

Millennial National Security's Cornerstones 5G, Cloud Technology, and Artificial Intelligence

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Abstract

Yesterday, humans were the only living thing species that can talk and have a conversation among them but today this has changed, non-living things such as refrigerators are able to tell us if it is working properly, what we have in it, send you a picture to your mobile phone what needs to be bought if we running low on something, they can even search the internet for close by stores for the best prices and send you the information with location's GPS coordinates and a map to follow, and if you can't go, it will order it for you and have it delivered to your home. How is this happening, the answer is 5G, cloud as a service, and artificial intelligence. Our world is going to change dramatically. We're going to have a world with more variety, more connectedness, more dynamism, more complexity, more adaptability, and of course more beauty. The shape of things to come will be unlike anything we've ever seen before; a new partnership between technology and humanity, this is a future well worth looking forward to. Fundamentally, with 5G connecting almost everything, public cloud has all the data, and artificial intelligence with its revolutionary power that could predict human behaviour. Technologies are amazing but could be frightening same time, technologies must be protected and most important protect us if it falls in the wrong hand. National security regulations offer checks and balances that guarantee the useful, productive use and prevent corruption and destroying society.

Keywords — 5G wireless network, Public Cloud, Internet of Things (IoT), Fixed wireless access (FWA), Long-Term Evolution (LTE), Mobile network operator (MNO).

I. INTRODUCTION

The popular and perhaps the dominant understanding of 5G, it is just the next generation of wireless communication, it is just about speed increase downloading videos, music, or data. In fact, 5G evolution is about enabling uploading extensive amount of data from a huge significant number of devices same time, process the data and make it available for users anytime anywhere in a blink of eye or sometimes just be ready for the user whenever

and wherever it is needed. The technology progress has taken a giant leap to a point that the millennials by year 2030 will consider their parents like a stone age. This publication will cover the 5G technology development, global deployment, and its industrial strategy around the world [1].

Technology progress cannot be stopped and the changes over the next 20 years will supersede all that happened in the last 2,000 combined. Matter of fact, we are at the dawn of a new age in human history where natural human capabilities are going to be augmented by computational systems that help you think, robotic systems that help you make, and a digital nervous system that connects you to the world far beyond natural senses. During our journey here, we will empower the reader knowledge by highlighting the latest advancement on public cloud and what can be done with the data utilizing artificial intelligence [2], [3].

“With great power comes great responsibility”, there are unanswered questions over these technologies, they could be used for the good reasons but also could fall in the wrong hands. National security is a vital priority and a fundamental responsibility of the federal government to provide the right policies and capabilities to fulfil strategic objectives without incurring an unacceptable level of risk. National security is responsible for global monitoring, collection, and processing of information and data for foreign and domestic intelligence and counterintelligence purposes. The publication will explain how national security plays an important role with these technologies and how they could be used to protect citizens, reduce crimes rates, and save lives [4].

II. 5G TECHNOLOGY DEVELOPMENT

The goal of 5G networks is to increase reliability and reduce latency to less than 1 millisecond, which is far more rapid than the comparatively sluggish figure of 200 milliseconds – even in ideal conditions – for existing 4G technology. Accordingly, ultra-reliable connections could become instrumental for mission critical applications due to the effective elimination of any element of risk. Due to low-latency, the autonomous vehicles will have the ability to evaluate the situation and stop before hitting a human being because the processing is real time. It



will allow surgeons to perform operations from thousands of miles away in real-time, if it was not real time, the consequences will be fatal, 5G will get us where want to be. Fig.1 depicts a simple and clear comparison between current 4G technology and 5G along with the human reaction time as well [5].

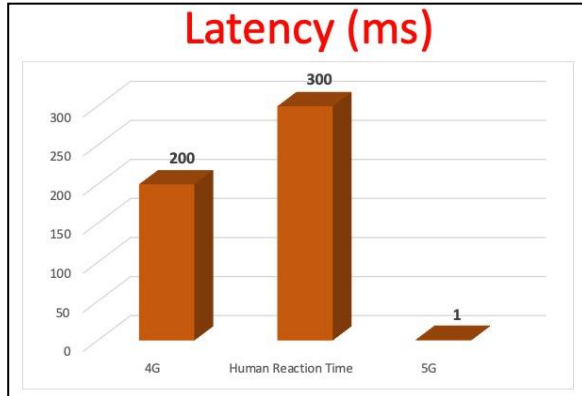


Fig 1: Latency difference between 4G and 5G

The radio frequency portion of the 5G is technologically advanced and focuses on three major aspects:

- **Focused beams:** Rather than transmitting a wide area broadcast spread over a segment of the cell around a base station, an “active antenna” technique is used to form a set of steerable radio beams with power focused on a small area – the receiving handset.
- **Potentially much higher frequencies and greater bandwidth for higher data rates:** Centimetric (3-30 GHz) or in millimetric bands (30-300 GHz) and popularly branded “mmWave”, but present technical challenges that are expensive to solve
- **Shorter range, more interference and indoor penetration:** That has major impacts on the capital cost of the cellular radio network and subject to more interference from weather – rain, snow, fog – and obstacles - wet foliage or buildings and their walls. This means that, at higher frequencies, indoor use may be problematic if based on through-wall or window penetration.

