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NOTE FROM ANTHONY CLAPP – LEAVING THERE HERE UNTIL PUBLISHED

\*\* FOOD FOR THOUGHT\*\*\*

* Only 1 member of the group needs to submit
* 1 PDF Report  
  1 Group Website -> Team Profile info
* Report has everything in it.  
  Report has links to Group GitHub Pages Website (Repo too) -> Group Website links to Individual A1 GitHub Pages
* Collaborate in Microsoft Teams / O365 / Google Drive/Docs / etc.
* Check A2 page has resources and additional info.  
  Check out the Rubric.

**1. Executive summary**

This report provides background on all the members of XVI, the tools they used, a variety of reports, and their project. Along with this, XVI, reflect on their time together working as a team.

Group XVI have recently teamed up so all members have participated in a range of tests in order to determine compatibility; you will also find a brief introduction on 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 have been working on a project called “Social Care Chat”, the project can be accessed three ways, through the website, desktop, or 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 learnt, 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.

**2. 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 proceed 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 sook of a 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 flavours. 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.

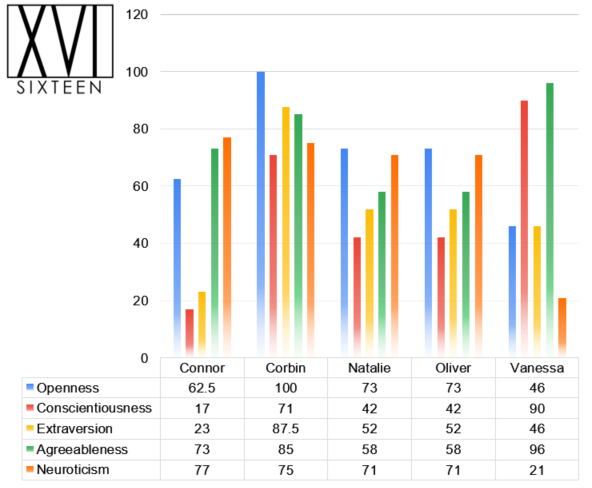
****I’m Corbin, ID s3855159, and I'm a part of XVI. Hailing from Melbourne City and originally from Country Victoria, I now live on the sunny Mornington Peninsula. My day job is in hospitality and tourism management but I’m always pursuing a new side-hustle. I’m an enormous music lover and spend most of my free time singing and playing 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 own 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.



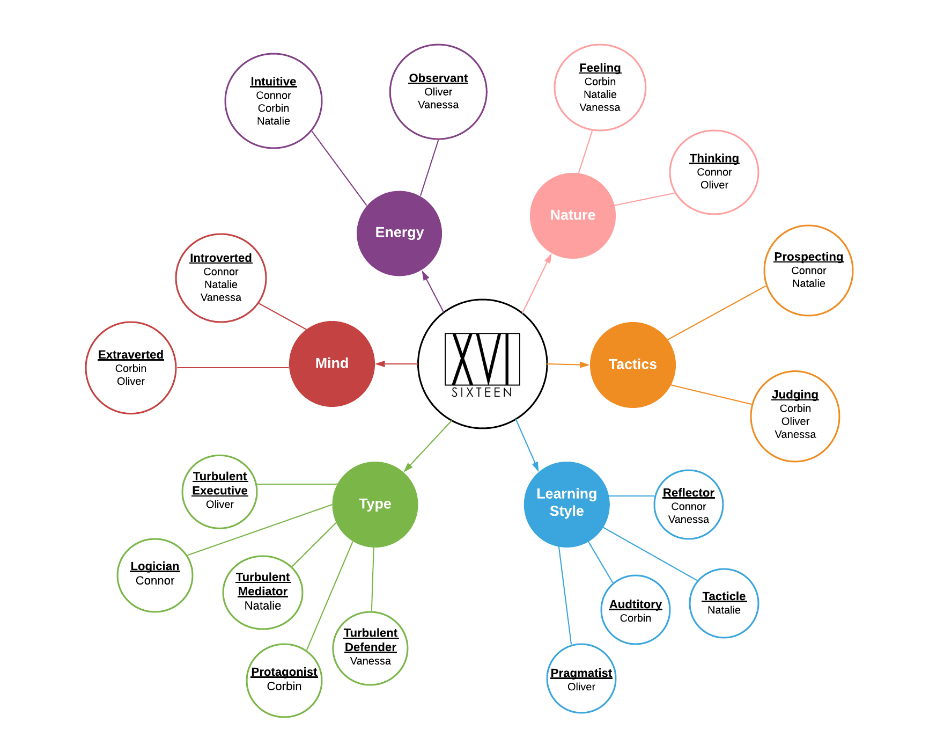
I’m Vanessa, ID s3864452, and I'm a part of XVI. I am 28, born and raised in Australia in a cute little country town that goes by the name of Orange! I grew up dancing to rock ‘n’ roll music and singing Shania Twain, I’m still quite the country girl to this day but living in the suburbs of Sydney with 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 experience and 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.

