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Introduction to Information
Technology

Assignment Two

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Executive Summary

This report provides background on all the members of XVI, the tools they have used, a variety of reports, and their project. Along with this, XVI, reflect on their time together working as a team. Group XVI has recently teamed up, so all members have participated in a range of tests to determine compatibility; you will also find a brief introduction to each member of the group. Further on, you will find four reports focused on various Information Technology subjects, a report on Industry Data, as well as an interview with an IT professional. XVI has been working on a project called "Social Care Chat", the project can be accessed through a website application or mobile application. Social Care Chat allows the elderly or those with a disability, to video call and interact with their loved ones with ease. Finally, in the group reflection, the team goes through what they learned, what they found surprising throughout the process, how technology allows for effective online collaboration and individual activity. This was done to determine what went well, what didn't, and what we could do better next time.



Introduction

XVI collaborated through the use of technology to plan, allocate, and discuss different components of the tasks at hand. The group decided on four subjects to investigate and report on, such as Raspberry Pi, Cloud Services & Servers, Cyber Security, and Machine Learning. The group proceeds to interview an IT professional so they can better understand the good and bad of the IT industry, as well as obtain Industry Data. In doing all of this, XVI, were able to commence with further planning of their "Social Care Chat" project with the new learnings and understanding of the IT sector; enabling them to plan in further detail and continue to leverage off technology to achieve results more efficiently and effectively.



3. Meet the team at XVI



I'm Connor, ID s3866963, and I'm a part of XVI. I was born 25 years ago in Ryde NSW and raised all over Australia by a single mother and technology. Currently living in Merriwa NSW with my fiancée and our giant furbaby Turbo. My passions include gaming, modding anything and everything to do with my PC, playing my guitar when I remember it exists, binge-watching whatever series has caught my attention for the week, and

travelling to find yummy new vegan foods and exciting new vaporizer juice flavors. I've had a very strong interest in IT for as long as I can remember, but the main things that have motivated me into studying it have been modding my gaming consoles, from the PS1 all the way through to the Switch, coding both mine and all my friends' MySpace themes back in the day and just generally getting a PC, the openness and freedom of the PC platform just completely opened my mind after being on consoles for so long.



I'm Corbin, ID s3855159, and I'm a part of XVI. Hailing from Melbourne City and originally from Country Victoria, I now live on the sunny Mornington Peninsula. My day job is in hospitality and tourism management but I'm always pursuing a new side-hustle. I'm an enormous music lover and spend most of my free time singing and playing the guitar, reading a good book, or involving myself in social or philosophical discussions. I've been a gamer for my whole life, and I don't really remember a time when I haven't owned some sort of gaming console. My interest in IT was spurred when I took a short course in Python. Tech had always interested me but learning a small amount of code showed me that it was something I could learn and not as out-of-reach as it appeared. I'm particularly interested in artificial intelligence and the future of computing.



I'm Natalie, ID s3505918, and I'm a part of XVI. I'm 24, Italian-Australian and I was born and bred in the northern suburbs of Melbourne. I enjoy modding my PC, playing video games, learning new skills, languages, and watching RuPaul's Drag Race. Since I can remember, I've always been in love with technology, from pulling apart electronics to hacking my game consoles and everything else in between. One of my big passions is making things and I

consider myself a part of the maker community. I have taught myself to solder, 3D design, and print and I enjoy woodworking. Recently, I designed and manufactured my PCBs for a project in which I was modding a DS console to run inside an original Gameboy case. In the future, I would love to combine my love of design, making things, and technology together as a career.



I'm Oliver, ID s3861675, and I'm a part of XVI. I am 16 and was born in Australia. I enjoy playing video games, watching shows, going out with friends, and using software such as Unity to explore cool ideas. I have always enjoyed using technology whether it was creating my own retro arcades with raspberry pies or making small fun games in Unity to mess around in with friends. I have never made a game with a serious intent to either sell it or release it but I have

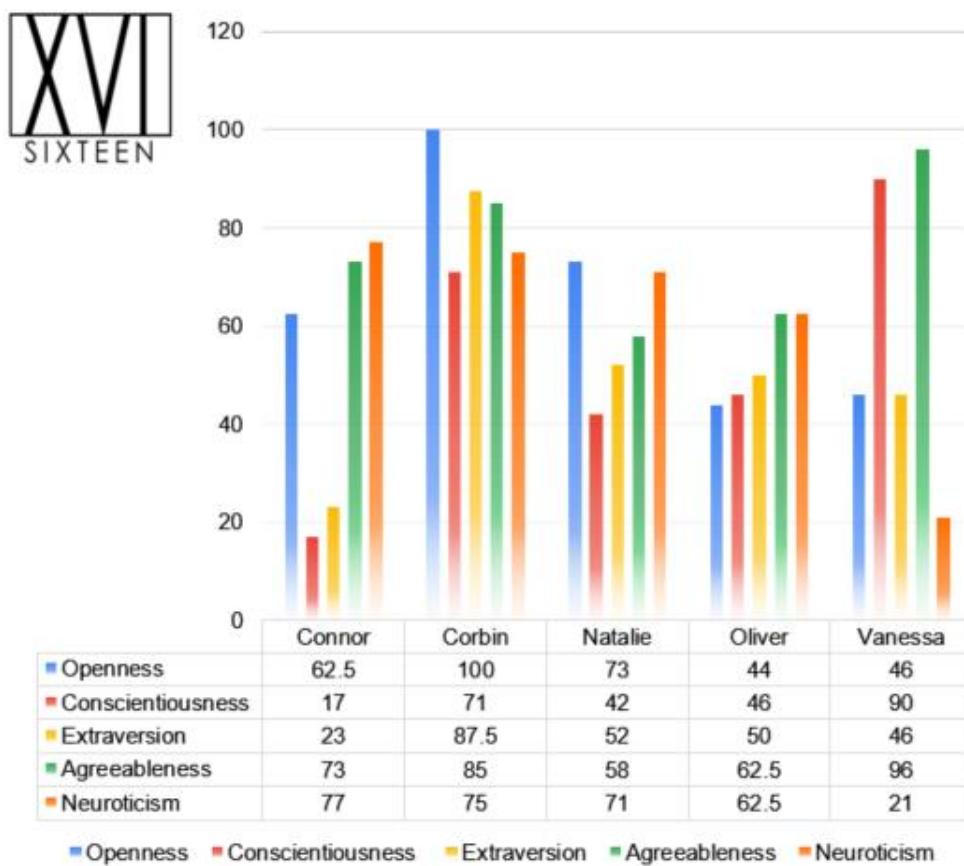
made multiple to share with friends and play together for the next week seeing who can get the highest score. IT leaves almost no limits to creativity and that's why I like it so much, I would love to get a job as a game developer in a company, but it has also been my goal to work either by myself or in a small team just having fun whether it is by YouTube or making Indie Titles.



I'm Vanessa, ID s3864452, and I'm a part of XVI. I am 28, born and raised in Australia in a cute little country town that goes by the name of Orange! I grew up dancing to rock 'n' roll music and singing Shania Twain, I'm still quite the country girl to this day but living in the suburbs of Sydney with my boyfriend, Chris, and furbaby, Layla. Snowboarding is my passion, I enjoy being outdoors but seriously love being a homebody as well. Throughout my time

working in the tech space, I have been involved in various projects that have allowed me to be a part of the changes in our product and ultimately improve the experience for the end-user. I have become very passionate about technology which is why I am looking to develop my skills and knowledge in order to pursue a career in Software Engineering.

The members of XVI participated in three tests each to determine the strengths, weaknesses, and compatibility of the group. The tests performed included The Myers-Briggs Personality Test, The Big Five Personality Test, and The Learning Style Quiz.



From the chart above, you can view the results of each individual from their Big 5 Personality Test, and from the chart below, you are looking at a combined result of The Myers-Briggs Personality Test and The Learning Style Quiz. It is evident from these tests that the members of the group are a combination of all personality traits. The group's personality type is different across the board with no same individual, as well as their learning styles with the exception of Connor and Vanessa both being reflectors.

The traits from each member complement one another and allow the group to leverage the skills and strengths of other individuals in the team. Working with a variety of personality types also allowed us to learn from each other, as the team continues to collaborate, the dynamic of the team will likely change.

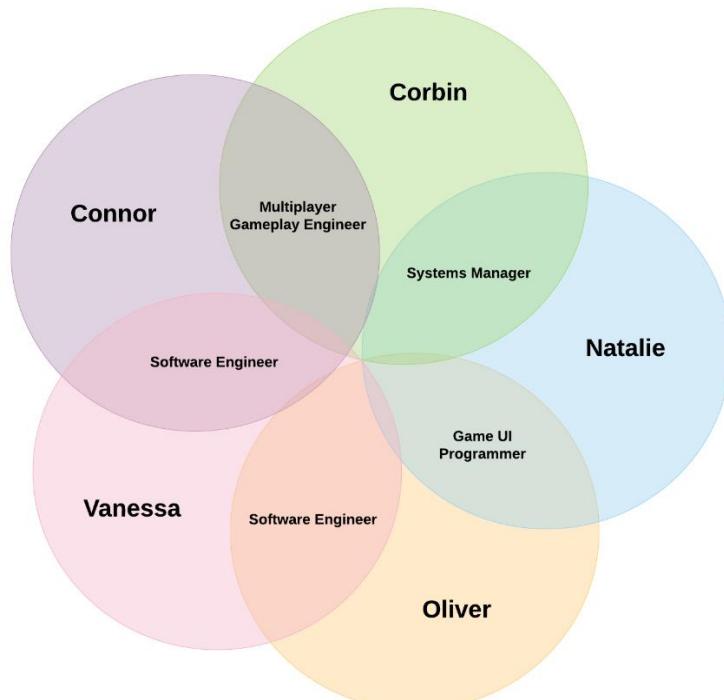




Ideal jobs for the members of XVI contain many similarities. Corbin aims to pursue a career as a System Manager, Connor and Natalie are prospecting careers in game development, and Oliver and Vanessa both seek to be Software Engineers.

The common thread between these jobs is engineering... Corbin's job as a System Manager would see him presiding over a group of System Engineers. System Engineers oversee a wide range of tasks and are usually involved in a project from start to finish. They focus on keeping a project running by monitoring software, hardware, and security systems to ensure they are up to date and running smoothly. Software Engineers, however, prioritize the development of software such as games, network control systems, operating systems, and more to facilitate the needs of the project.

One of the jobs that stands somewhat alone compared to the rest is Game UI Programmer as it incorporates design alongside code, but doesn't hold the same emphasis on the running of the core game like Connor's choice of Multiplayer Game Engineer. Game UI Programmers are more involved in the front end development of the game, focusing on the end-user experience by creating a design that is intuitive and easy to navigate. Gameplay Engineers control the back end of the game, making sure it runs the way it was intended. These two jobs would work rather closely with each other to reach final objectives.





4. Tools

Website: <https://teamxvi.tk/>

GitHub: <https://github.com/nataliecursio/XVI>

As a group, we have used a variety of tools in order to complete the tasks required. We have collaborated daily via Discord chat and caught up frequently via Discord voice chat. In doing so, this has enabled the team to engage on a personal level which then allows us to work comfortably as a team.

Initially, we used Google Sheets to collate data for our assignment, after which we transitioned over to GitHub and proceeded to commit our work to the repository using Microsoft Word. A couple of the members of the team used GitBash to push to the repository. All members of XVI contributed to the repository, whilst some may have been higher than others, we feel that everyone did their best and do not feel that anyone "slacked off".

Visual Studio Code was to create our website and Photoshop to create our logo, Lucidchart and Microsoft Excel were used to create our graphs. FreeNom.com was used to reserve the website's free .tk domain name and for DNS management.