While technical standards for the next generation of mobile radio services are not yet finalized, the EU, USA, China, and other countries are still planning to be the first to deploy a working commercial network. China is currently backing 2.6 GHz for 5G, which may influence other countries. In the EU, the Radio Spectrum Policy Group (RSPG) favors the 3.6 GHz band (3.4-3.8 GHz), the 26 GHz band (24.25-27.5 GHz) and the existing EU harmonized UHF bands for mobile services, below 1 GHz, such as the 700 MHz band and above in the UHF range, in its third opinion. USA four major mobile carriers are conducting their trials on the 26 GHz band (24.25-27.5 GHz), 2.5 GHz, and 600 MHz.

Thus 2019 will be a key year for working standards. Agreement on standards for spectrum may be reached at the World Radiocommunication Conference (WRC-19) in October-November in Sharm El Sheikh). It should determine the use of particular spectrum bands for 5G in each of three global regions for the next four years and beyond. The next 3GPP 5G standards contribution, Release 16, is for the IoT applications in smart cities, massive machine communications and connected vehicles, etc., and is expected in December 2019 or early 2020 for handover to the ITU working groups for endorsement.

Significant concern is emerging over the possible impact on health and safety arising from potentially much higher exposure to radio frequency electromagnetic radiation arising from 5G. Increased exposure may result not only from the use of much higher frequencies in 5G but also from the potential for the aggregation of different signals, their dynamic nature, and the complex interference effects that may result, especially in dense urban areas. While the International Commission issues guidelines for limiting exposure to electric, magnetic and electromagnetic fields (EMF), the problem is that currently it is not possible to accurately simulate or measure 5G emissions in the real world [6].

III. 5G GLOBAL DEPLOYMENT

5G will bring a huge advance in speed and reliability to mobile devices and will enable a new wave of technologies and applications such as smart cities, advanced manufacturing, healthcare systems and connected cars.

5G is more complex than previous wireless technologies and should be considered as a long-term project to solve technical challenges and develop a clear business case. It is becoming clear that 5G will cost much more to deploy than previous mobile technologies (perhaps three times as much) as it is more complex and requires a denser coverage of base stations to provide the expected capacity. Accordingly, economy and jobs will be strongly stimulated by 5G deployment. MNOs have limited capacity to invest in the new technology and infrastructure as their returns from investment in 3G and 4G are still being recouped.

5G communications networks will enhance the performance of the internet of things, autonomous vehicles and other technological advancements in the 2020s. China will exert greater effort to set the parameters for the development of the new network. 5G is representing a great leap forward over its relatively pedestrian predecessors [7].

China is already a leader in antenna and base station architecture with Huawei and ZTE, whose only global competitors are South Korea's Samsung, Finland's Nokia and Sweden's Ericsson. Although the Scandinavian equipment vendors have a small lead when it comes to memorandums of

understanding on 5G and pilot tests with global carriers, Huawei surpassed Ericsson in 2016 to become the world's biggest producer in mobile equipment, gaining a global market share of roughly 30 percent. Fig. 2 shows the top five telecommunications equipment vendors in 5G network trials across the globe [8].

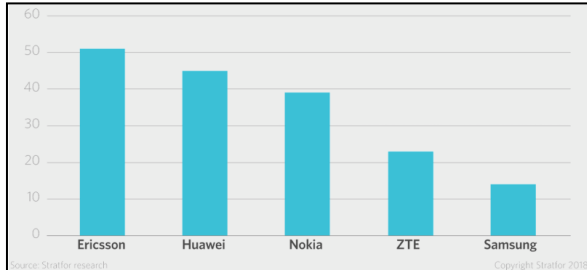


Fig 2: Top Five Telecommunications Equipment Vendors in 5G Network Trials

The United States will seek to protect what remains of the 5G industry in the country, even if the manufacturing process is not always based there. This is one reason Washington has focused so strongly on China's intellectual property strategy and technology transfer, especially when companies like Qualcomm do not always manufacture the semiconductors that they design, instead outsourcing them to pureplay foundry companies (which produce semiconductors using someone else's designs), some of which are based in China [9]. Fig. 3 shows the telecom carrier operators and their manufactures' partners for the 5G trials across the world.

