20computing%20market,according%20to%20Grand%20View%20Research

IBM Cloud Education. (2021, September 2). *IaaS versus PaaS versus SaaS*. Retrieved from IBM: https://www.ibm.com/cloud/learn/iaas-paas-saas

IC Insights. (2021, December 20). *17 Semiconductor Companies Forecast to Have >$10.0 Billion in Sales This Year*. Retrieved from IC Insights: https://www.icinsights.com/news/bulletins/17-Semiconductor-Companies-Forecast-To-Have-100-Billion-In-Sales-This-Year/

indeed. (Updated 2022). *Hardware Engineer salary in Australia*. Retrieved from indeed: https://au.indeed.com/career/hardware-engineer/salaries

McFadden, C. (2020, August 04). *The Difference Between Hardware Engineering Vs Software Engineering*. Retrieved from Interesting Engineering: https://interestingengineering.com/the-difference-between-hardware-engineering-vs-software-engineering

Morra, J. (2021, December 17). *Intel Proposes New Path for Moore's Law With 3D Stacked Transistors*. Retrieved from Electronic Designs: https://www.electronicdesign.com/technologies/embedded-revolution/article/21183706/electronic-design-intel-proposes-new-path-for-moores-law-with-3d-stacked-transistors

O*NET. (Updated 2022). *Computer Hardware Engineers*. Retrieved from O*NET: https://www.onetonline.org/link/summary/17-2061.00

Sharma, D. (2022, Feburary 9). *The Fusion of Future Technologies – AI and Cloud Computing*. Retrieved from esds: https://www.esds.co.in/blog/the-fusion-of-future-technologies-ai-and-cloud-computing/

Team, I. E. (2021, November 13). *What Does a Computer Hardware Engineer Do? (With Salary)*. Retrieved from indeed: https://au.indeed.com/career-advice/finding-a-job/what-does-computer-hardware-engineer-do

Team, I. E. (2021, Feburary 23). *Why Demand of Software Engineers is High*. Retrieved from indeed: https://www.indeed.com/career-advice/finding-a-job/demand-of-software-engineers

TheCodingHands. (2017, Feburary 25). *ABC of Cloud Computing*. Retrieved from medium: https://medium.com/@thecodinghands/abc-of-cloud-computing-c8b56ec7026b

U.S. Bureau Of Labor Statistics. (Updated 2022, April 18). *Computer Hardware Engineers*. Retrieved from U.S. Bureau Of Labor Statistics: https://www.bls.gov/ooh/architecture-and-engineering/computer-hardware-engineers.htm#tab-6