The effort from each individual in the team has been tremendous. Throughout our journey of working in a group, we have all attempted to be transparent regarding the status of our work and held each other accountable to deadlines. We provided each other with feedback on what was done well and what could be done better.

As a group, XVI, have successfully collaborated effectively to produce excellent work to the best of their ability.



5. Industry Data

This report discusses the demand for skills, both specialised and generic, and how they compare the Australian and New Zealand employer's demands. We will also look at how the ideal jobs of the team, XVI, compare to Australian and New Zealand employer demands. We will be comparing the team's ideal jobs and skills to research done by Labour Insight Jobs (Burning Glass Technologies).

With the rise of IT specialised jobs, it's important to have the right skills necessary to be a better candidate for any job you may find ideal. Based on the findings in this report, we can see what skills we will need and how the skills we have ranked by demand from employers. We can also see how our ideal jobs are ranked by demand.

Despite being the most in-demand job within the last 12 months, Solutions Architect has not been chosen as an ideal job by any group member. The most common within the group was Software Engineer. Oliver, Vanessa, and Connor all chose Software Engineer or some branch of it. Corbin selected Systems Administrator and Natalie chose UX Designer.

Out of the top 25 jobs in demand, the highest in-demand job in our team was Systems Administrator. Systems Administrator came in at 8th on the most in-demand jobs with over 681 job openings in Australia and New Zealand. The most common ideal job within the team was a Software Engineer, which came in at 11th on the most in-demand jobs. UX Designer was 21st most demanded jobs during the research period while IT Specialist was not featured on the top 25 demanded jobs.

Generic skills are mostly similar between jobs whether it is in the IT industry or something like fast food. The most common generic skill was communication. Communication skills were featured as a generic skill across all the ideal jobs within the group. Software Engineers required both strong communication skills and the ability to work effectively with a team; they need to have excellent time management, be passionate, be logical, and able to problem-solve.

UX Designers also need to have strong communication skills, curiosity, and empathy which allows UX Designers to create products that appeal to the customers' needs. UX Designers need research skills to help improve their appeal to the consumers to create more attention to their product.

Systems Administrators need to feature the ability to work great under pressure, have good attention to detail, and strong team working skills. Organisation and time management skills are..



..essential in most IT jobs but are needed especially here as well as good leadership.

Specialised skills are a big factor in the IT industry. The required skills can create easy entry-level jobs but also creates jobs only available to the best of the best, creating a massive but hard to get into the industry. It can take decades to get to a high position in the IT world as many jobs require years of experience in big companies.

Software Engineering is a broad title... Many companies hire different engineers who have different skills. Software Engineers are required to have extensive knowledge in usually multiple coding languages to appeal to more employers. C++ or similar languages is one of the common skills looked for in Software Engineers, but other languages also include HTML, PHP, Java, JavaScript, Perl and Python.

UX Designers need to possess strong C/C++ Programming skills, and Object-Oriented design skills. UX Designers also need to feature a good understanding of common UI design patterns such as MVC and MVVM.

Systems Administrators need to feature strong technical skills as well as analytical and problem-solving skills. System Administrators should also have Networking Skills, the ability to make and keep contacts is vital for a system admin. Tertiary qualification in Information Technology or Engineering discipline is desirable.

The most prominent generic skill must be communication skills. Out of over 120,000 job listings, communication skills were the most common declared skill with almost 45,000 of the job listings including it in the skills; since all the ideal jobs featured this skill, it shows a high demand for it. Another common skill listed in our Ideal jobs was problem-solving which plays a big role in almost all the ideal jobs, problem-solving is the 2nd most desired skill as many IT-related jobs are just problem-solving. IT companies are solving problems using the technology available to them and creating their own technology and software to solve problems you may have not known even existed.

Teamwork/collaboration is an important skill, Software Engineers are often working in teams both small to large to create world-changing applications. Teamwork is the combined action of a group, especially when effective and efficient. This can be useful as being able to co-operate with your team means work is done well and efficiently.

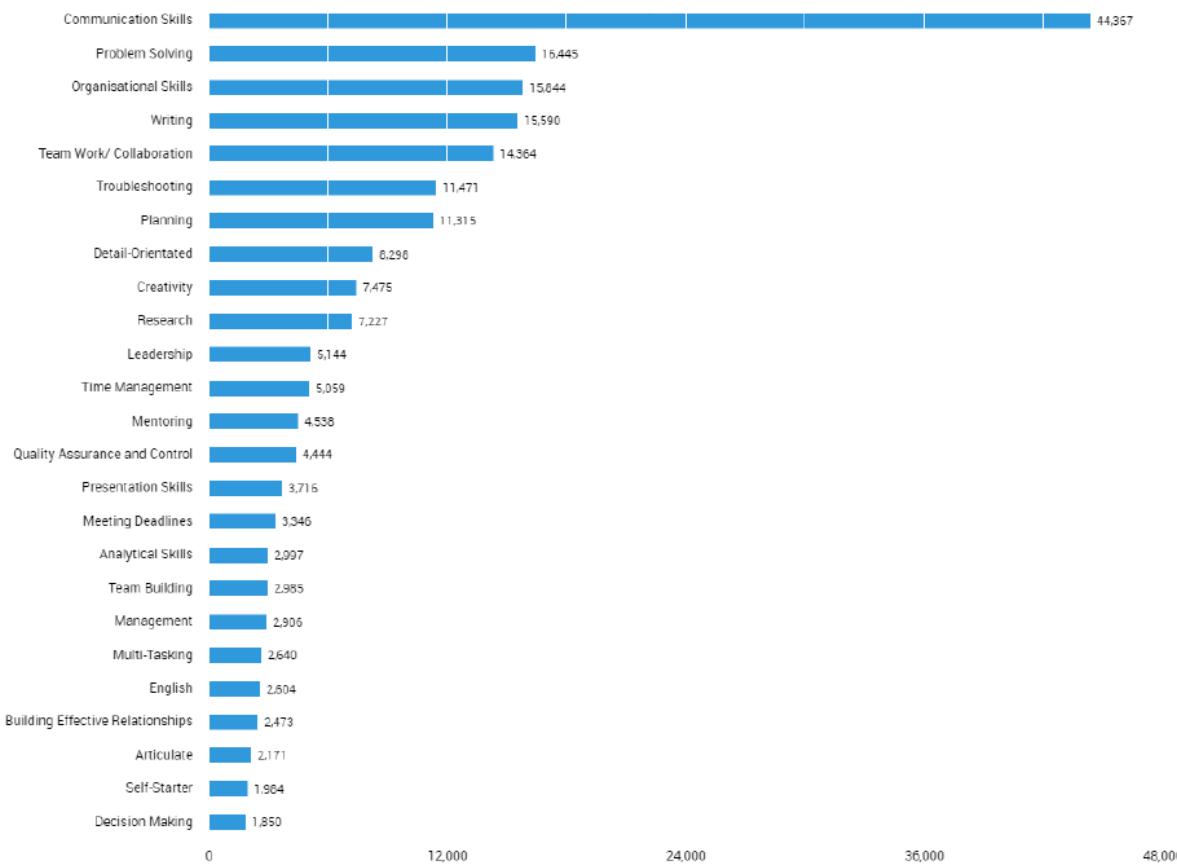


UX Designers need to be creative, this allows them to create new original designs the appeal to the consumers, this can and will set the company apart from others giving another reason to use their product over others, and this creates a high demand for this skill at 9th place out of the top 25 skills. Leadership skills are 11th on the most demanded skills and are required in a lot of jobs to gain promotions or high-level employment.

Systems Administrators will find that leadership skills would be a great bonus on their resume to gain employment. Troubleshooting is a skill that would help any ideal job as it allows people to find and maybe solve most issues they may encounter. This skill is number 6 out of the top 25 making it a skill that would create more demand for you to any employer.

Active Selections

Last 12 months AND Australia OR New Zealand AND (BGTOCC Family : Information Technology)





The most popular specialised skill seen within the group is JavaScript, used by a lot of companies, it creates a high demand for its uses. Software Engineers can and should learn JavaScript as it is most used within web pages to create a dynamic and interactive experience for users on said web pages. Every company wants a website, and that means almost every company wants someone who knows how to use JavaScript to create a unique experience for its customers when going to that company's front page. JavaScript is the 2nd most demanded specialised skill making it a must-know for a lot of Software Engineers. JAVA is another popular skill desired by companies, coming in at the 3rd most popular specialised skill. JAVA is most popular due to its platform independence; this means that Java programs can run on many different types of computers.

Being able to create programs that can run on almost any machine creates an extremely open market to their consumers as they can be sure it will be able to run on their machines. A skill common in both UX Designers and Software Engineers is Microsoft C#, this language is common and like many other languages.

The video game industry is extremely large and is only getting bigger, C# being one of the most popular video game coding languages it is a must-know for any Software Engineers looking to get into the video game industry. C# is at 12th out of the 25 most demanded skills and will increase along with the gaming industry. Project management is the 5th most demanded specialised skill, being a skill with such a large demand it creates many opportunities for employment as a Systems Administrator.

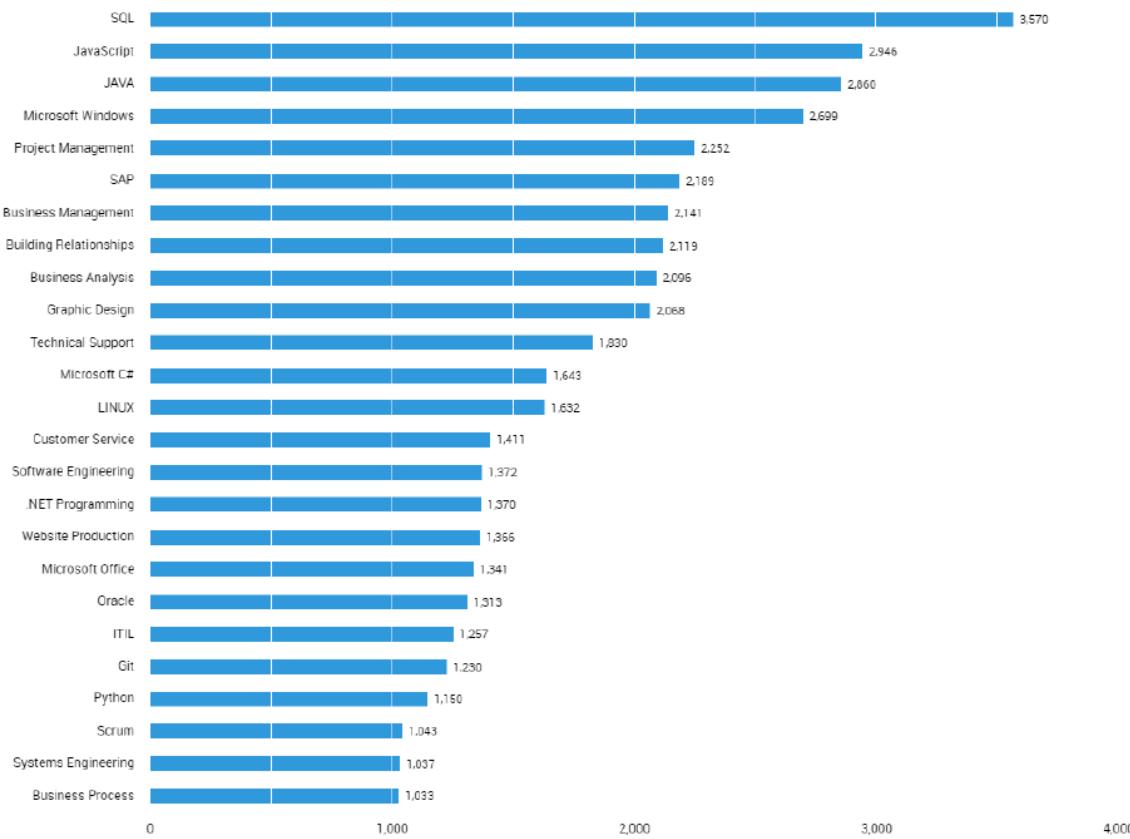
A lot of generic skills are ideal to almost any employer, the ability to almost do anything of these would be useful in many situations and create more demand for your skillset, but some of the top skills not mentioned in the current ideal jobs skillsets were writing, mentoring and presentation skills. Mentoring is less of a demanded skillset in there ideal jobs as employers are usually looking for employees with the skillset ready, this way it can be cheaper and faster to create projects as you don't have to train or pay someone to train/mentor an employee.