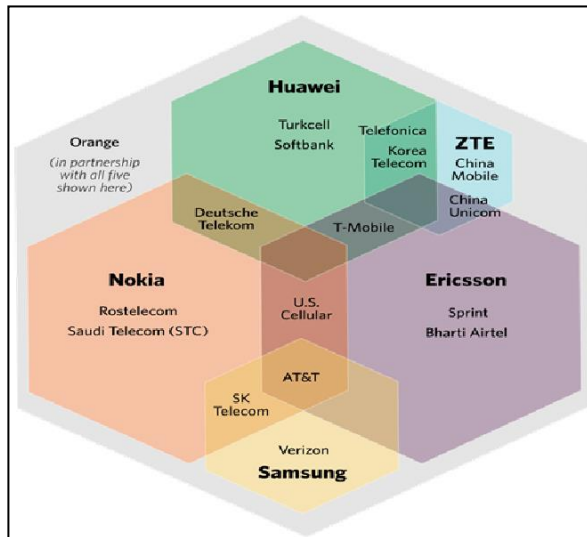


Fig 3: Telecommunications Carriers and 5G Manufactures' Partnership

The real key players in the world and considered the 5G deployment leading economies are USA, EU, China, Japan, the Republic of Korea, Singapore and Taiwan and the rest of the world likely will follow their steps. Some are producers, consumers, or both. Producers of 5G technology are Korea, Taiwan, consumers of 5G technologies are Singapore, Europe falls in the latter category, along with the USA, China

and Japan. Nokia and Ericsson are considered significant equipment suppliers as well as various key integrated circuit designers (e.g. ARM/Softbank) despite ownership by Japanese, US or Chinese enterprises. Fig. 4 describes the 5G Global Geographical Deployments.

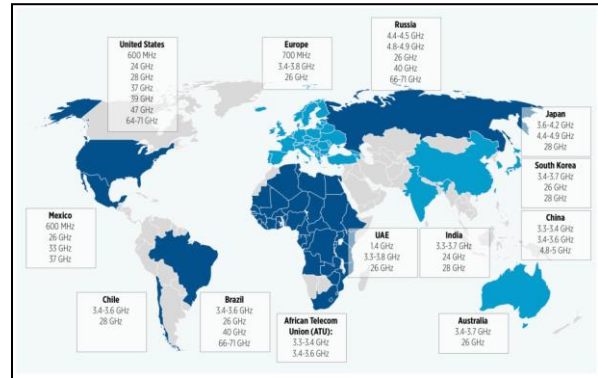


Fig 4: 5G Global Geographical Deployments

A. USA

The plans of the major four MNOs – AT&T, Verizon, Sprint, and T-Mobile – will determine the USA's progress in 5G for the next five years. They are quite diverse in terms of what they term "5G", their business models, rollout schedules, and which parts of the spectrum will be used. Only prototype handsets have been available for first consumer models are already existed in 2019. The Federal Communications Commission (FCC) held a high-band spectrum auction (i.e. above 10 GHz) in November 2018, but it is unclear when mid-band spectrum (i.e. above the UHF band from 3 GHz - 6 GHz) will be made available perhaps sometime in 2020.

1) AT&T

AT&T remains reserved about 5G for Fixed Wireless Access (FWA). AT&T has been offering its own form of 5G that has caused some controversy, termed 5G+ but which is essentially an upgrade of LTE. AT&T proposes the Netgear Nighthawk 5G Mobile Hotspot device to run on AT&T's 5G+ network but over mmWave spectrum rather than UHF. Controversially, it has branded its LTE network as 5G Evolution or 5G E, a clear example of the hype surrounding 5G.

2) Verizon

In October 2018 Verizon launched "5G Home", speeds range from 300 Mbps to 1 Gbps, it offers FWA broadband for home connectivity in parts of few large cities, the service tariff is \$70 per month or \$50 per month for existing customers. Verizon's network is based on the 28 GHz spectrum for which it holds a license which suits rapid data downloads but not coverage of large areas.

3) Sprint

Sprint has the most 2.5 GHz spectrum of any MNO in the USA, and proposes to re-use it for both LTE and 5G, in city centers via massive MIMO, so it can leverage its current macro cell sites and towers. Sprint is still discussing a proposed merger with T-Mobile USA, hoping to combine its 2.5 GHz 5G network for city centers with T-Mobile's 600 MHz network for rural and suburban use, with future centimetric bands near 26 GHz, and higher, for dense urban settings in the future.

4) T-Mobile

T-Mobile does not want to waste its vast 600 MHz spectrum investment. The MNO expects the FWA coverage based 5G to offer 100 Mbps data rates for up to two-thirds of the US population in the next 5 years and cover 90% of the USA by 2024. The 600 MHz band will be the carrier for launch and first rollout, with 28 GHz and 39 GHz bands in a second stage. Their strategy is to demonstrate high speeds with a broad coverage early and corner the US market. T-Mobile also confirmed a successful tri-band video call leveraging its latest technologies, for three users connected via three different spectrum bands – 600 MHz, 28 GHz, and 39 GHz. T-Mobile signed two \$3.5 billion contracts with Ericsson and Nokia in August 2018 to support this nationwide 5G NR network deployment.