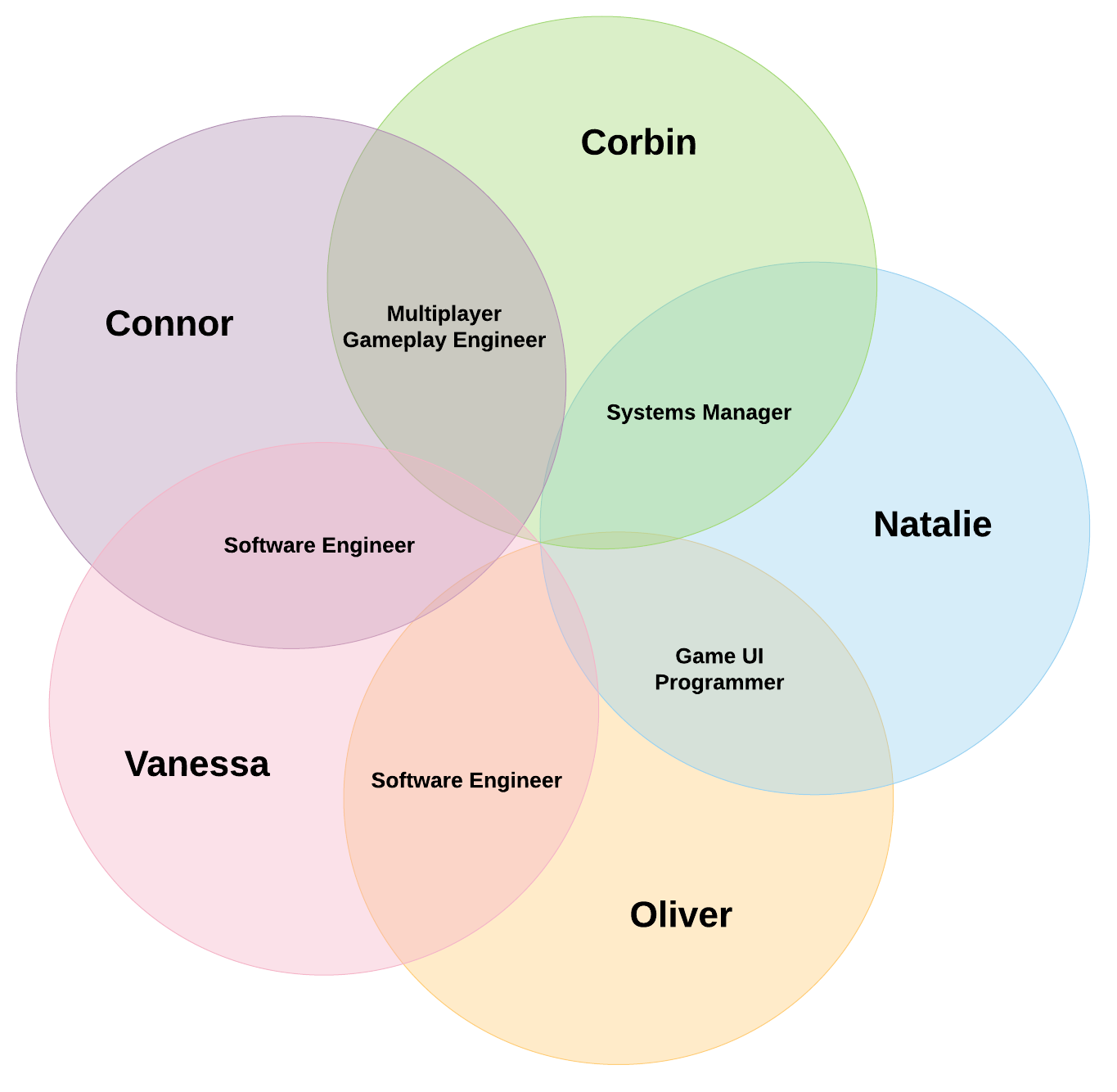
The traits from each member complement each other and allow the group to leverage of the skills and strengths of other individuals in the team. Working with a variety of personality types also allowed us to learn from each other.