Writing skills are not as required by employees such as a software engineer, as they are more required to code and create software rather than write reports and analyse data. This is the same as presentation skills, this is not required by employers as they do not need their employees hired to create for them to suggest or repeat there or their customer's ideas. SQL is the most demanded specialised skill by employers, despite this none of the previous ideal jobs require this a skill. SQL is a language mostly related the creating and analysing databases related to websites, apps and games. Every company wants a website and almost every website needs a database. This creates a high demand for SQL proficient employees.

Microsoft Windows is a skill that almost everyone should know, and although it is listed highly in the top 25 at number 4, no job listings or employees have stated Microsoft Windows in their skillset for Software Engineers, UX Designers or System Administrators. Microsoft Windows skills would allow an employee to navigate the operating system at higher speeds due to the common knowledge of binds such as "Windows Key + E" to open Windows Explorer. An employee skilled in Microsoft Windows would know binds for almost every action increasing the work speeds by a drastic amount. I believe employers just expect many potential employees to already have some knowledge of the OS. Business management is the 7th most demanded skill by employers however, the ideal jobs listed by the group are not associated with running a business or assisting with monitoring an organisation.

Active Selections

Last 90 days AND Australia OR New Zealand AND (BGTOCC Family : Information Technology)





So now that we understand more about industry data and what our ideal jobs require, let's take a look at what each member of XVI thought regarding their choice of career.

Connor: Looking at the Burning Glass Technologies data, I conclude that a multiplayer gameplay engineer would fit somewhere between a Software Engineer and a Network Engineer. With Software Engineer being at the top of the occupation list and 11th on the titles list, and Network Engineer being 15th and 9th respectively, I believe that this job is still ideal to me to achieve as both fields seem highly sort after. I will of course need a lot of experience in both fields and the technologies that they use, but the skills that I learn between both fields will be applicable to either side.

Corbin: Through review of the Burning Glass Technologies data, it reaffirms my confidence in becoming a Systems Manager, albeit the nature of the system is now quite different, and I have a better understanding of what is required to get there. Originally, I focused on becoming a System's Engineer and, through experience and merit, a Systems Manager. The Burning Glass data shows a reasonable requirement for System's Engineer's and Software Engineers in the industry which highlight the potential to move into a position with relative ease, as opposed to other jobs. Also, after doing research by proxy on the current nature of "system's" I would like to move into a cloud-like system rather than a local one used by a company; like a data warehouse or a company that offers PaaS software.

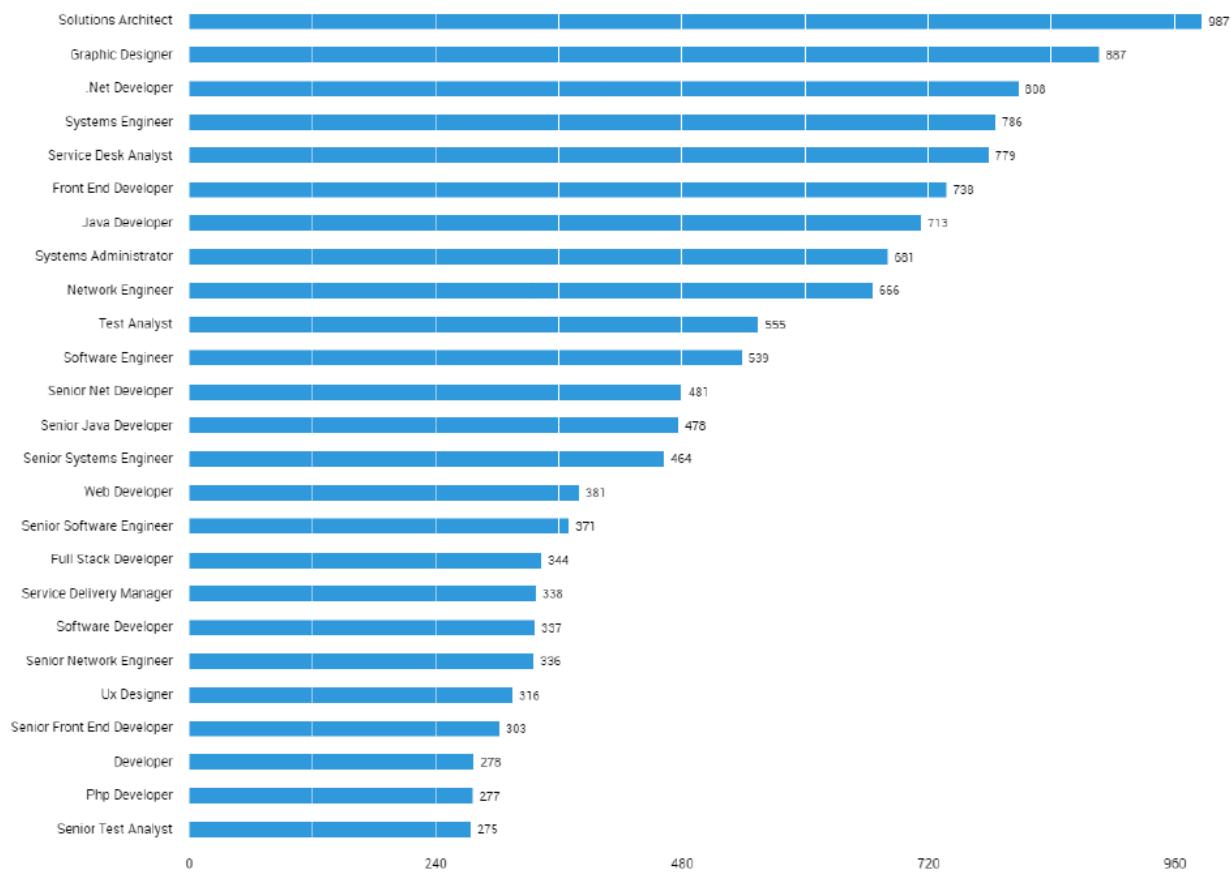
Natalie: After analysing the Burning Glass Technologies data, it is clear to me that the job of a UI Game Programmer is quite a niche title in the IT world. UX designer (user experience) is the only similar alternative, and is ranked in the bottom five job titles. This has made me evaluate what draws me to the job in order to branch out into other titles. One of the key things that attracts me to it is design, and seeing that graphic design and creativity are still highly sought-after skills, I think I would there would be opportunities in other fields that combine design and code skills.

Oliver: My ideal job has not changed after reading the Burning Glass Technologies data. My goal is to be a Game Developer/Software Engineer. After seeing the data I have noticed that a lot of the higher up skill sets are related to skills I believe a software engineer should have and a skills that employers are looking for, leading me to believe following my career choice could create amazing opportunities in the future. Therefore, I am not changing my ideal job and do not believe it is changing any time soon.

Vanessa: Upon review of the Burning Glass Technologies data and seeing that Software Engineers are ranked 11th for top titles reassures me that my career path is one that is needed as it sits close to the top 10. Software Engineers must be effective communicators as well as being highly organized. I believe that my current soft skills align with my choice in career however, my hard skills are currently lacking and require a lot of learning and further development.

Active Selections

Last 365 days AND Australia OR New Zealand AND (BGTOCC Family : Information Technology)





6. Interview with an IT professional

I had the pleasure of interviewing, Grant, a Senior Solutions Engineer. Grant and I caught up through the use of Zoom so we could have a comprehensive conversation that would allow me to learn from him about his role, what his day-to-day job looks like and the challenges he faces, in not only his role, but the IT sector in general.

Can you tell me about the industry you work in?

I work in the accounting industry, making one of the most popular cloud accounting products for small businesses.

What does the job of a Senior Solutions Engineer look like?

I perform customer research and get involved in the design of solutions and their implementation. I also regularly present to clients and produce materials to help educate them on emerging technologies, industry trends and how our company is working with these to stay at the forefront in our industry.

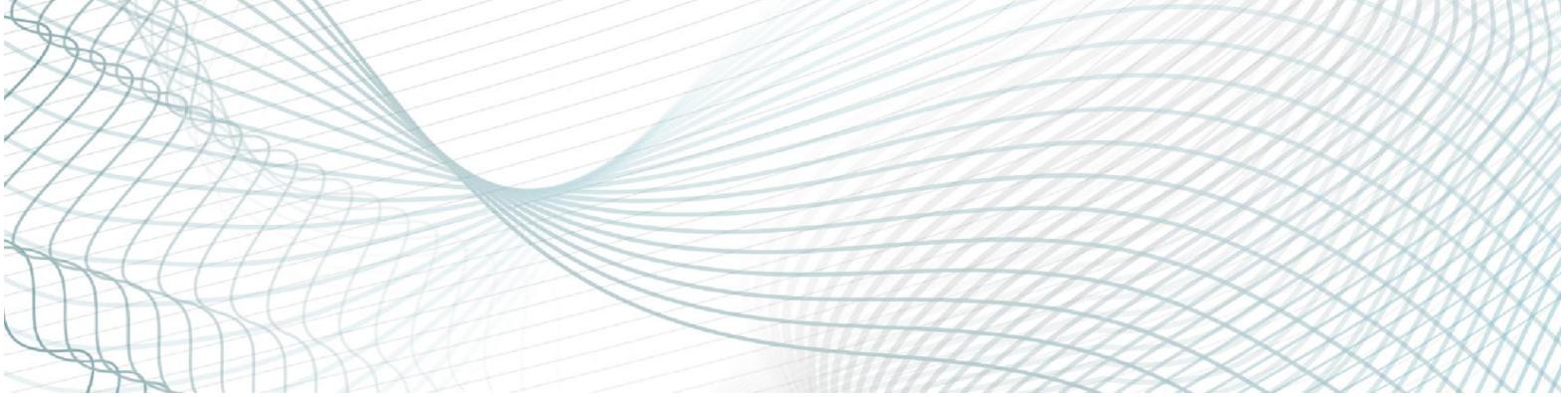
“Collaborating with other IT professionals is essential to working efficiently”

What other kinds of work do you have to do?

Part of my job is customer-facing. I regularly work with clients to understand their needs better and develop solutions to help make them more efficient at their day to day jobs. I also represent the business at events, speaking about technology and the trends that are impacting the accounting industry. I also get involved in projects that are not IT-centric, such as the development of training materials.

What aspects of your work do you spend the most time on?

Currently, I am working mostly in project and development work. This involves meeting with customers, understanding their needs and then making decisions around product directions. From there I work with a team to implement changes and deploy them back to customers in the shortest timeframe possible.



So where would you spend most of your time whilst working on projects?

It depends on what phase of a project I am in. In the planning phases, I spend the most time interviewing clients and consolidating research. When it comes to implementing a solution, I will spend a lot of time alone programming with regular short meetings with other engineers. I also interact with my colleagues (predominantly software engineers, but also designers, product managers, sales managers, and others) to collaborate on solutions.

"This really exemplifies how IT has transformed not just rapidly, but also in a direction from a more isolated role to a role that requires much more collaboration and teamwork"

Do you interact with other IT professionals?