The USA is moving towards some form of rollout of mobile broadband as 5G but not necessarily in a holistic, well-orchestrated operation, Fig. 5 shows the current 5G deployment in USA.



Fig 5: Current 5G deployment in USA

B. China

China has invested in a 5G national action plan to orchestrate its industry R&D and deployment efforts through central government support (China Mobile, China Unicom and China Telecom). China Mobile (the current market leader) could benefit most, being awarded 2515-2675 MHz and also 4.8-4.9 GHz bands. This 2.6 GHz band is typically a 4G band and also could be for 5G, with longer range than the higher frequencies, lowering the cost of a new network. China Telecom received 3.4-3.5 GHz and China Unicom was awarded 3.5-3.6 GHz. Taking the

longer-term view of China's investment plans and Huawei's problems, China may lead the world eventually. Overall for the various reasons cited above, a slow rollout is expected, beginning later in 2019.

C. Japan

Key spectrum bands are yet to be confirmed but may include 4.5 GHz, 28 GHz, 39 GHz and 90 GHz. They claimed the world's first successful 5G communications, and noted a 5.5 Gbps throughput, for the trial with eight users having prototype 5G handsets. The pilot demonstration in Kawasaki City used inter-base station coordination in the 4.5 GHz band to control the beamforming. Other NTT DOCOMO trials have used 28 GHz. Japan began its experimental trials of 5G in 2014 and so has nearly five years of understanding of the practical challenges. Consequently, the recent attempt to reduce the hype is interesting and it also echoes the views from China –the technology will take much longer to come to fruition than previously thought.

D. Korea

In February 2018, Korea's Winter Olympics pilot demo was a focal point for early 5G investment and trials by the MNOs, such as KT, which showed its network for 20 Gbps with latency under 1 msec and aiming for over a million devices per sq. km. It was intended to serve the public and user sectors. That introduced 5G base stations with active MIMO antennae, fiber-to-the- antenna to reduce latency in the base station, microwave line-of-site backhaul in mmWave bands with diverse routing for reliability, plus testing of mmWave operation.

Naturally the largest Korean company, Samsung, will also participate, with its Large-Scale Integration (LSI) business to make the chipsets for 5G. Samsung would prefer that the 28 GHz spectrum, in which it is stronger than in 3.5 GHz, will be the basis of 5G standalone (SA) deployments early (in 2019 and 2020) to give it an advantage over Huawei.

In many ways, Korea's 5G motives are quite different to those of other countries. Its aim is to perfect its 5G equipment offering, especially in chipsets. Those LSI substrates for the software-defined radio modem, RF integrated circuits and MIMO antenna chips could be the foundation of every 5G base station and 5G smartphone, both for their own smartphone sales (Samsung, LG, etc) but also to sell to every other smartphone vendor, including the Chinese and Taiwanese. In some ways, the country acts as a laboratory for its export initiatives.

E. Singapore

In many ways, Singapore, although a unique commercial and managed innovation environment, is a more useful yardstick for the EU than the USA or China. It is more relevant especially as the target of

this technology is the dense urban center. It balances existing UHF technology and 5G in a way that looks at business cases pragmatically, rather than in a hopeful “build it and they will come” syndrome.

F. Taiwan

Taiwan depends on its major ICT suppliers for economic success and technical leadership, and so, like Korea, views 5G as a technology to be sold globally. Hence, Taiwan has to invest in its own 5G infrastructure so that it may use it as a learning tool. It is one part of its industrial strategy for leading in global exports. Taiwan may lag Japan and China in field testing but its prowess in the latest semiconductor manufacturing will assure its presence in supplying several of the key components for base stations and handsets.

IV. 5G INDUSTRIAL STRATEGY

After technology is figured out, the most obvious concern is what is the deployment strategy, who is going to fund the operation, how soon a large significant number of small cells can be deployed in densifying the network. China and the Asian Tigers have an advantage here because their political structures and culture mean that they can mandate deployment without the need for public assent. In contrast, deployment of small cells in the USA will have to overcome legal challenge at municipal and state level in response to the FCC’s proposed light-touch regulation. A third factor concerns the scale and who is the driving force behind the 5G campaign. The level of marketing activity is a key, with intense lobbying of governments by equipment suppliers and operators – and also of the public by governments [10].

There are broadly three main actors in the 5G initiative – first, governments who can invest, then suppliers and operators. The drivers for politico-economic position between these three players consists of a trio of components ranked in order of impact, based on examining industrial strategy to manage innovation for growth:

- **The strongest driver** – government industrial policy to stimulate national or regional industry.
- **Secondary driver** – supplier pressure on the MNOs and then on governments.
- **Subordinate driver** – operator acceptance of a sound business case and the need to invest.

Analysis shows three models of 5G promotion and financing – EU, Asian producer nations, and USA, as shown in Fig. 6 below [11 - 13].

