**(IT TECHNOLOGIES) Cloud, services, servers**

The concept of cloud computing has existed since the 1950’s when mainframe computing allowed a central computer to be accessed by multiple users. A single user did not need the considerable processing power or storage the mainframe provided. The suitable economic solution of providing shared access for multiple users to a single sophisticated resource was born, with terminals serving the sole function of providing users access to the mainframe (Neto, 2014). In the 1970’s, this concept was further enhanced with virtual machines – using software to create a layer over the bare metal hardware of a single computer with the elements of a processor, memory, and storage, allowing it to be utilized by multiple virtual computers - called virtual machines (VMs). Each individual VM behaves as an independent computer and runs its own operating system (OS) by using just a portion of the underlying hardware.

Virtualization in turn gives more efficient use of the physical hardware or server with these virtual environments - and therefore a better return on the investment costs. The VMs simulate physical computer servers in purely software form. Hypervisors are the software layer over the hardware which coordinates the VMs as the interface between, giving each access to the resources it needs to work. The hypervisor also prevents the VMs from interfering with one another or imposing on each other’s computer cycles or memory space (IBM Cloud Education, 2019). Virtualization is a fundamental part in the foundation of the cloud as we know it today, and the development of the Internet gives users access to servers across the world and the use of hardware, storage and software not kept on their own physical computer.

The cloud is an essential part of life in today’s online world. Millions of worldwide users access it daily for web searches, connecting and working remotely, online shopping, news articles, social media, music, and entertainment streaming services - all done via the cloud. Emails no longer need to be sent from the same computer running a specific program - now accessed anywhere, anytime and sent via a web-based service eg. Hotmail, who takes care of storing and processing their client’s emails through their own servers (Woodford, 2020). Services offered via modern day cloud computing, set to grow and expand in the coming years, are outlined as follows:

* Infrastructure as a Service – or IaaS – provides clients or organizations access to storage, networking, and servers as part of their resources. Companies no longer need to keep physical hardware on site and only pay for what they need, without the effort of tasks like backing up, maintenance, and archiving. Amazon Web Services offers IaaS through their cloud platform.
* Platform as a Service – or PaaS – offers access to a cloud environment from which a developer can develop, manage and then deliver their own applications without having to also host them. Google App engine offers this service via their Google managed data centers.
* Software as a Service – or SaaS – is the one most of us are familiar with and likely to have used. It is cloud based software and applications that can be accessed via the web or a service provider, allowing for users to store and collaborate on projects. Github is classed as a SaaS, providing user control software with space to store code (IBM Cloud Education, 2019).

What does the future of the cloud look like? By 2025, the cloud will serve as the key element in end-user and business innovation. It will do this by offering next-generation services to those utilizing the cloud, giving them greater capabilities to enhance their core competencies (Lerner, 2021). The pandemic has already pushed acceleration for companies moving to the cloud, supporting the world economy by enabling business continuity and allowing employees to work remotely with accessibility and flexibility (Goodison, 2020).

Edge cloud computing is expected to see further development with the rise of connect devices (Internet of Things), and by 2025 nearly 30% of data is estimated to need real-time processing (Analytics Insight, 2021). Edge computing can reduce data traffic by processing data closer to the customer. This will require three times more scaled-down data centers to be built geographically closer to the edge of the network, where the user content is consumed and created (Mobile Experts, 2019). The need for more physical yet smaller data centers will generate construction work and require employees to man the centers. Mobilization of edge computing will enhance user-end experiences and reduce latency, for example when accessing entertainment streaming services like Netflix.