Collaborating with other IT professionals is essential to working efficiently. Many times in software development you will encounter hard to solve problems that can take you many days to solve, but if you know someone who has solved a similar problem they can save you a great deal of time. I also get involved in development projects that have multiple engineers working on them and I need to collaborate with the others closely (meeting at least once per day) to make sure we are not wasting our time working on the same things.

What do your interactions with clients look like?

I deal with clients regularly for research purposes. I spend a lot of time interacting with clients to understand their needs and capture their feedback on newly developed features. I have also been involved in the sales process for some clients and provided technical demonstrations of our product. I also sometimes get involved in customer service issues when there is a technical problem concerning something closely related to projects I have been involved in.

What aspect of IT do you think is most challenging?

Keeping up to speed on the latest technologies has become more difficult as my career has progressed. There are a lot more frameworks available now and while they provide great efficiencies, they require a big commitment to learn. The pace of change has become so fast that it is very difficult to stay on top of everything new.

*"The one thing that is really important is to never stop learning
- it's important to stay up to date"*

Which aspects of your work as a Solutions Engineer do you find most challenging?

I have never liked dealing with office politics and this has always been a burden to me. In IT, many people are logically minded and the best ideas tend to win more often than they do in other parts of the business. When other stakeholders involved in decision making, they may want to make decisions without having a deep technical understanding of the problem or any proposed solutions. Part of my job is to work with these people so that they are better informed on such aspects and less inclined to make decisions based purely off personal biases or a desire to gain political favour with others. Unfortunately, I'm not always successful!

Can you share an example of the work you do that best captures the essence of the IT industry?

One feature I developed recently really highlighted the ways that working in the IT industry have changed so much in just the past 10 years. I created an export functionality. Ten years ago this would have involved me working primarily by myself - I would have made code changes to a monolithic code structure and they would have gone into the next release cycle, which may have been once every 3-12 months. Today, a large web product is usually written in a containerised fashion, so I had to find an existing plugin where I could have my code hosted. Once I discovered a suitable plugin, I had to pitch my work to the team that owned it to make sure they were happy for me to extend their work to include my new functionality.

Once I started building the code, I was able to get new releases out every two weeks, so I could start testing changes with beta testers and get feedback very rapidly. None of this would have been possible if we didn't have a large team that oversaw our deployments and infrastructure using Kubernetes services. This really exemplifies how IT has transformed not just rapidly, but also in a direction from a more isolated role to a role that requires much more collaboration and teamwork.

"The pace of change has become so fast that it is very difficult to stay on top of everything new"

Do you have any advice for graduates?

There are so many opportunities in IT. I was worried early in my career that I was tiring of it, but it is so easy to pivot and get involved in different areas. The one thing that is really important is to never stop learning - it's important to stay up to date, so if you find you're not passionate enough about something you're working on, see how you can pivot to be learning about things that do interest you.





As a Senior Solutions Engineer, Grants, days are ever-changing dependent on the project being worked on, as well as other requirements throughout the business. Grant has the advantage of working directly with the end-user to understand what's working and what's not working. Grant's role is essential to the business as he works to improve the overall experience and effectiveness of the software based on the research obtained from clients.

Throughout the interview with Grant, it became apparent that the progression of the IT sector impacts all IT professionals significantly and that it is of utmost importance to continuously stay up to date with current trends and to never stop learning.

I found this interview to be enlightening and invaluable. I am very passionate about customer service and technology, and by combining the two and creating a role that works on both aspects motivates me to study hard and learn quickly as this is what I want to do. I want to work to improve the end-user experience and improve overall efficiencies. I am excited to be working in the tech space and pursuing a career in IT.

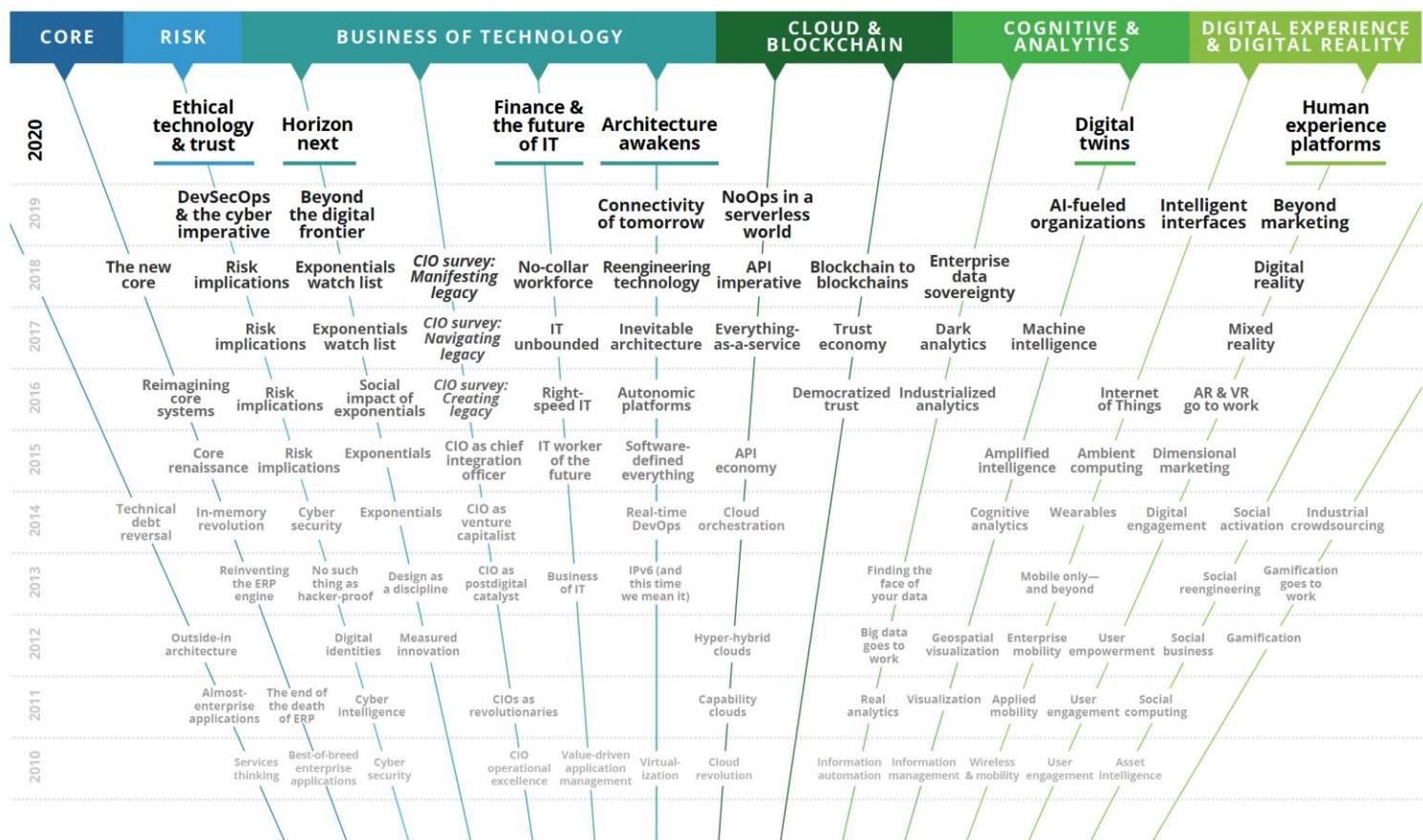
In saying this, there were a few things Grant brought up that weren't necessarily unknown but still a surprise or a simple reminder... for example; the investment an individual needs to make to keep up to date with the latest trends in technologies. Many career choices require Continuing Professional Development (CPD) hours and whilst it may not be a requirement for the IT sector, we essentially need to take this upon ourselves to ensure we continue to grow in our roles, otherwise, we may fall behind and eventually lose track.

Another point that stood out to me was the office politics and the work that needs to be done to ensure decisions are informed and educated... I also really like the idea of being able to pivot in my career and take on new responsibilities and/or challenges, I guess this comes back to continued learning and finding areas of the IT sector that you're interested in.

Overall, this interview with Grant has provided me with a lot to think about but most importantly, it's a big motivator! I am grateful for the opportunity to interview Grant during the busiest time of year for his workplace.

11 years of research of Tech Trends prepared by **Deloitte**.
(Deloitte Insights. 2020.)

"Deloitte's 11th annual Tech Trends report provides insights and inspiration you will need for the digital journey ahead. Several of this year's trends are responses to persistent IT challenges. Others represent technology-specific dimensions of larger enterprise opportunities. All are poised to drive significant change and transform business in unpredictable ways."





7. Information Technology Reports

The IT industry is large and there are many fascinating developments that continue influence the way we live and how the world works. Such developments that have already impacted the world we live in include smartphones, the Internet, as well as Artificial Intelligence and Robotics.

The following reports discuss development in technologies that currently impact us and will continue to have a place of importance in the world we live.

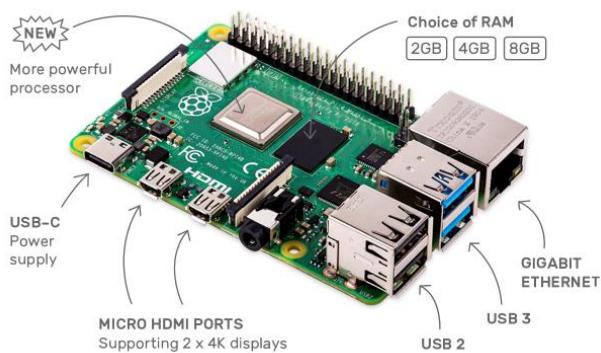
Reports to follow:

- Raspberry Pi and Arduino
- Cyber Security
- Cloud Services and Servers
- Machine Learning

7.1 Raspberry Pi and Arduino

Raspberry Pi and Arduino dominate the maker scene. Their low cost and ease of access have sped up a wide range of projects worldwide, making them accessible regardless of location, allowing for true world-class innovation. It is easy to get confused and group the two purely from a visual standpoint -but they are very different.

A Raspberry Pi is a single-board computer developed by the Raspberry Pi Foundation in the United Kingdom in 2012. Originally, the board was developed as a way to make computer development and education a lot more accessible through its low cost. Being the first of its kind, it evolved to be a lot more. A user only needs a mouse, keyboard and screen to emulate a traditional desktop experience. With its size being a little bit bigger than a credit card, it has found its way into a lot of projects, both professional and hobbyist. Raspberry Pi runs on Linux, a free and open-source desktop operating system. There is also an even smaller iteration of the board named Raspberry Pi Zero that is about half the size and can be bought in Australia for under \$20. The board is also upgraded every few years, keeping it competitive with the latest specifications.



The Raspberry Pi 4 (pictured on the left - *Raspberry Pi, 2020*), released in 2019 features an upgraded processor, USB C, dual 4K monitor support and up to 8GB of ram. Something that makes the Raspberry Pi so desirable, other than its price and size, is the ease of access to the computer's input/output ports (I/O). The board has two lines of header pins, called GPIO pins (general purpose input/output ports). These pins allow for development and experimentation 'through coding and programming. Arduino, roughly the same size as a Raspberry Pi, has a very different use case. Whereas the Raspberry Pi runs as a

small low-cost desktop alternative, Arduino does not. Arduino is a single-board microcontroller that is completely open-source which has allowed for its many iterations.

With a selection of inputs and outputs, an Arduino board allows the user to write code via the Arduino software to complete a range of tasks. The board has become an invaluable part of the expanding Internet of Things (IoT), letting users connect and automate a wide range of monotonous tasks for convenience and accessibility.



The future progression of wireless technology such as 5G, alongside developing countries such as India, becoming more online will allow for even more devices connected to the IoT. This will push the rapid adoption of the Raspberry Pi and Arduino, expanding the use case beyond what we can currently imagine.