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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 are up to date and running smoothly. Software Engineers however, prioritise 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.

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**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 to and proceeded to commit our work to the repository using Microsoft Word. A couple of the members in the team used GitBash to push to the repository.

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 remained transparent regarding the status of our work (we had a few personal hurdles to overcome) 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 our ability.

**5. Industry Data**

This report discusses the demand of 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 team XVI compare to Australian and New Zealand employer demands. We will be comparing our team’s ideal jobs and skills to a research done by Labour Insight Jobs (Burning Glass Technologies).

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The purpose of this report is to investigate the ideal jobs of XVI and the required skill sets both generic and specialised, ranked by demand from employers around Australia and New Zealand. This report will analyse data from secondary sources and a study done by Labour Insight Jobs (Burning Glass Technologies) and will discuss whether our ideal jobs have been impacted by the research done and how many of the skills needed for our jobs are in demand.

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, with the findings in this report we can see what skills we will need and how our skill we have rank 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 members. 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.

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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. Software Engineers 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 essentials 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 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 an 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.

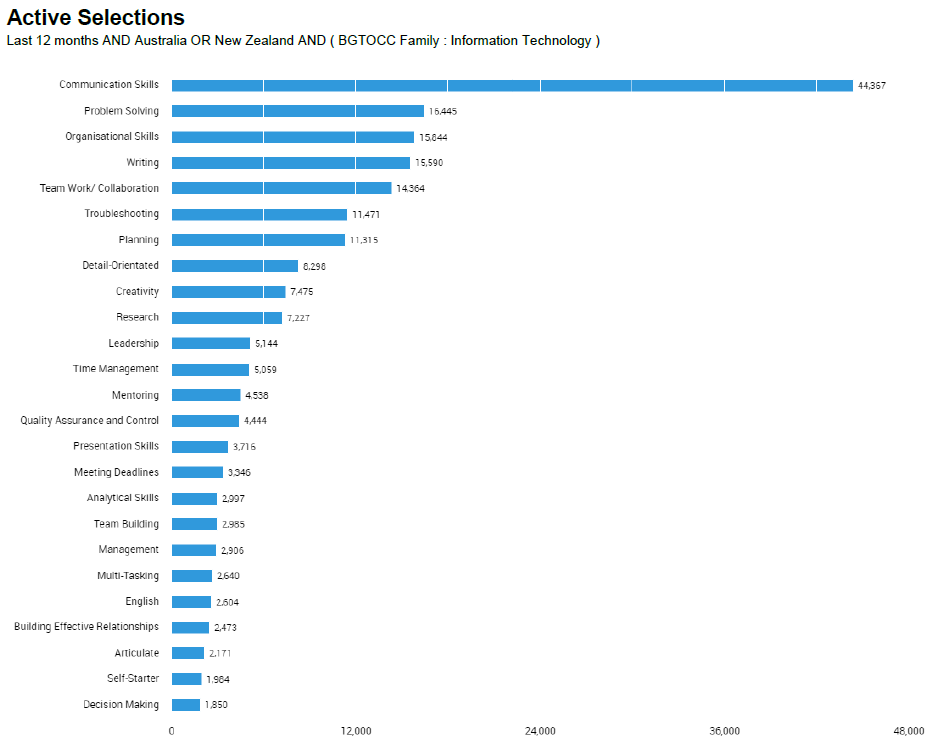
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The most prominent generic skill must be communication skills. Out of over 120,000 job listings, communication skills were the most common declared skill with almost 45,000 of the job listings including it in the skills; since all the ideal jobs featured 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 would help any ideals job is 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.