Artificial intelligence cloud computing merges the capabilities of machine learning with cloud-based environments. Everyday examples of this include Amazon Alexa, Google Home and Siri as digital assistants - able to make connected and intuitive experiences, such as choosing music, adjusting home lighting or heating, or making online purchases instantly. It was recently reported that the annual AI market will globally reach $89 billion by 2025 (EZmarketing, 2020). SaaS providers are now adding AI tools into software, with the ability to capture customer data to allow better functionality to users by personalizing their customer relationships. AI can help clients/businesses identify customer patterns in interactions, providing insights and recommendations for future interactions. AI turns data into actionable insights in areas such as sales and customer engagements. Cloud computing has made AI technology available to even the smallest of clients and businesses, enabling them to utilize their data to provide better services, become more efficient in their processes, streamline workloads, and enhance productivity via automation of repetitive tasks in IT infrastructures. AI in the cloud means more processing power, identification of patterns, and predictions with its growing analytical capabilities and deep learning algorithms. It may soon be able to independently run routine operations, by monitoring and making corrections to systems – and forecast stock portfolios, real estate investments, disease prediction, and streamlined delivery services. Advances in cognitive computing and algorithms combining language processing, data mining and pattern recognition are making this future of AI possible. Automation by AI in the workforce may eliminate some positions, yet it is set to create jobs – with estimates of AI creating up to 97 million new jobs for job seekers by 2025 (Rodrigeuz, 2021).

Serverless computing is increasing in popularity among developers and product owners, as Function as a Service or FaaS. It allows the team or customer writing the code to focus on the core product - while the provider takes care of infrastructure concerns like servers, hardware, container management, virtual machines and even any tasks – for example multithreading - that are often built into the application code (Fruhlinger, 2019). In turn, this allows product owners to spend less on infrastructure and running time costs, with better service scalability - unlike traditional architecture. Serverless computing allows for developers to reach the market faster, for less cost to investors or product owners, with this potential to scale (Brunko,2020). Serverless computing in the cloud opens the door for enhanced developer productivity, reduced cost for infrastructure, and furthers innovation for the future of applications and delivery of new products and services for clients and customers.

Cloud gaming is set to be revolutionized on the cloud, with the likes of Amazon and other startups moving to offer their own platforms for cloud gaming – where users can pay a monthly subscription to access large libraries of games, instead of the traditional method of downloading the game onto a user’s device (smart phone, gaming console, PC). Latency and bandwidth have been the main challenges of game streaming, compared to streaming film and television entertainment - where the end content is the same for every user and is delivered downstream. Game players are continuously influencing the media experience shown to them, with each player receiving an individual view. Need for greater bandwidth for cloud gaming is an important factor. Large scale uptake of 5G is possibly the future in delivery of cloud gaming services, enabling a richer experience and the incentive needed to attract gamers to the cloud. Telecom companies will need to review strategies for delivering the needed network requirements and comparative costs to gaming households (Arkenburg, 2020). The future of cloud gaming may eradicate the need for gamers to invest in hardware such as high-end PCs or gaming consoles, as long as networks connecting to the cloud can handle the user traffic in cost sensitive ways.

The cloud is set to provide the foundations for future IT developments, accessible to a wide array of global users. It aims to enhance user experiences, opportunities and create further employment opportunities. We live in an exciting new technological world, and the cloud has personally affected me and those close to me in positive ways. I can access and complete a university degree via Canvas with RMIT, enhancing future career opportunities. I can connect and collaborate with students for team projects on SaaS cloud services - and then future business - via Microsoft Teams and GitHub. I can safely ask artificial intelligence – Hey Google - for assistance and directions, hands free while driving my car. I can access and enjoy libraries of entertainment in the form of Netflix streaming. Our family business has a website with user accounts and online products for purchase to be hosted and accessed via the cloud, boosting sales and customer relations. Cost effect availability of serverless computing or PaaS offers me the opportunity to develop games or applications. The potential for startup ideas to get off the ground becomes more achievable, with access to a wide range of services and infrastructure via the cloud, as well as the prospect of new and developing jobs. The impact of cloud computing has been in shaping a connected, innovative, and agile world for individual users to big business – with the future of smart cities including automated vehicles, efficient power plants and farms, and enhanced public transport on the not-to-distant horizon (Linke, 2021).

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