In 1965 Gordon E. Moore, the co-founder of Intel, famously made a statement that today is referred to as Moore's Law. The statement by Moore was "the number of transistors on a microchip doubles every two years, though the cost of computers is halved" (*Moore's Law Explained 2020, para 1*). This means that these devices, as well as all devices, will only get more efficient as time progresses. However, experts predict that this Law will no longer be applicable in 2025. That allows for five more years of rapid development in the specifications and applications of single-board devices like Raspberry Pi and Arduino.

The impact both boards will make on the world differs, although both leading to mostly positive results for humanity. As the Raspberry Pi is inexpensive in comparison to competitors of similar specifications, it serves as an entry point for people who couldn't afford a computer. A recent example of this: the device saw an uptake in demand as a cheap, computer alternative to work and study at home due to COVID-19. "The number of unique IP addresses accessing the Raspbian Raspberry Pi OS's mirror system passed 90,000 on several days in March, up from a peak of around 58,000 in March 2019" (*Tung 2020, para 3*).



COVID-19 also created a lot of obstacles in the modern healthcare system following the limited supply of devices like ventilators. In Colombia, medical technicians have started testing an open-source design from robotics engineer Marco Mascorro. Mascorro shared the code and components on code-sharing site GitHub. The design includes a Raspberry Pi and an Arduino (pictured on the left - *Arduino, 2020*), both easy to source, "the Colombian team said the design was important for their South American country because parts for traditional models could be hard to obtain." (*Raspberry Pi ventilator to be tested in Colombia 2020, para 7*)

Overwhelmingly, Raspberry Pi and Arduino are set to benefit people in lower-income, developing countries as well as the online open-source community. Rather than big companies holding the market share on, for example, ventilators as mentioned above, individuals can research online to make their own devices.

This will also break down the Apple and Google ecosystem, through education people will be a lot more competent with technology and can find solutions to their problems leading to a shift in the sector. I am an avid user of Raspberry Pi and Arduino personally, owning multiple variations of both boards.

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My use and development of projects with the two have taught me a lot about the back end of technology, electronics theory and manufacturing. A Raspberry Pi led to the development of my own game console, and Arduino led to the development of a home-built desktop-sized computer numerical control mill. I assume they would have the same impact on other people who use them. The development of computer-controlled devices being accessible to almost anyone on the planet and beyond (a Raspberry Pi was sent to space).

As mentioned earlier, the Raspberry Pi was originally developed as a way to teach people, especially young school children, how to use and manipulate technology. As each generation begins schooling, the devices (including Arduino), will only be faster and more powerful, expanding each group's knowledge and understanding of these technologies. Currently, most people have very tech-illiterate parents, some who even struggle to understand how to use the World Wide Web and require assistance from their children. Perhaps the next generation of kids will be helping their parents understand quantum computing. Overall, Raspberry Pi and Arduino's continued evolution will only make everything so much more connected, leading to all of us relying on connected systems and technology even more than we do today.



7.2 Cloud Services and Servers

Cloud computing is a relatively new term on most people's lips, but it is something that has been around for a long time now. According to [educba.com EDUCBA](https://www.educba.com/cloud-computing/) (2020), the earliest form of cloud computing dates all the way back to 1963 when J.C.R Licklider, an American Psychologist and Computer Scientist, created a computer system that allowed three users to all operate on the same, local, computer that ran on magnetic tape. Licklider would go on to create an early precursor to the internet, called ARPAnet, in 1969.

Since then cloud computing, and computing in general, have come a very long way. Where it was once only possible for three users to operate locally on a primitive computer using magnetic tape and pulleys, we can now easily maintain online networks of hundreds-of-thousands of users, all sharing their own personal data, at millions of gigabytes per minute. It is expected that by 2025 the internet will exceed 163 zettabytes in size (Nicole Martin 2019, para 9). That's the equivalent of 151.7 trillion, studio length, television quality, 1GB movies.

The size of the Cloud is massive, and it affords us so much utility, but how does it work? HCL tech summarises nicely on their website ([hcltech.com n.d, para 1](https://hcltech.com/what-is-cloud-computing/)) - "Cloud-computing is an application-based software infrastructure that stores data on remote servers which can be accessed through the internet." It gives internet users access to systems, applications, services and storage that they would normally have to pay to license or develop themselves. This is especially useful when you need to upgrade your storage but don't want to commit to a large initial cost; you can buy data from a data pool like Google Cloud or Microsoft Azure. Or as a company you can't afford the hefty costs of a local server network; you can use a collaboration service like Dropbox or Slack. Or as a fledgling business you can't afford to buy a full Microsoft Office Suite for all of your staff; you can use Microsoft Office Online for free!

With the rapid expansion and commercialisation of the internet, society has been impelled to revolutionise and improve on how we manage ourselves online. Data storage, security, flexible scalability, technical support and social and environmental impacts are all topics that are important to consider when contemplating how we manage the internet, our data and how we move forward. Cloud computing offers a solution so effective; it's already becoming our primary solution worldwide. In fact, unless specifically designed not to, almost all current data is in contact with the Cloud - in some form or another.

Traditionally, data storage has always been done locally. Though there are a few upstream data-storage services that have been around for a long time, like data storage on a website, the status-quo has been to store your own files on your own hard-drive, external drive, or local network. Similarly, if you interacted with a website online, or downloaded a file, it would come from, or be stored on, the other party's local storage in a peer-to-peer format.



There are clear benefits to storing your data this way. You, the user, know exactly where your data is stored and who has access to it, own your own equipment outright without risking future expenses, have control over the equipment used - you can fit your needs and can have confidence in the backup procedure in case of data loss.

With huge advancements made in cloud technology, and the ever-increasing requirement to revolutionise our data storage methods in-way for more flexible options, cloud computing is becoming more diverse than ever. Cloud-companies now offer a huge array of online services designed to give the user better control, with less of the initial cost.

Services are online based, customer facing solutions leveraging cloud software and are used in innumerable different functions. They come in three main forms; Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service.

Here is a brief explanation on the three:

- **Infrastructure-as-a-Service:** Refers to a physical, data-storage or hosting facility or enterprise. IaaS is mainly used as a data cloud storage solution because it affords customers flexible scalability options, thorough backing up and redundancy and unparalleled security, all without having to buy their own equipment or pay for maintenance and management of their local network. Examples of IaaS are data warehouses/lakes like the Microsoft Data Centre in Iowa, USA.
- **Platform-as-a-Service:** This is when a company establishes a platform, or suite, in which a user can develop, test and launch their own apps, without having to manage data storage or fluctuations in data requirements. Often, they are developed with built-in SaaS functionality. Although Microsoft Azure is based on IaaS architecture it also offers a PaaS to develop, launch and manage web and mobile apps among other things.
- **Software-as-a-Service:** Also known as web-based software, hosted software and on-demand software (Josh Fechter 2020, para 1), SaaS refers to when a company offers a user-facing software that is centralized by the company and has limited usability. Cloud-Based Microsoft Office Online is an example of SaaS. It allows users to create, edit, share and collaborate on a host of Office 365 applications, purely online, for free.

There are many other types of services like Security-as-a-Service, Machine-Learning-as-a-Service and Data-as-a-Service, but all are speculative and haven't achieved notoriety like the three previously listed.



Even though the Cloud is already such a prolific aspect of the internet, its growth is only expected to increase with the global public cloud computing market set to exceed \$620 billion US by 2023 and upwards of 90% of companies already existing on the cloud(Hosting Tribunal 2020, para 4 & para 10). As you can imagine, there are many different iterations of cloud computing.

The primary examples of cloud computing are:

- **The Internet** - the first and most notable form of cloud computing – a system that allows users to share data between devices over long distances using the Internet Protocol.
 - **Social Networking** - is currently the most popular form of cloud computing if you don't include the internet. Huge amounts of data are stored and shared between users, in real-time, constantly. Examples are Facebook, Instagram and Tik Tok.
 - **Streaming Services** - such as Netflix, YouTube, Apple Music, Soundcloud and Twitch. These SaaS companies allow users to manage and store their own data and preferences, but only through access to the front-end of the application.
 - **Chatbots** - involve machine learning programs that leverage large cloud-based databases to interact with humans usually in-regards-to customer service queries or technical support. You can find a chatbot on most good quality websites.
 - **Communication** - SaaS applications like Skype, Microsoft Teams and WhatsApp that enable groups of people to communicate at the same time using video or sound, sometimes with built-in PaaS functions.
 - **Productivity/Collaboration** - applications like Google Docs or Slack that users can use to organise groups of people in a professional capacity. Specifically focuses on productivity in a vocational or educational setting.
 - **Storage/Recovery** - facilities that offer IaaS solutions to their customers – data centres in particular. Data centres are large facilities whose sole purpose is to offer data storage solutions on a large scale with the highest possible security, back up/redundancy and flexibility. An example of a data centre is the Equinix Data Centre in Sydney.
 - **App Development** - PaaS or suites that allow development, management and deployment of web and mobile applications. Examples include Microsoft Azure, Amazon Web Services and Google App Engine.
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- **Application Development Testing** - clouds like mobile app testing clouds that are used to test new applications on a variety of devices in life-like situations. Amazon Web Services comes with a Device Farm for testing alongside development.
 - **Cloud Analytics** - a term describing big businesses using cloud computing to perform market analytics on massive amounts of customer data from pre-structured data warehouses like Google BigQuery.
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Cloud computing may have started as a complex system of mechanics in a college laboratory almost sixty years ago, but its progress has come far. There is no shortage of choice in the way of safely storing our personal data, and there are more software development options than ever before. But is there a cost to such a boon? And where are the nay-sayers, if there are any? Well, certainly in some ways there is an impending need to be concerned about the future of the Cloud and what it implies for our privacy and security.

The nature of the Cloud is its interconnectedness, this is also its greatest downfall. Because the Cloud is a collection of many devices, if someone were to upload malware or gain access to one device, they have the potential to affect a vast network of people and the damage can have massive, worldwide consequences. In 2016 it was expected that data centre outages were caused by cyber-attack 22% of the time, up from 18% in 2010 (João Marques Lima 2017, para 12). In 2014 Apple's iCloud was accessed by hackers and thousands of super-famous celebrities' nude photos were leaked to the public (Susan Noakes 2014, para 2). A hacker gained access to a user's device through the find-my-phone function and was able to access countless more accounts through the cloud. In 2017 Amazon Web Service experienced a four-and-a-half-hour downtime due to a mistake in performing updates (Amazon 2017). This affected Expedia, Slack and even the U.S. Securities and Exchange Commission (Nat Levy 2017, para 2).

But the future of the Cloud is anything but overcast. We will all notice its presence more and more as companies adopt it as their primary way of offering products to customers. Or perhaps we'll notice it less and less as it is imbibed as the new representation of computing on the internet rather than the exception. Microsoft Azure is a perfect example of this.

Azure has a massive range of products to choose from, encompassing every example of a cloud service. Machine Learning, analytics, blockchain, databases, DevOps, Mobile and Web Apps, Storage, Security and Virtual Machines are a few examples of their huge product range (Microsoft 2020). It really is a fully functional development suite to build, manage, launch, maintain and store fully-fledged mobile and web apps. But this is a very small droplet in a very large Cloud.



According to Larry Dignan (Larry Dignan 2020) Amazon, Google, Oracle, Alibaba, Dell and IBM are a few of the other market leaders that also add a ton of water-weight, with countless more unmentioned.

The usefulness in being able to “bolt-on” applications, storage and platforms to launch from is undeniable and the allure of compartmentalising services into smaller “bite-size” pieces that can be adjusted to suit the user’s needs is too appealing when the alternative is often a large up-front cost or many hours of work.