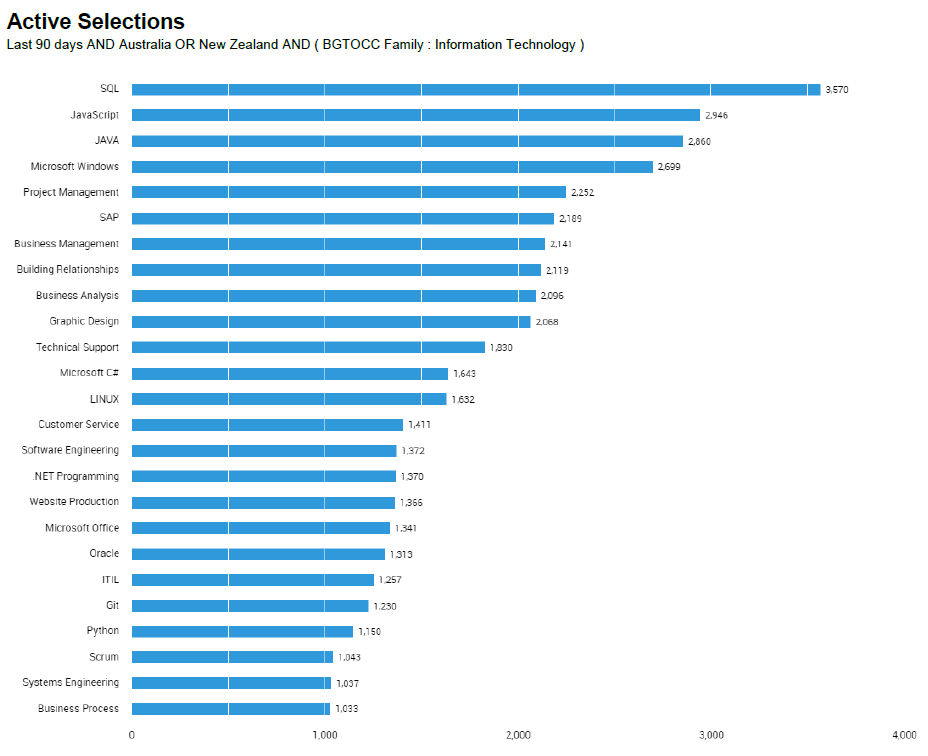


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The most popular Specialised skill seen within the group is JavaScript, used by a lot of companies, it creates a high demand for its uses. Software Engineers can and should learn JavaScript as it is most used within web pages to create a dynamic and 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 it 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.



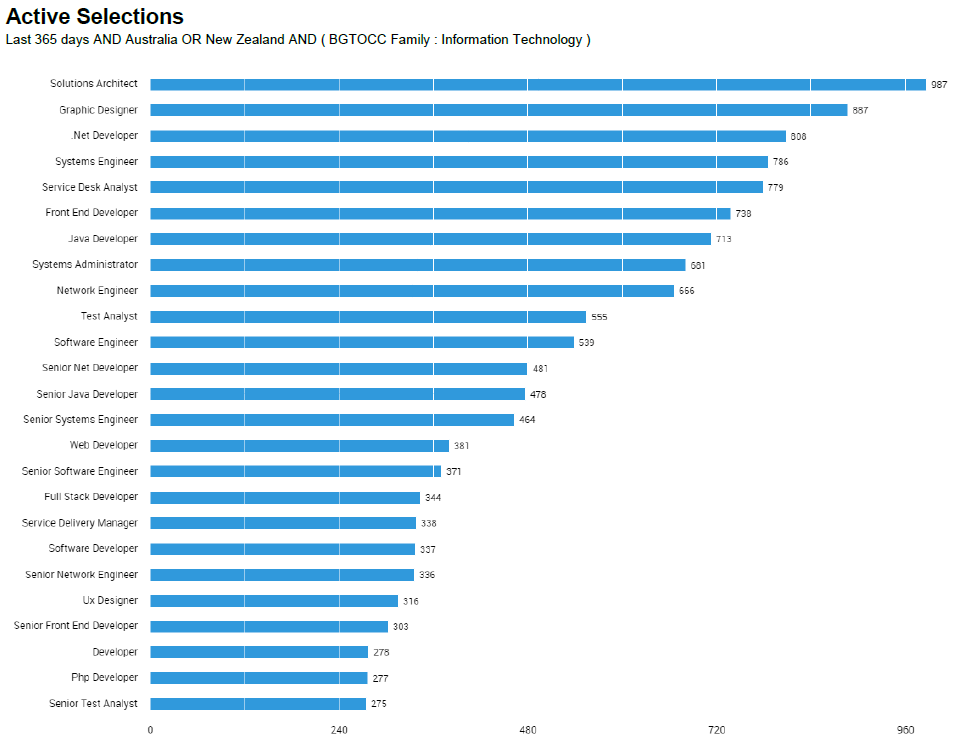
A lot of generic skills are ideal to almost any employer, the ability to almost do anything of these would be useful in many situations and create more demand for your skillset, but some of the top skills not mentioned in the current ideal jobs skillsets were writing, mentoring and presentation skills. 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.