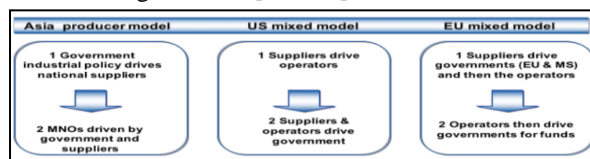


Fig 6: 5G financing Models

V. PUBLIC CLOUD AND ARTIFICIAL INTELLIGENCE

Cloud computing is taking over. Demand continues to rise from both companies and consumers that rely on remote storage and computing power accessible from anywhere. Tech giants Amazon AWS, Google, Microsoft, IBM and others are vying to be the Go-To providers behind a lot of the technology we use, from calling a Lyft to checking your video doorbell, to streaming your favorite shows. When people are watching a Prime movie, or they're watching a Netflix movie, or a Hulu movie, or others like that, they're watching it and streaming off Amazon Web Services, the Super Bowl streams off AWS and Major League Baseball and now NASCAR and Formula One racing as well, if you use Intuit to do your taxes in USA, that runs on AWS. Fig. 7 explains how our life transforming to be smarter and intelligent [14].



Fig 7: IoT and Smart Life

Company and customers move to a cloud service provider save between 22 and 54 percent versus running all in, building their own data center, their own networks, powering it, having people to operate it. One of the biggest reasons that people look to the cloud is not necessarily cost, but around flexibility. Developers can get access to massive amounts of compute and storage and networking resource as well.

5G will start moving the needle on mobile data growth in 2020: The latest Cisco Visual Networking Index is forecasting a seven-fold increase in global mobile data traffic from 2016 to 2021, with 5G traffic expected to start having a relatively small but measurable impact on mobile growth starting in 2020.

Fig. 8 shows 5GaaS architecture model utilizing Multi-Cloud platform to be able to reach everything end to end.

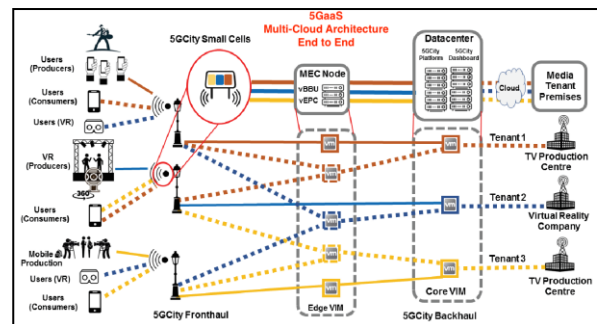


Fig 8: 5GaaS Multi-Cloud Architecture End to End

According to Cisco's 11th annual VNI, more members of the global population will be using mobile phones (5.5 billion) than bank accounts (5.4 billion), running water (5.3 billion), or landlines (2.9 billion) by 2021. Strong growth in mobile users, smartphones and IoT connections as well as network speed improvements and mobile video consumption are projected to increase mobile data traffic seven-fold over the next five years [15]. Fig. 9 shows the Global Mobile Data Traffic Growth; Global Mobile Data Traffic will increase 7-Fold 2016-2021.

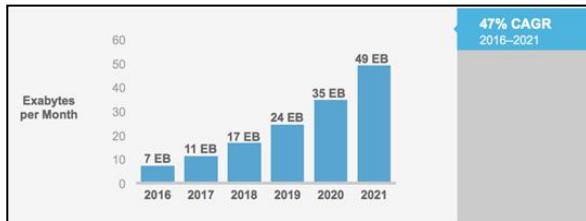


Fig 9: Global Mobile Data Traffic Growth

The business potential of Artificial Intelligence (AI) has been on the horizon for a long time but many businesses have found AI hard to implement or even imagined. Machine learning is about to teach computers to learn than to program them with every single skill needed to complete a given task this, However, deep learning is a subset of machine learning that uses neural networks a set of algorithms modeled on the human brain enable AI to tackle even bigger problems. Machine learning and deep learning in particular have enormous potential for the entire economy such as voice recognition, improve medical diagnosis, and even self-driving cars.

Implementing machine and deep learning can be super hard to implement alone into a business's workflow which can be a complex undertaking. Second, it is computationally intensive and expensive, buying and running the compute power necessary to implement deep learning can be cost prohibitive. Thanks to three global dominant public cloud providers; Amazon AWS, Microsoft Azure, and Google GCP, positioned to take on both challenges. They use the same advanced machine learning algorithms powering everything from search recommendations to voice interactions with devices such as Alexa App or Google Assistant. To remove the complexity of developing AI applications, AWS for instance developed the Amazon sage maker platform making it easy to get started with pre-installed algorithms and with new reinforcement learning, it allows agnostic support developers have the flexibility to use whichever deep learning frameworks they are most comfortable with including Tensorflow, Pyorch, and Apache MXNet. To meet the computational demands and high costs through harnessing the power of Nvidia GPU core, it provides the fastest network throughput.