As an aspiring professional in IT, I expect my career will be defined by cloud computing in many ways. I already have access to more storage potential on cloud IaaS than I do on any local storage device and I can see clear benefits in using development-specific utilities when creating market-level applications. The industry is ever-changing, and Moore’s Law, the law that posits that the processing power of new computers doubles every two years, has now begun to slow down with some people suggesting that theory will have completely run its course by the early 2020’s (Luke Dormehl 2018, para 5).

Industry has been driven by a constant improvement in computing power and to continue this age of prosperity, we will have to take on a different approach to new advancements and I believe Cloud computing has incredible potential to become the “new” way we evolve technology, alongside other powerful new creations like machine learning and ingenuity in CPU cores.

Either way, Cloud computing is here to stay. It is already a monolith of data and continues to increase every day. The future of computing is still unsure, but there certainly isn’t a storm coming over the horizon. Just nice, sunny, days for the Cloud.



7.3 Cyber Security

Cybersecurity is the process and practice of protecting IT systems, programs, networks, and various other hardware and software configurations from a digital attack. Such attacks are known as cyberattacks, the most common of which relate to gaining access to, making changes to or even destroying sensitive information, extorting money from users through ransomware, or just generally interrupting workflow and business processes. Effective implementation of cybersecurity can be quite a challenging task in today's IT climate as there are many more devices than there are people, and cyberattacks are getting more innovative than they ever have been. A secure approach to cybersecurity will consist of multiple layers spread across all the technologies that need to be protected, i.e. computers, programs, networks, or data that an individual or organization wants to keep safe.

In regards to an organisation, the people, processes, and technologies need to complement each other and work together to be able to create an effective defense against cyberattacks, with a unified threat management system being the best way to accomplish this. The weakest link of any security system has always been the same, people, there are many ways an individual can contribute to cybersecurity. This includes users understanding and complying with some basic data security principles such as: choosing strong passwords that aren't used in other places, being aware of what emails the user is opening and especially being careful that any attachments to an email are scanned for viruses, but most importantly that users are backing up their data regularly and in a multitude of ways, whether that be externally on USB drives or external hard drives, through the cloud, or a combination of both. No matter how broad, effective, or even how much you or your company pay for cybersecurity tools, the whole project or company can fail if a careless user makes a simple mistake. If a user clicks on an unfamiliar link or opens a suspicious-looking email attachment this could bring about a massive data loss.

Technology is a very important part of cybersecurity as it gives individuals and organizations the means and tools to protect themselves. Three main entities that must be protected on a technological level: user endpoint devices such as your computer, phone, and even the way you access the internet such as your modem or router, the users network itself, and the cloud. Technologies that are common in protecting these entities consist of firewalls, filtering of the domain name system (DNS), anti-malware and antivirus software like Malwarebytes or Windows Defender, and an email security system.

Cybersecurity is important and everyone benefits from being more secure in a digital environment. On an individual's level, a successful cyberattack can result in anything ranging from identity theft or extortion to even losing sensitive data like family photos. The main forms of cybersecurity threats are phishing, which is the practice of sending fake emails that look like they are from a legitimate source that aims to steal data sensitive to the victim such as a credit card number or..



.. The user's login details to one or many websites. Ransomware, which is software that is designed to extort money from a victim by blocking access to files or even a whole computer system until one pays the ransom, which does not guarantee that the user will be able to recover everything. Malware, which is software designed to gain unauthorized access or cause damage to the victim's computer, and lastly Social Engineering, which is a tactic that cyberattacks use to trick victims into revealing sensitive information, usually resulting in either blackmail or them stealing confidential data.

As our society becomes more dependent on technology, so must our cybersecurity systems change and grow with our usage. Gone are the days of hiding personal information, as a lot of it ends up all over our social media accounts and people even store sensitive information such as credit card or bank details in 'secure' cloud services such as Dropbox or OneDrive. This means we have a database of cybersecurity threats that is constantly evolving and changing.

As world governments bring more attention to cybercrimes and bring in solutions like Europe's General Data Protection Regulation (GDPR) threats such as data breaches can be held more accountable. GDPR forces all organisations that operate in the European Union to communicate these data breaches when they happen, assign a person in the organization as a data protection officer, anonymise user data for privacy and most importantly require users to have to consent to their information being processed. Being complacent with cybersecurity can have many impacts on a user or organisation. From economic impacts like the theft of intellectual property and corporate information, the general disruption in trading while an organisation tries to recover from a data breach, and even the cost of having to repair systems. Reputational impacts, the breach of trust that a consumer may feel and choose to go with a different service and being slandered in the media. To regulatory costs such as fines or even sanctions for breaking data breach laws such as GDPR.

A few examples and consequences of cyberattacks and data breaches include:

- 'Equifax - Equifax suffered a cybercrime identity theft event that affected approximately 145.5 million US consumers, 400000-44 million British residents, and 19000 Canadian residents. As a result of this breach, Equifax shares dropped 13% and numerous lawsuits were filed against the company. Equifax agreed to a settlement that consisted of \$300 million for victim compensation, \$175m for states and territories affected, and \$100m in fines.' (Upguard 2020, Examples of damages to companies affected by cyber-attacks and data breaches)

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- 'eBay - eBay was the victim of a data breach targeting encrypted user passwords between Feb and Mar 2014, which resulted in the company asking every single one of its 145m users to reset their passwords. The attackers used a set of employee credentials to access this password database. As well as passwords, the database also included information such as names, email addresses, dates of birth, phone numbers, and even the physical addresses of the userbase. eBay disclosed the data breach in May 2014 after a month-long investigation.' (Upguard 2020, Examples of damages to companies affected by cyber-attacks and data breaches)

Cybersecurity and privacy affect my daily life immensely, I am constantly checking databases to see if any personal information of mine has been breached. I visit both Privacy Tools and Prism Break regularly to find new ways to protect myself from digital threats and to inform friends and family of better ways that they can protect themselves. Even going as far as looking into hosting my own cloud service on my home network through Nextcloud to prevent the possibility of any sensitive information being in an unsecured cloud service such as OneDrive or Dropbox.

I used to run a multitude of antivirus, malware and spyware software on any computer I would touch but have since come to realise the best combination of security software, at least for my needs and usage, is simply a few browser extensions: uBlock Origin, HTTPS Everywhere, Decentraleyes, ClearURLs, and Firefox's built-in containers; Windows' built-in antivirus software Windows Defender, a bi-weekly scan of Malwarebytes and most importantly common sense, which is the hardest thing to try and teach friends and family members about when it comes to online safety.

A few examples of common sense regarding cybersecurity consist of avoiding piracy wherever possible, as fake programs are one of the biggest ways that people end up with virus' and the like, avoiding suspicious websites with 10 different 'download now!' buttons and avoiding the use of logging in and making new accounts through social media links such as Facebook and Google. These simple measures can help ensure that one can feel extra safe personally regardless of the user's confidence in the service they are attempting to use.

Another huge part of keeping myself protected on the internet is using a password manager. I originally used LastPass for the longest time as I felt paying for the service would make sure that it was extra secure and that the money they received from their user base subscriptions per month would go into adding extra layers of security.



I ditched LastPass as soon as I heard that even they had a data breach and moved on to hosting my own password manager through KeePass and hosting the database on Dropbox so I had access to it on any device I needed to use. Realising Dropbox probably is not the best place to store such secure information I have now moved onto Bitwarden which at least for the meantime is everything I need out of a password manager.

CYBER SECURITY STATISTICS 2020

- 01** 1 in 13 web requests lead to malware.
- **Symantec**
- 02** 53% of companies had over 1,000 sensitive files open to every employee.
- **Varonis**
- 03** Most malicious domains, about 60%, are associated with spam campaigns.
- **Cisco**
- 04** About 20% of malicious domains are very new and used around 1 week after they are registered.
- **Cisco**
- 05** 69% of companies see compliance mandates driving spending.
- **CSO Online**

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(Achilles Resolute Private Limited, 2020)



7.4 Machine Learning

Machine learning is a sub-concept of artificial intelligence and essentially refers to a computer program with in-built functions that allow it to learn through experience rather than needing to be programmed by a human. To put it simply - the computer learns by itself.

"Why do we need a computer to do the learning for us?" - You might ask. Well, traditional programming takes time and lots of it. Working out what to make, how to make it, writing the code and debugging can take months, even years to do on large projects. This has been the tried and true method since the beginning of computing and has helped us to evolve the technology to where it is today. But now we have an alternative - machine learning.

Machine learning takes the arduous and time-consuming task of writing large amounts of code and puts it on the computer to work it out itself. This is called "training" and requires the user to input usually massive amounts of "training" data into a human-made program. In more complex machine learning algorithms, the programs can generate their own methods or programs through experience, but that's starting to move toward more advanced areas of artificial intelligence.

Machine learning works by taking in information through an initial set of data nodes known as "neurons" that analyse the data's qualities. It is then passed down through sequential "layers" of neurons until enough is identified about the data to predict what the program believes is the desired result. Over time the program refines its ability to define the correct answer by improving its ability to make informed guesses based on previous successes and failures. That is where the term "learning" originates.

A common way to do this is by the user entering in an example of the desired result and distinguishing it from the other possible, incorrect outcomes. The program then processes the input and analyses it to find comparisons between the data, examples of the correct result and what the program has learnt so far through previous analysis. The program uses this analysis to guess the correct result and is given feedback by the program on its accuracy. The program then records the results and uses them to improve its ability to make correct choices in the future.

A good example is a commonly used program designed to identify hand-written characters like the letter 'A'. Even though it is easy for a human to understand what the letter 'A' represents, there is actually an incomprehensible amount of subconscious processes that have to take place for our eyes and brains to inform our conscious mind of what 'A' actually means. A program also requires a complex method of analysing and storing data to be able to recognise 'A', but the way it works it out can be completely different from the way we do.



Often, handwritten characters are processed as an image in machine learning. The program can use the values of the pixels to identify patterns in the image. In the case of the letter, 'A' the program might recognise a small horizontal line in the centre and two, sloping, vertical lines on either side that meet at a tip. It could then compare those shapes to known shapes of correct answers and find similarities between them. But the letter 'E' also has a small horizontal line, so the program needs a way to differentiate between characters that share qualities.

To do this, in the first layer the program might look for horizontal lines and pass the input to neurons attributed to a small horizontal line in the centre. Then in the second layer, it might look for vertical lines. When it notices that the input image doesn't have a single, straight, vertical line on the left side but the diagonal lines of the letter 'A' it may then stop looking for the letter 'E', confirm more information about the symbols that compare to the letter 'A' in subsequent layers and make a guess that the answer is 'A'. The program is then given feedback, records the results and runs the program again with the new information until it is eventually able to guess the correct answer nearly every time.

This is a fairly basic example of machine learning. In reality, the amount of data, research and processing power required to process even basic examples of artificial intelligence make it a difficult field to research and as such we have only begun to scratch the surface of its potential. Established global tech giants like Amazon, Google, Facebook, Twitter and Uber have to lead the charge in artificial intelligence development but other non-household-name companies like Qburst and Skytree (who literally call themselves "the Machine Learning Company") have also been key players in the advancement of machine learning (Andy Patrizio 2018).

Ride-sharing giant, Uber, has invested huge resources into researching artificial intelligence. They use it to predict ride times, delivery times for UberEATS, set surge pricing during peak times and many more functions that help Uber offer the premium ride-sharing app on the market. In fact, Uber faced difficulty in creating machine learning programs finding they were "limited to what a few data scientists and engineers could build in a short time frame with mostly open-source tools." (Jeremy Hermann and Mike De Balso 2017, para 5).

