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Internet of Things

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EDITOR'S NOTE



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The initial point of communication between two separate computers occurred on October 3, 1969 marking the birth date of the Internet (i.e., interconnected networks). During the time of its initial conception, the worldwide web garnered a fair share of skepticism, with many favoring the notion that digital computing was a "fad" or unnecessary luxury. Today, experts may argue that digital communications largely form the backbone of our society.

Arguably the most unique tool emerging from the modern era is the Internet; A non-physical platform/service where communications can be relayed anywhere in the world in the blink of an eye, and an endless amount of information is available to access at a moment's notice. The enhanced ability to communicate with anyone has complimented humanity's innate social characteristics. The Internet has enabled bustling international trade, borderless activism, and consistent accessibility to nearly all of the information known to modern man.



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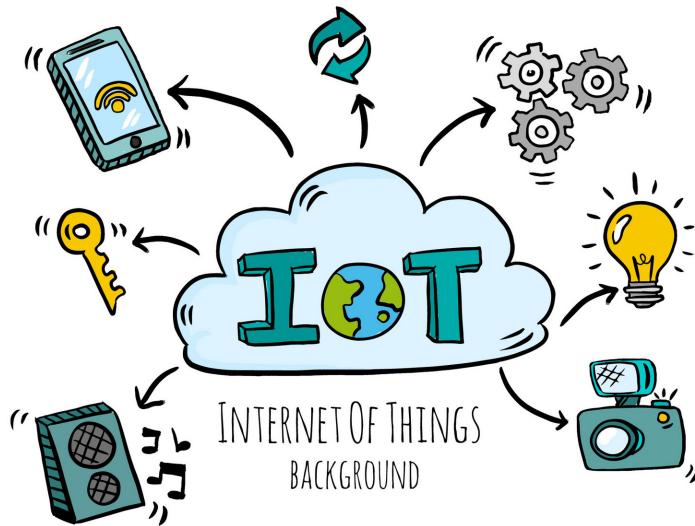
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What is the CATCH-22?

As it currently stands, the Internet is only useful as a tool when we have access to a network connection. On July 8th, 2022 Canadian residents and business owners who relied upon the Rogers parent company mobile network solutions were left isolated from the world. Customers were unable to watch cable television, make or receive phone calls, conduct online searches, make debit payments/acces financial services, and were even unable to dial emergency services. In an official statement released by Rogers, the outage was the result of a “network update”. A total unexpected outage in an era where emergency services and critical infrastructure rely upon data transmission carries the potential to cripple nations, so to speak, and is a vulnerability which must now be addressed.

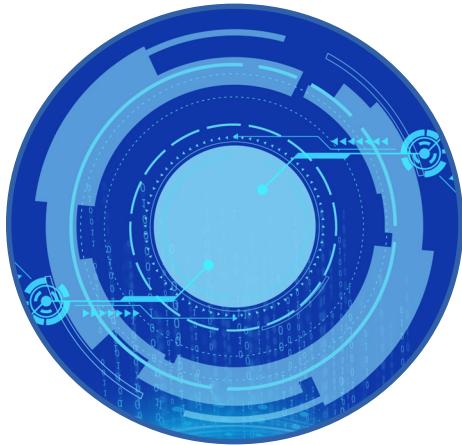
Readily available information systems are aimed at simplifying transactional data for users. Interest for networking access escalated during the turn of the twenty-first century, and is showing no signs of slowing in the decades to come. Societal demands increased further as COVID-19 swept the globe in 2020, forcing employees to work remotely. Many employees were limited by internet connection speeds, or access to reliable connections at all. The introduction of AI assisted cloud-computing technology and high frequency internet connections have boosted the speed of data transfers and improved the online user convenience, however there remained a critical, unresolved issue; the network databases which host and process all of our data were not becoming any smarter.



The Internet Of Things (IOT) has received a significant amount of public attention resulting primarily from increasing web traffic. In short, the Internet Of Things refers to a network of devices which share data with one another, often utilizing hardware such as embedded sensors. Sharing such data allows devices to understand and learn from their environment in more natural ways; similarly to how our brain utilizes a wide array of sensory data biologically to coordinate and perform functions. The Internet Of Things aims to truly validate the word 'smart' when speaking in context of devices which significantly enhance our daily lives.

The complex systems we rely upon such as farming, transportation, manufacturing, and shipping can be optimized by IOT allowing for lower cost production, greater amounts of product output, and reduced cost of maintenance, courtesy of increasingly accurate networks of environmental sensors. This issue will explore the potential applications of deeply connected software and hardware systems, and how they may be able to solve some of our greatest challenges.