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Connor

Corbin

Natalie

After analysing the data, it’s 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 previous 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 reviewing the Burning Glass 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.

**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 really learn from him about his role, what his day-to-day job looks like and the challenges he faces, in his role but the IT sector in general.

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**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?**

A 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 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 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.

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As a Senior Solutions Engineer, Grants, work is 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.

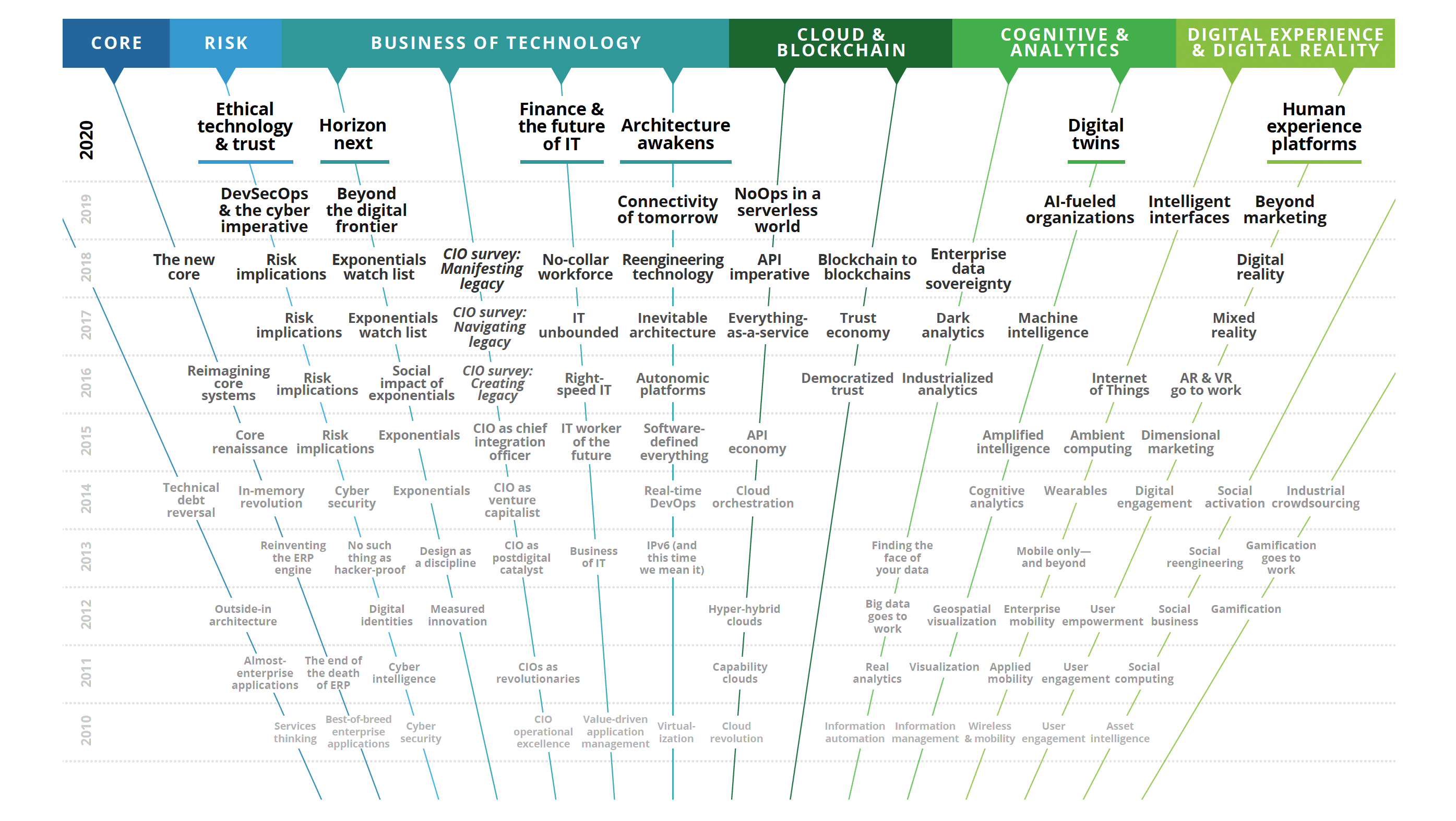
I found this interview to be enlightening and invaluable. I am very passionate about customer service and technology, and by combining the two and creating a role that works on both aspects really motivates me to study hard and learn quickly as this is what I want to do. I want to work to improve the 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 in order to keep up to date with the latest trends in technologies. There are many career choices that 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 really 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 **Delloitte.**