Machine learning on public cloud has enabled leading financial service company's data scientists to train new machine learning models in hours instead of days or even weeks such as models that helps

troubleshoot customer problems can now be trained in as little as 30 minutes. Fig. 10 illustrates the logical flow of communications between connected devices and artificial intelligence [16].

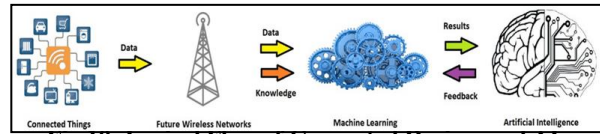


Fig 10: Logical Flow of Connected Devices and AI

In banking cyber security, major financial institutions use machine learning mitigate risks to flag fraudulent or questionable activity and alert account holders in real time. In medicine drug discovery is sped up scientists that biotechnology companies have used AI technology to make sense of genes in clinical trials more quickly with the help of algorithms.

Machine learning has the potential to revolutionize the way we do business but it needs to be easy to use, businesses of all sizes can utilize the power of artificial intelligence to maximize the present and stay one step ahead of the future.

In the last decade artificial intelligence has gone from a science-fiction dream to a critical part of our everyday lives. AI technology is to interact with our phones through Siri and Alexa. Cars like Tesla's interpret and analyze their surroundings to intelligently drive themselves. Amazon monitors our browsing habits and intelligently serves us up products it thinks we'd like to buy. Even Google decides what kind of search results to give us based on who it thinks utilizing artificially intelligent algorithms but this is only the beginning because in the future AI is going to change everything.

The simplest descriptor of artificial intelligence is collecting data about the world and using that data to make predictions in the short and long term that applies to both people and machines so when we talk about AI in our lives we're talking about everything from a computer being able to read a handwritten document like an OCR reader to a robot performing complex surgery on its own even to a massive database categorizing your personality based on what you've written and looked at online because the world of AI is so incredibly large.

Some of the most groundbreaking developments are expected to see in the very near future and whether that's a step forward or backward for society, first and foremost AI systems are already primed to take over thousands if not millions of jobs any job that consists of a human taking down information from other humans and inputting it into a system is likely to go obsolete so cashiers, receptionists, telemarketers, and bank tellers are all on their way out. As self-driving cars, self-operating drones, and other conveyors from A to B get more complex will also take over cause loss of jobs like truck drivers, postal workers courier services, even pizza delivery factories are also becoming fully automated. Car washers, movie theaters even jobs such as journalists

are threatened by rapidly improving news algorithms that can gather information and deliver it faster and more accurately.

As society changes to accommodate in all machine service world, it will also open up new jobs for the next generation; writing software repairing, maintaining robots, and developing new and better systems. Even with most notably machines are also primed to take over dangerous jobs firefighting mining deep-sea oil drilling construction and other careers with high mortality rates will be replaced by machines that can't get sick or hurt.

Economists and scientists believe that the world will be a brighter and more rewarding place with machines taking over the more dull and hazardous jobs as we develop better AI we're discovering that it cannot just replace human labor but also think in ways that humans can algorithms that can monitor and process massive amounts of information and make conclusions based on patterns in that data are poised to change every avenue of society starting from something small like optimizing traffic patterns over time to figure out the best routes to take or how to fix roads and rebuild highways all the way to something much more serious like monitoring epidemics and disease and stopping them before they spread.

Machine learning has even shown to analyze human behavior and predict warning signs but recognizing common language used by people like sexual predators or terrorists and alerting law enforcement to take action to prevent it. Improving lives through increasing connectivity across the world is the goal and artificial Intelligence research and innovation is to create a safer, faster, and healthier world.

Facial recognition is a great promise offered by data-driven technology. China is the world's leader in the use of this emerging technology and many artificial intelligence startups are determined to keep it that way in the future.

It is a meth and pretty much deceiving the claims about people are unhappy because a lot of machine learning artificial intelligence stealing their jobs based on the concept that AI will create machine to do what the humans are doing, the truth is that AI meant to create machines to do what the humans cannot do, be more powerful, faster, able to memorize, facts are those people just not adapting or not willing to learn or to adapt to do something else than what they are used to do.

For the next decade at least will be greater opportunities for different job creations, some of which will be just doing what human are normally doing, the normal person will question why these people getting paid for just doing normal things, the surprise here is not about what they are doing but about teaching computers the human behavior, neural thinking to be able to help humans the following decades later to come.

VI. NATIONAL SECURITY

Keeping up to date and reviewing the status of 5G deployment technical and economical wise in countries such as USA, China, Japan, the Republic of Korea, Singapore and Taiwan is very important to build a proactive dynamic model for the National security.