THE INTERNET OF THINGS

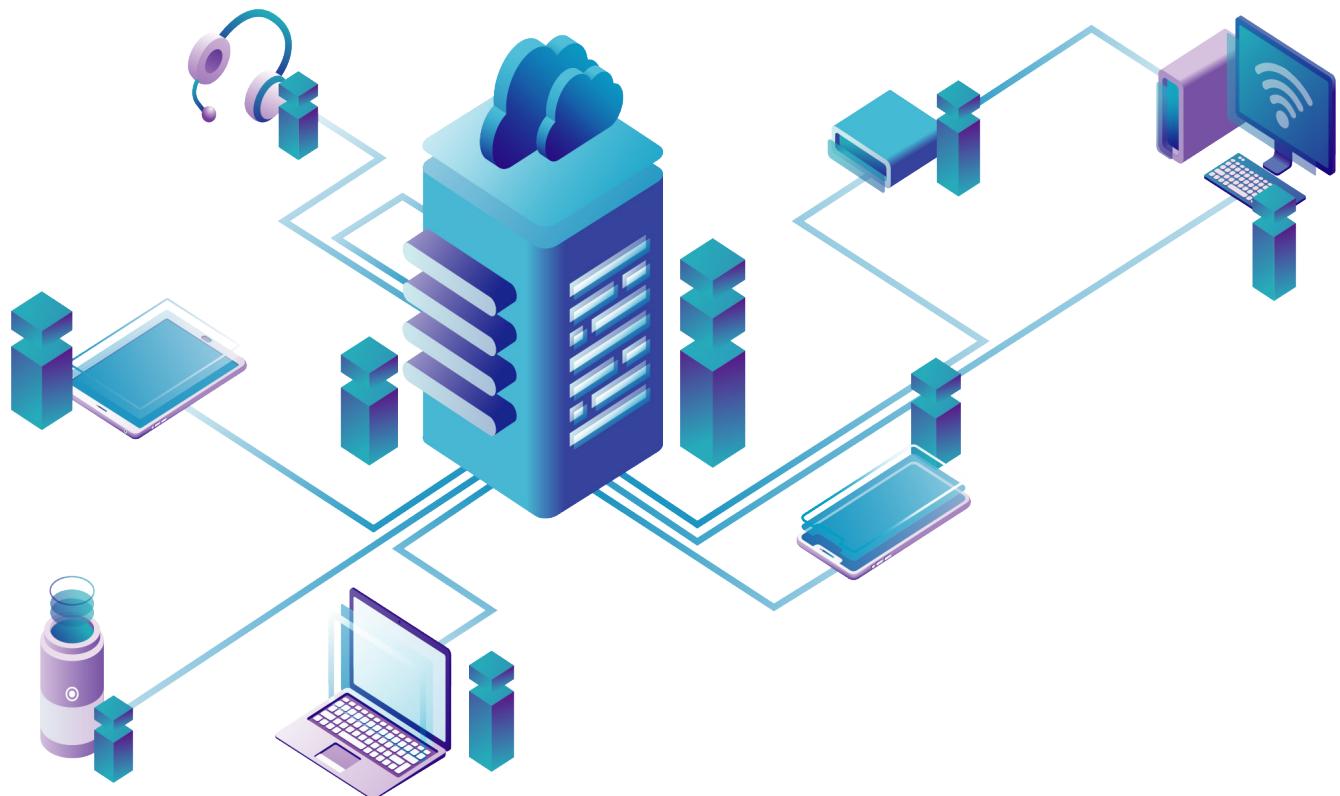


What Happens When We Are ALL ONLINE?

While the majority of casual internet users will benefit from reduced data-overage fees, there are more serious impacts which universal internet access will have. For example, worldwide internet access will allow for individuals to contact emergency services in areas which are currently inaccessible via cell tower. It would allow for a significant number of people to access internet services in countries where the infrastructure is lacking. Estimates provided by the World Economic Forum find that roughly 63% of the glob-

al population is currently connected to the internet in some capacity. Though this number may seem reasonably positive, there is far more to these statistics than it would initially appear.

If 63% of the population is utilizing online networks, that leaves 37% without internet accessibility, equating to approximately three billion people that are without internet access. Among the 63% who are online, only 24% have access to true ‘internet freedom,’ meaning that internet access is free of all censorship.



These statistics indicate that an overwhelming amount of the world population is still isolated from a complete online experience, often due to limited infrastructure, state control of media, or ISP prices becoming unreasonably high in certain areas of the world.