*“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**

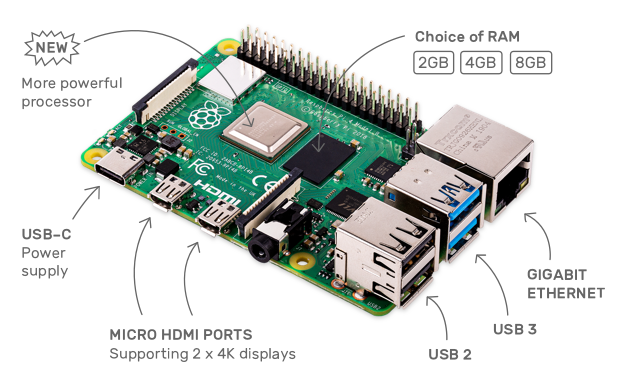
\*\*\*add some text here to lead into reports\*\*\*

**7.1 Raspberry Pi & 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, 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.

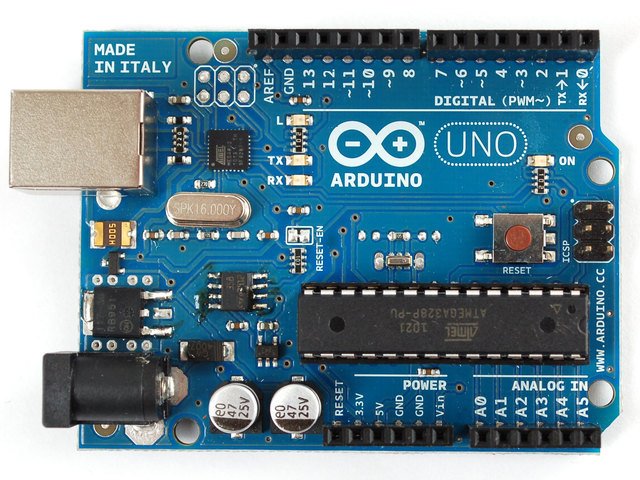
The future progression of wireless technology such as 5G, alongside developing countries such as India, becoming more online will allow for even more devices connected to the IoT. This will push the rapid adoption of the Raspberry Pi and Arduino, expanding the use case beyond what we can currently imagine.

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).* 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).

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, 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).*

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. 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 groups 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**

**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 cyber-attacks, 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.

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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.
* 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 user base. EBay disclosed the data breach in May 2014 after a month-long investigation.

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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.



**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 the 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 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 make a prediction on 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 in order 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 corrects 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.

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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 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, *datamation.com*, 2018).

Ride-sharing giant, Uber, have invested huge recourses 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, eng.uber.com, 2017).