To combat this Uber have developed their own machine-learning-as-a-service platform called "Michelangelo" that offers their in-house engineers an end-to-end service to develop, evaluate and eventually launch machine learning programs on one convenient platform. Uber have speculated over releasing Michelangelo to the public, but they have not confirmed a date or how they plan to launch.



Other, less-known, companies are taking advantage as well. For example, PlantVillage, a company that specialises in open-source information on plant health and farming practices that assists farmers in developing countries to improve their crop health and eventually, yield, has developed an app called "Nuru" (Swahili for light), that gives farmers in isolated areas, and without access to good quality internet, the ability to diagnose disease in Casava, a plant that is "tolerable to droughts but susceptible to disease and pests" (Fred Alcober 2018, para. 3).

Nuru uses machine learning to identify trends in plant-related health issues. Because of poor internet in isolated areas, Nuru has been designed (once downloaded) to be used offline and will be scaled to not only detect ill-health in Casava but eventually to be used to diagnose countless types of crops in countries all over the world. It has been a boon to small-industry farmers and is a commonly used app for farmers in African countries today.

These are only a few examples of established machine learning companies, but countless other companies are trying to get ahead of the pack and develop machine learning-based programs to lead them into the future. As of June 2019, Aptiv and Lyft celebrated successfully completing 50,000 driverless rides in Las Vegas (Kyle Hyatt 2019 para 1). Apple has been using machine learning in Siri to "do more than calling someone on your contact list" (Andy Patrizio 2018, para 11) for years already and have formulated an enormous pool of Apple user data. Machine learning has even been used to combat COVID-19. Earlier this year "300 data scientists and health care professionals held a COVID-19 Datathon to see what insights they might uncover [in-regards-to COVID-19]" (Kim Martineau 2020, para 1).

The potential for artificial intelligence and machine learning is difficult to describe because we just don't know how far it will eventually take us. We do know, though, that it is one of the most prolific and powerful forms of computing to date and is likely to reach soaring heights within our lifetimes.

We are only in the budding stages of understanding machine learning but the potential for this type of programming is almost limitless. There are three levels of artificial intelligence programs cognitive capability, all of them refer to computer programs ability to replicate natural human intelligence.

The three levels of artificial intelligence are:

1. **Artificial Narrow Intelligence.** This refers to a computer being able to perform specific tasks extremely well, for example, chess (Astute Solutions, n.d). Currently, all forms of artificial intelligence that exist in the world fall under this category.
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2. **Artificial General Intelligence.** At this stage, artificial intelligence will have reached a comparable cognitive ability to a human. It will "independently build multiple competencies and form connections and generalizations across domains, massively cutting down the time needed for training." (Naveen Joshi 2019, para 12).
 3. **Artificial Super Intelligence.** This is when AI surpasses humankind in intelligence. When this happens, artificial intelligence will begin to evolve at a rate that humankind will struggle to comprehend. This is often called the "singularity" and specifically refers to the point when the exponential growth of intelligence drawn against time as a line on a graph becomes vertical. Meaning a programs intelligence increases infinitely, irrelative of time (instantly).

Machine learning is more present in day-to-day life than most people expect. Whenever you scroll through Facebook, for example, a data-mining program is paying attention to which posts you like, spend time on and how long, which advertisements you click on and a plethora of other information to do with your activity. The data is then fed into a machine learning program which analyses it to learn about how you react to certain content and what you are likely to spend your money on. This helps Facebook improve the quality of their advertising programs and therefore the amount of revenue they can generate from it. This is a pretty common practice in social media companies and raises a host of ethical and legal problems.

In the case of Facebook, a company called Cambridge Analytica used data mining and machine learning programs to extract the personal information of not only the 300,000 users that accessed a link with in-built data-raking protocols, but also their friends, giving Cambridge Analytica the personal information of tens of millions of users without any of them ever opting in. In May 2019 Facebook was forced to pay \$5 billion to a U.S. Federal trade commission over the investigation (Joel Rosenblatt 2019).

Another of the key issues with artificial intelligence is deciding who is responsible for legal breaches made by the program. Arguably, a program with artificial intelligence capabilities can have agency over its own decisions and therefore responsible, especially as the cognitive ability of artificial intelligence edges closer to human capability. Others claim that the companies who develop the programs are responsible, much like a child and a guardian.



This is not the only ethical problem artificial intelligence faces though According to Harvard Magazine, "AI systems can reinforce what they have learned from real-world data, even amplifying familiar risks, such as racial or gender bias" (Jonathan Shaw 2019, para 5). In the military, drones are already being tested using artificial intelligence removing the human element of empathy, mercy and the ability to make situational choices, and raises possible human rights questions and even potential war-crimes.

Before long, machine learning will affect every facet of life. The amount of funding and research being thrown at machine learning indicates that there is a large interest from industry and when industry wants to get something done, it doesn't often fail.

Although all artificial intelligence programs sit under the "Artificial Narrow Intelligence" umbrella, it is believed with confidence that we will achieve "Artificial General Intelligence" possibly within a few decades. At this stage computers will be able to interact with humans on an equivalent level and be able to "learn, perceive, understand, and function completely like a human being." (Naveen Joshi 2019, para 12). When this happens computers will likely be given rights and agency the same as a person, and we will interact with them as equals.

Eventually though, if we continue to develop artificial intelligence (which we likely will), computer programs will reach "Artificial Super Intelligence" level of cognition. When that happens, we will no longer be the most intelligent species on planet Earth and will be overtaken by a new type of intelligence - like a parent being overtaken by the next generation of their offspring. Like us and the chimpanzee.

You can already clearly see the effects of machine learning programs in your personal life.

Whenever you interact with an advertisement on a social media website like Facebook or Instagram, it has in-built machine learning programs that analyse how long you spend on the ad, whether you put an item in your cart or navigated to a certain category, if you have bought items similar to it in the past and how your interests, search results and other information relates to the ad, among other information.

This is the process what allows targeted advertisement through millions of tiny data transactions every minute. That is why when you search for "how do I buy a new wallet" your feed is filled up by ads for wallets, or if you hover over a post for too long in regards to stand-up comedy, you see nothing but ads for stand-up comedy show tickets for weeks afterward. Because of this, companies can target consumers based on their proven interests and maximise revenue generated from a marketing campaign.



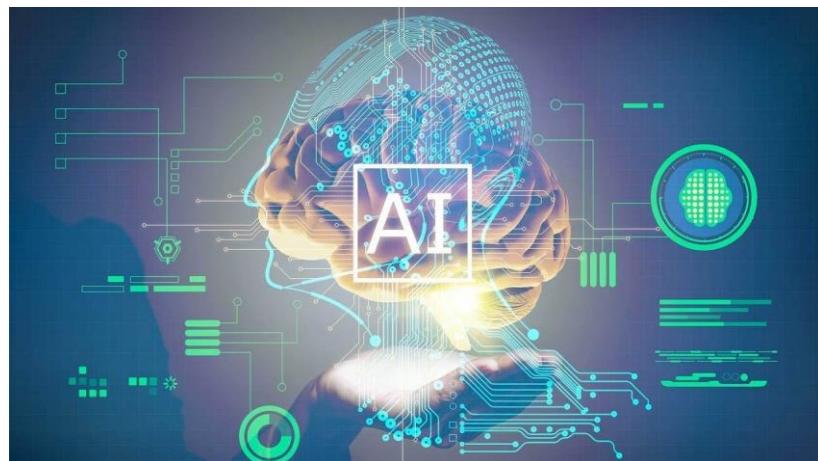
As of 2016, it is believed that global mobile advertising funding surpassed \$100 billion for the year (Anastasiia Minak, 2016, para 2), a number that would have grossly increased since then. Even if machine learning counts for a small portion of this funding, that is still an unbelievable amount of resources and translates to exorbitant profits.

Machine learning is only going to continue to become more and more prevalent in our every-day lives. As further development is put into "the Internet of Things" (IoT), it will begin to involve more and more artificial intelligence, meaning every time we use our household items that are connected to our Wi-Fi network, even the TV, toaster or microwave, we will be giving data to one if not many, machine learning programs.

Eventually, when all of our possessions are connected to the internet and artificial intelligence becomes the dominant form of programming, our entire experience will likely be targeted towards us in some way or another. For example, you might walk down the street and advertisements in the windows of shops you pass may change what product they are advertising, or even the look of the ad itself, thanks to a giant database of information that thousands of artificial intelligence programs have compiled about your character over decades of interacting with technology. It is not unbelievable that the rooms in your house change colour, temperature or music depending on your mood at the time. In fact, that is already possible in a primitive form.

Artificial intelligence will eventually exist side-by-side with human intelligence and be given rights the same as us. One day, it may overtake us, and become something much greater than anything we can imagine today.

Either way, it is here to stay, and something we will all have to accept eventually...





8. XVI Project: The SocialCare Chat

Purpose

XVI from the Royal Melbourne Institute of Technology University, have come together to expand on an idea that came from an individual within the team. The SocialCare Chat will allow for the elderly or those with a disability, to connect and engage with their loved ones through the use of technology. We all have such fond memories with our grandparents and love them dearly however, not being able to visit them makes it really difficult as they tend to get lonely. During the unprecedented times we face through the COVID-19 pandemic, the idea of SocialCare Chat was born.

The focus of this application is to make digital contact with family and friends uncomplicated for those that may struggle with technology as well as incorporating brain teasers.

Objective

The SocialCare Chat project will require various technical skills in order to successfully create and launch. The team at XVI will be working hard over the next 6 weeks to begin with our beta product...

The SocialCare Chat application will be in the form of a web and mobile application that is intuitive and user-friendly. Through both applications, we aim to have Voice operated commands, a navigational layout that is straight forward so our beloved elderly generation can jump on and easily understand what to do next. We will need to use simple language and steer clear from jargon and any form of millennial language, we would also like to consider implementing different languages to suit all backgrounds. We will look to understand the phycology of colors and utilise such colors that will resonate with the elderly generation and have a positive influence.

The SocialCare Chat will consist of many features, the most important feature is the chat option. We want to give the elderly the opportunity to connect with their loved ones through conversation, whether that be through text format or through the use of audio and video connection. The text format will ideally have various language options, so those who may not understand the English language as well as their own native language, can still connect with their loved ones through the ease of their first language. Our beloved elderly will also be able to send and receive photos through The SocialCare Chat.

Another feature of The SocialCare Chat are the games! It's important to keep the brain as active as possible and to exercise the muscle so, we will look to have a variety of the games that our elderly generation may find interesting enough to get involved. We will look to include games such as chess and checkers, and cards.



Methods

There are three main online Application development tools: Amazon Web Services (AWS), Google App Engine and Microsoft Azure. We intend to create a web application that can also be accessed in a mobile format. After careful consideration at XVI we have decided to go with Azure in conjunction with Microsoft Visual Studio as our development suite, storage warehouse and launching platform.

Azure offers extensive testing and DevOps tools, expansive middleware, an enormous data staging ground that scales with usage, virtual machines to use as containers and simple compatibility with Visual Studio for front-end support as well as an unimaginable amount of other functions.

We are able to use Java to code the back end and .html for the front-end in Visual Studio. Both offer fantastic platforms to work off and have shared functionality between the two – meaning; we can use those two Microsoft products for most of our project without leaving a conjoined Microsoft suite.

After development of our application, we can perform containerized testing against massive, pre-structured data-pools created by Microsoft, also in Azure, that replicates devices in real-world situations. This ensures we can perform thorough testing without having to establish real-world scenarios, expanding the scope of our testing and giving us an opportunity to ready ourselves for market. These tests will then allow us to go into alpha-testing in isolated, situationally specific, environments like aged-care facilities and schools.

As SocialCare grows, so will the staging ground set by Microsoft Azure. With extra data availability and future development capabilities always at-the-ready Social-Care, like the market and our families, never has to stop growing.