Qualcomm's challenges prompted a hostile takeover attempt by Broadcom earlier this year for \$121 billion. Broadcom's move, however, raised immediate concerns in Washington regarding the implications for U.S. national security and technological leadership following suggestions that it would cease funding for Qualcomm's 5G research and development, thereby allowing a Chinese competitor like Huawei to potentially emerge and supplant Qualcomm as an industry leader. Broadcom, a Singapore-based company, had promised to move its headquarters to the United States and continue investing in 5G to help facilitate the deal, but the pledges failed to persuade U.S. President Donald Trump, who nixed the deal with an executive order in March. The decision also relieved Intel, which had even toyed with the idea of acquiring Broadcom just so it could scuttle the deal and prevent the emergence of a new colossus in its midst.

China is not anymore to be thought of as the country that makes cheap counterfeit products, China has already moved to a new role, a role of advanced technologies such as AI, autonomous vehicles, robotics, Space, and 5G [17].

The Chinese government also controls China's wireless service market and is pushing its three major providers, China Mobile, China Unicom and China Telecom, to combine efforts to develop a standalone 5G network that'll commercially launch in 2020. Now the market for 5G gear is led by Chinese-based Huawei as well as Nokia and Ericsson, both based in Northern Europe.

Huawei is one of the biggest makers of 5G equipment, and its technology is also considered to be the most advanced. And it's the second largest smartphone maker behind Samsung, having surpassed Apple last year.

Huawei is in the middle and a factor of escalating the trade war between the US and China, Huawei is to be considered a dominant supplier in the 5G market but from US national security point of view, Huawei has a close tie to the Chinese government which could be interpreted as a threat. Despite Huawei what seems to be a security issue with United states, so far It has nothing but positive effect by promoting the company globally and despite the warning from US. Some of United States' European allies Germany and UK are reportedly considering allowing Huawei to build their 5G High Speed infrastructure because it is simply it is technologically advanced, reliable, and affordable.

None of the big four US carriers uses Huawei equipment, so the impact is minimal however the

small rural carriers will be affected because they used Huawei and ZTE gear in their 4G networks since it was more affordable. And this could be a problem for getting 5G into rural communities. FCC Commissioner Geoffrey Starks and others are pushing to have this Chinese gear ripped out and replaced to ensure the security of US wireless infrastructure, however price tag on replacing Huawei or ZTE technology will likely range from \$800 million to \$1 billion.

5G requires deploying small cells that are more densely packed and is going to allow much larger number of devices to be connected to the internet, those small cells will not only be transmitting and receiving for connected devices and users, it could be equipped with other advanced equipment such as cameras, motions sensors, microphones, and more.

IoT is not only about the mobile devices, it is everything around us; autonomous vehicles, traffic lights and roads, and exercise equipment. When you have almost everything is connected along with the industrial sensors such as electric, water, gas, etc. and using AI and deep learning, an intelligent life is established or we call it these days, smart cities. From IoT smart cities to advanced equipped small cells, it creates a more secure platform that intelligence service can use to protect citizens.

It is a new era where everything we know from humans to devices around us are connected with 5G technology, cloud environment to harness all data, and the significant power of artificial intelligence, all that could be used with massive surveillance audio and video to record and store actions and behaviors in real time like never before.

This information is being mined to identify social media trends for targeted advertising, but it's also being used to predict riots, election outcomes, disease epidemics, data from tweets and social media is useful for predicting both disease outbreaks. With the technologies are mentioned above combined with human daily life activities such as Twitter, Facebook, snapchat, or else, it could track things like restaurant apps, traffic maps, currency rates and even food prices. Even more, these non-traditional data sources, like restaurant reservation information, hospital imagery and so on to predict the flu, (see Fig. 11) [18].



Fig 11: Artificial Intelligence and Data Analysis

Advanced AI applications such as Embers mines big data for trends rather than information on individuals. For example, if it detects a mass cancellation of restaurant reservations and then hospital parking lots fill up, the system can predict that there is probably an outbreak of food poisoning or flu and it is incredibly accurate. It correctly predicted Hantavirus outbreaks in Argentina and Chile in 2013 and political uprisings in Brazil and Venezuela in 2013 and 2014. In fact, it is correct in its predictions about 90% of the time.

Crowd analysis is a very interesting area and very challenging, when you have thousands of people, it becomes very complicated. This is where AI comes in. For real time spontaneous events such as crowd stampedes or terrorists, with the video surveillance, AI, and complicated mathematical algorithms are used to track and predict the movements of dense crowds and the individuals in those crowds. It can help spot abnormal patterns in a crowd like bottlenecks and crowds can be diverted to uncrowded areas, thus avoiding stampedes and ultimately, saving lives.

Also, individual tracking from a place to a place, when he enters a store or an event. The Boston marathon bomber was seen in many different locations, inconsistently because of different cameras and belongs to different stores or else. Re-identification in the crowd is much harder because there are lots of people and those cameras do not belong or funnel to one system real time. Networks' cameras data are mined for suspicious behavior could stop future bombings, and it can also help law enforcement to make them more efficient and help solve crimes (see Fig. 12).