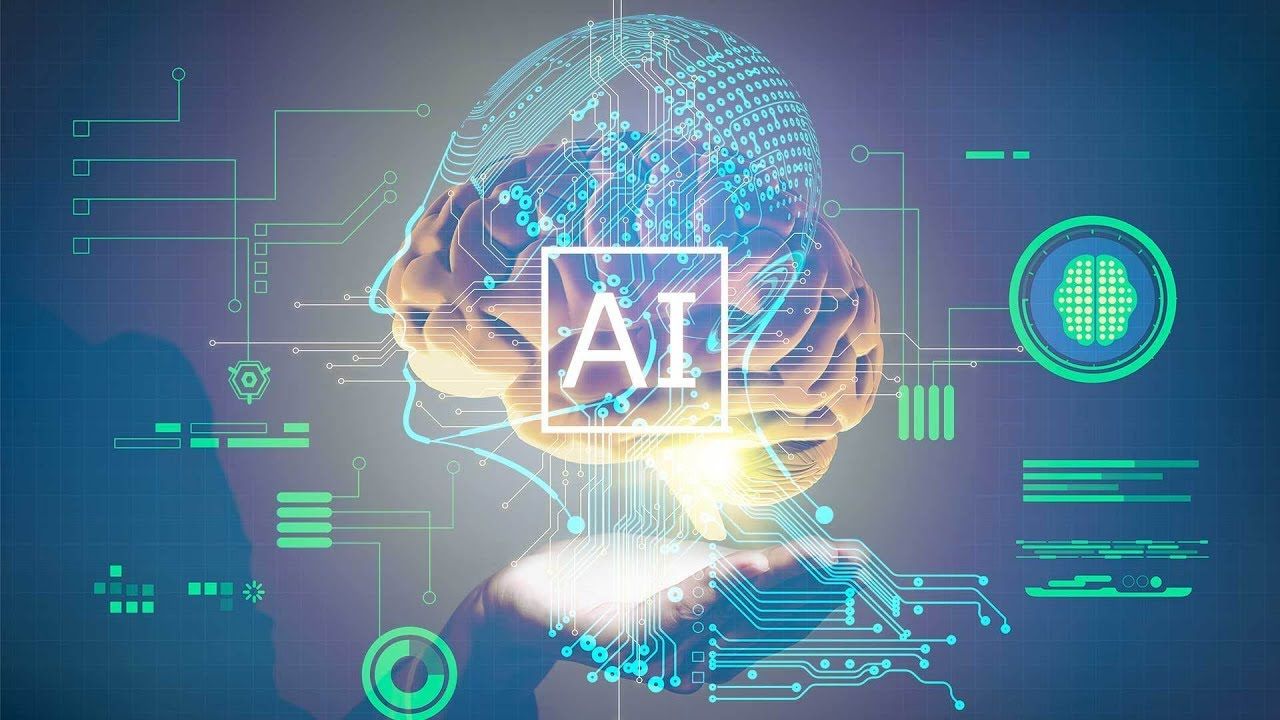
To combat this Uber have developed their own machine-learning-as-a-service platform called “Michelangelo” that offers their in-house engineers an end-to-end service to develop, evaluate and eventually launch machine learning programs on one convenient platform. Uber have speculated over releasing Michelangelo 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, have 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, *blog.google*, 2018)

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 there are countless other companies 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, *cnet.com,* 2019). Apple have been using machine learning in Siri to “do more than call someone on your contact list” (Andy Patrizio, *datamation.com,* 2018) 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, *news.mit.edu,* 2020).

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 a 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 (astutesolutions.com, “ANI: Artificial Narrow Intelligence”, *viewed 9th July 2020*). Currently all forms of artificial intelligence that exist in the world fall under this category.
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, forbes.com, 2019).
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).

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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 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. According to Joel Rosenblatt (Bloomberg.com, 2019) in May 2019 Facebook was forced to pay $5 billion to a U.S. Federal trade commission over the investigation.

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Another of the key issues with artificial intelligence is deciding who is responsible for legal breaches made by the program. It is arguable that a program with artificial intelligence capabilities is able to 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 harvardmagazine.com (Jonathan Shaw, 2019, havardmagazine.com), “AI systems can reinforce what they have learned from real-world data, even amplifying familiar risks, such as racial or gender bias”. 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 faucet 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, *forbes.com,* 2019). 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.

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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 afterwards. 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, *linkedin.com,* 2016), 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 recourses, 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, it is likely our entire experience will 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…

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