Testing Plan

After spending time planning and developing the SocialCare Chat application, we will need to test the application thoroughly before the official release. Testing phase one will be conducted by, XVI, and their friends and family. This could be hardware related testings like how the application scales on different devices, screen orientation and mobile devices by different manufacturers. This can be done quickly by researching the most widely used mobile device in our specific target audience. By doing quick test between XVI and friends, we can test the functionality of the application and quickly fix any bugs that would hinder further testing, things such as installing and running the application and seeing how it affects the devices resources. XVI can also test how convenient the application is by re-locating icons and buttons depending on how used they are, how easily reached they are and how noticeable they are to stop users from getting lost in the UI.

After bugs and issues are resolved, we can start testing in the target audience by releasing the application to select nursing homes that would like to partake in phase two. We can gather information given to us by the application and also by employees at the Age Care Facilities.



As the application is made for the elderly, talking directly to them after using the application for a period of time will allow us to make adjustments we may have not been made aware of previously or that our audience believe will better suit them.

When the application is in the final stages, we can start releasing it to testing groups who will be more focused on finding issues with the application. This will allow us to find and fix issues that can be created on accident or in certain scenarios and stop that from happening before releasing the market. Being able to find and fix as many of these features will allow us to more confidently release the application without fear of issues appearing in possibly important situations. After this the application should be in a highly useable state and be able to be released briefly for users to beta test such as on the Google Play Store and Apple AppStore. Feedback can be acquired from this and we can continue to improve the application and debug related issues before the official release.

Marketing/Launch

The first stage of the XVI advertising and launch plan for SocialCare Chat will focus on creating brand awareness through connecting with various managers and owners of elderly and disabled care facilities. To show them the product, how easy it is to use and discuss whether they would be interested in and find benefit from having our software in their facility. Once we have several care facilities on board with instalment, we will roll out the application on both the Google Play Store and Apple AppStore to follow, so that the relatives of those in these care facilities can download the application. This will allow users to communicate with their loved ones during times when face to face visits are not an option, like with the current COVID-19 climate.

The second stage of our advertising plan for the SocialCare chat software will predominately focus on advertisements towards older demographics. Instead of using digital advertising, we will be using print media, radio and television advertising to create awareness around our software. A variety of promotional content will be required, such as images of individuals using our software, and a short informational video that can be used for television. The advertisements will all focus on the benefits of SocialCare chat, the ease of use, our contact information, and how to download or receive our software.

While digital advertisements will not be our primary focus for advertising, we will be looking at gathering and analysing data from a small run of advertisements on digital platforms such as Facebook and Twitter. This information will help us determine whether it is important for us to focus on ads in this direction as well.



Roles

To further support our interest in our ideal jobs, we have decided to assign roles that align well with the job's elements. After conducting research into the application development process, roles have been split into the following areas:

- Researcher
- Designer
- Developer
- Head Coder
- Marketing and Testing

The first task of the researcher will be to bring the team together to identify the main goal of the project and make a road map on how we will achieve this. The researcher will complete an investigation into similar applications and competition. They will also lead the brainstorm into features the team identifies and how to implement them.

The designer will focus on the design of the user-interface and will be in charge of creating a style guide that the rest of the application will be built on. They will work with the rest of the team to develop a basic mock-up application. The developer should aim to identify the elements of the application and what route will be taken to achieve them. For example, the developer will research ways to implement the communication element, whether it's voice, text or video and how we will make it happen. Although all members will be involved in code development, the head coder will oversee all of it, guiding others and most importantly they will seek to eliminate bugs and errors in the application itself. Marketing and testing will firstly work alongside the head coder once the alpha is developed, testing the app. They will then decide how to market the app and the target audience.

Conclusion

We have thought cohesively as a group on the project idea and our plans of implementation. The unprecedented times the COVID-19 pandemic and the impact it has brought upon the world has changed the way we interact, moving most of it online. The uptake in software use has mainly orbited around the professional space. Said software relies heavily on the user already having well developed skills with technology and the internet.

SocialCare Chat aims to be as adaptable as it can be in order to suit elderly users through clear displays, size and language, while also giving a fun experience and removing the fear and annoyance of having to create and use social media platforms in order to connect.

XVI aims to fill these gaps with our own application, SocialCare chat.



9. Reflection



9.1 Personal Reflection

Connor: Even though we got off to quite a rocky start with 2 of our initial members leaving, and then one of our replacement members also leaving, team XVI has been working together quite productively. From our weekly voice call sessions to just daily text communication on Discord I feel that we have bonded quite closely as a team. Like Corbin, I was also nervous about working in a group as I usually prefer to do my own thing and go at my own pace but everyone has been super accommodating and friendly which definitely helped with my anxiety surrounding group work, it's not as scary as I thought it would be!

We started our work collaborating on a Google Doc and using Discord to communicate about what progress we're making on our assigned objectives but quickly moved our work onto our team GitHub Repository that Natalie set up, which has helped smooth out our work flow and I even used GitHub's issues to assign and keep track of the work that we assigned ourselves in the Google Doc, which has been very helpful as we can just close an issue once that part has been completed. The most surprising part of this was how well we all contributed to the repository and that we had no issues with overwriting one another's work or accidentally deleting something that was not ours.

I feel that I could have engaged and communicated where I was personally at a little better but other than that I feel like we have worked quite awesomely together as a team. I'm looking forward to completing assessment 3 with our group as I feel like with the progress that we've made on assessment 2, we will absolutely smash out the next one together.





Corbin: Working with group XVI has been fantastic. In the beginning we had some trouble with group members leaving and bringing in new members, but everyone has used good communication and shared effort to continue to succeed as a team. I was quite nervous about the group assignment at first, but I've found everyone to be more accountable for their work than I expected, and they are actually really easy to get along with.

Our communication on Discord has been practically daily. After a short initial period of using Discord and Google Docs to collaborate, we moved our project files onto GitHub and have used it for every update since.

I was amazed at how simple to use and practical GitHub was. It allowed us to all collaborate on the same files and send updates to one another instantly which we took full advantage of updating our shared repository as often as possible.

Over our weekly voice-chat sessions we were able to efficiently establish weekly goals and come up with ideas on a more dynamic platform.

The only area of improvement that I would suggest is some proactivity in engaging from some team members. It can be hard to reach out most of the time without seeing progress. Fortunately, though, everyone has held up their end of the assignment and I am thoroughly impressed by my teammates in their technical abilities, work ethic and ingenuity. It's been great working together and I look forward to carrying it on in future group assignments.





Natalie: To be honest, when I first saw this course had a group element, I was worried, especially considering that the course is online. I struggle with social anxiety; however, I have really enjoyed working with the other members of XVI. I set up the original Discord server for our Intro to IT class and the members of XVI and myself were all eager to join a group as soon as possible. I think this reflects on each of us – we were on task and ready to start things on time to be as organised as possible.

We chat on Discord daily through text and try to engage in voice chats at least 1-2 times a week. In these chats we set deadlines, divided up the tasks to suit each other's strengths and have bonded together closely, ready to help each other whenever needed. Even though overall we lost three group members, the core of us that remains kept right on task. I think this is a testament to our adaptability and perseverance as individuals and a team.

XVI has taken to GitHub really well, and we all regularly push and pull documents. I may be the main contributor when it comes to commits, but that is purely because I coded the HTML and CSS of our site – otherwise it is quite even.

It surprised me how organised we have been as a team. We owe some of this to Vanessa who really did an amazing job at helping keep track of our self-imposed deadlines.

Our work as a team really put me at ease in regards to the assignment. It seemed a bit everywhere and hard to follow in the beginning, but having the support of each other showed to me how valuable a group can be.





Oliver: Being a part of XVI has been an amazing experience, I was late to join the group but despite that the group members still welcomed me and assured that they were here to help. I don't like forming bonds over the internet and despite most people being more confident when online, I prefer meeting people in real life and making first impressions there, but after the extremely positive and helpful support by everyone it felt a lot easier.

I have used Discord for multiple years, so finding out the group had been communicating using discord I was relieved to not have to figure out a new software. Seeing messages daily and watching the team work together was amazing as they all wanted to help each other. GitHub is still a bit confusing to me and I have tried to follow online tutorial with little success, I did not know how to contribute or push anything onto it, but with the help of both Corbin and Vanessa I was able to get my work on there and even end up learning how to use it.

Although my random work schedule and other commitments left me missing some of the weekly voice-chat sessions, I found it amazing that when I was in there many questions were so quickly asked and resolved as a team, the communication throughout this experience has been some of the best I have seen whether in school projects or at work.

I really enjoyed working with everyone and wished I could have helped somewhat more. Being able to trust that everyone was able to do their part felt amazing to me being part of a group and if I were ever invited again, I would join the group again.





Vanessa: Finding out that I had to work in a group for this assignment filled me with excitement because I love to work in group settings and to learn from others in a collaborative environment but also some concern because I didn't know who I would be working with and their ethics.

Working with the XVI team has been a positive experience, we quickly found our place in the group and who took what role. There was no clash of personalities in the group, everyone was given the opportunity to speak up and we all encouraged each other to ask for help, if and when needed. The goals of the team align with what they want to achieve personally from this course which has enabled us to work hard to produce our best work. The team was very supportive and provided constructive feedback when required.

The team was very organized from the beginning and despite three members dropping out of the unit and the new members joining, the original four members held on tight and as a result, it did not interrupt the collaboration of the group as a whole. We caught up at least once a week via Discord voice chat and spoke every day about A2 through chat.

I'm very pleased with how everyone worked together, although the only downfall was work not being produced within the time frames given without any form of update or communication as to why before being asked.

I have really enjoyed working with the individuals in this group and look forward to working together in A3 and who knows, maybe other units as we all have the intention to complete the Bachelor of IT.





9.2 Group Reflection

All members of XVI completed their personal reflections prior to getting together to discuss group reflection...

What went well for XVI throughout assignment two?

It is across the board for all members that working in our group was a positive experience in terms of communication, organization, effort, punctuality and ingenuity.

Prior to working in a team most of the members had little to no experience working in online educational environments, there was a mixture of anxiety and excitement for the team. The team is delighted to have worked together over the last four weeks and feel confident with each other's abilities, as well as comfortable moving forward together in the next assessment.

We have established a clear direction of where we want to head throughout the next assignment, the team shares common goals for the future of our degree.

Moving into A3, what can be improved?

Initially we had three team members drop out if the unit in the first couple of weeks which caused a slow start as there was a bit of hesitation in opening the lines of communication as we didn't know one another and we were out of our comfort zone. Moving forward, we now know to simply start conversation through any means such as jokes, memes, general chit chat etc. which will allow everyone to engage.

Ensure all team members are transparent with updating the team on the status of their work and any issues they are encountering as this will allow others to assist and leverage of each other's abilities and knowledge.

What did you find surprising about working in a group for A2?

As this was our first time using GitHub in a group it was surprising that there was absolutely no impact on individual work when pushing to GitHub as well as the other tools we used such as Google Docs and Discord. Through the use of GitHub, all members have equally contributed their share to the assignment however, GitHub is not a direct reflection of the effort everyone has put into their work.



The group has surprisingly formed a strong comradery which has been a delight because the interactions have been fun and lighthearted, regardless of the topic. This allows for the team to support and lean on one another through difficult conversations in a safe environment without judgement and also provide constructive feedback without ill feelings.

What has XVI learned about working in groups?

That's its not scary and nothing to be afraid of... in fact, it enabled us to bring out the latent skills in each member and focus on our areas of interest and experience. The group has remained strong through the adversity they have faced through losing three team members in 2 weeks.

The group feels mutually that the experience has been a blast and look forward to working together as proceed through the unit, as well as entirety of the Bachelor of IT.



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