Fig 12: Intelligent Tracking System

Face recognition will change our lives, the human face will become your password unlocking smartphones and bank accounts, pay at the restaurant, get on the subway, go to the movie theatre, no more waiting to pay or check your ID. There are other advanced features such as track your movements or follow you around even be able to guess your sexuality through facial features alone which could be breakthrough of protecting crimes like rape. Face

recognition is going to feel normal for daily life activities.

Plans to use this new biometric technology to develop a vast national surveillance system based on facial recognition to monitor millions of citizens with the capability of tracking everything, from their emotions to their sexuality thru vast network of CCTV cameras. Merchandizes that are deemed dangerous could be tightly controlled and tied to the individual ID (see Fig. 13).



Fig 13: Biometric Technology

Some of the applications on face recognition is transforming a photo into text then teach machines to read faces. The face recognition model can measure the distance between the eyes, the width of the lips, the distance from the lips to the nose etc. At the end, it's this precision that makes the technology an effective new tool for surveillance. It can identify people without them knowing that they are being identified, as shown in Fig. 14.



Fig 14: Facial Recognition

China also is a harbinger of the future for this kind of technology, companies have access to a government image database of 700 million people; almost half of China's population is already using this widely in security, looking for terrorists or people who have warrants out for their arrest but they're also using it to let people pay in fast-food restaurants to access their parks without having to buy a ticket and even bizarrely to try and catch people whose steal toilet paper from public toilets.

The police officers are now trialing sunglasses and body cameras, loaded with facial and gesture recognition technology that is helping them to identify wanted suspects in real-time or monitor people entering malls or super markets by correlating data, pictures, videos, and AI analysis. Moreover, aggregating even more data to build predictive policing programs that imposes even tighter security for protection.

Tech companies are going forward full speed with their plans to make facial recognition as part of everyday life. This technology is a new kind of power and needs to be protected from the bad guys and this could only happen through government regulation and oversighting that allows only the perceived good uses. No one should stop the progress because of the fear of privacy, the advantages of security of business information and the whole nation is far greater than a single individual privacy issue.

The national defense could take this a step further, micro militarized drones self-flying, its processor can react a hundred times faster than a human and the stochastic motion is an anti-sniper feature, just like any mobile device these days it has cameras and sensors and just like phones and social media apps it does facial recognition. In addition, there are few grams of shaped materials inside those drones that could have anesthesia effect or temporary paralysing for living things such humans or animals and it also could be explosive that are enough to penetrate and cause malfunctions for non-living things such as vehicles with an accuracy that is considered airstrike with surgical precision, (see Fig. 15).

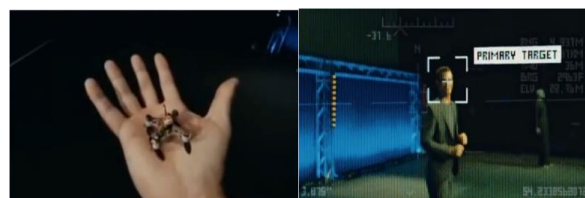


Fig 15: Modern National Defense

It could be improved and enhanced and trained as a team, they can penetrate buildings, cars, trains. Nuclear is obsolete, drones take out your entire enemy virtually risk-free. Just specify the target, characterize it, release the swarm and rest easy. National defense can target an evil ideology right where it starts. The next option is to integrate it with militarized technologies that we already have.

"If you have nothing to hide, you have nothing to fear", it is understandable that not everyone is convinced and will feel under surveillance but can we imagine for a moment how many cops in the street do not have to die anymore, how many soldiers' lives will be spared, how many innocent people will be saved, it is worth it to use these new technologies for the good of mankind.

VII. CONCLUSION

John F. Kennedy (JFK former US president) once said "Nuclear science and all technology has no conscience of its own whether it will become a force for good or ill depends on man"

5G networks will hold together many of the technology innovations that will define the world in decades to come, including the internet of things, outdoor autonomous robots for agriculture and industry, the smart utility grid, and autonomous vehicles and drones. Today, we are surrounded by devices and machines but they're not intuitive, they do not learn and do not retain and create a pattern in their mind and do nothing without our explicit direction. Tomorrow, artificial intelligence (AI) will change our lives, it is going to be generative, use a computer and algorithms to synthesize geometry, come up with new designs all by themselves. All it needs are goals and constraints.

Education is very important in the next few decades, if you're not innovative enough, if you're not creative enough, your job won't be available, you will be enforced to learn and change to a high-tech job and that might be uneasy and unfeasible to many of us. There is certainly a fear that robots are going to take jobs away from humans, and that is true in certain sectors. The better way to think about it, is that humans, robots, and AI to work together not to compete against each other. Machines are good in ability but human beings are good at the wisdom. One thing is clear, the situation is still evolving and changing and it is hard to predict what will happen next but 5G will result in economic growth, job creation, and prosperity. New generations living in smart cities with the state-of-the-art artificial intelligence technology will simplify our lives and help us do things we would never dream off. Finally, national security to utilize these technologies, monitor, regulate, and drive policies will keep us safe.

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