Internet rate hikes are especially concerning in Canada, where prices are the second highest world-wide, trailing only the United States. This largely boils down to the legislation among these nations allowing for monopolistic practices of Internet Service Providers (ISP's).

STARLINK

Though we are still far off from a true 1:1 internet users to living people ratio, the launch of a satellite network by Elon Musk and the company known as Starlink may be a step in the direction towards achieving this goal.



What does Starlink mean for those without internet freedom?

- Uncensored social media posts/ film footage
- No more blocked websites
- An end to constant surveillance
- An escape from government propaganda.
- Freedom from wireless carrier price gouging

By removing state control of internet access and circumventing the requirement to buy and develop land necessary for cell towers, Elon Musk's idea to put a web of satellites around the Earth may not be so far fetched after all.



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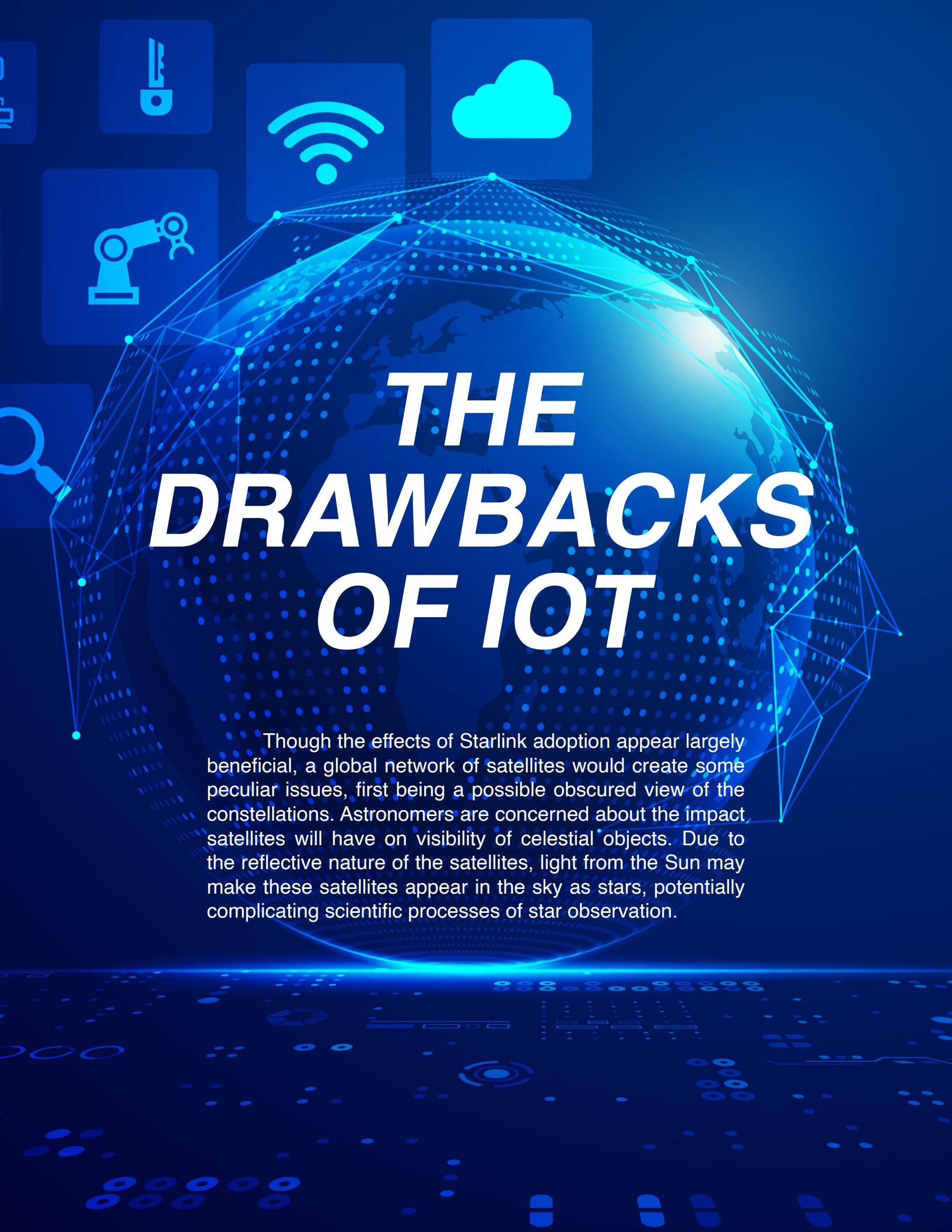
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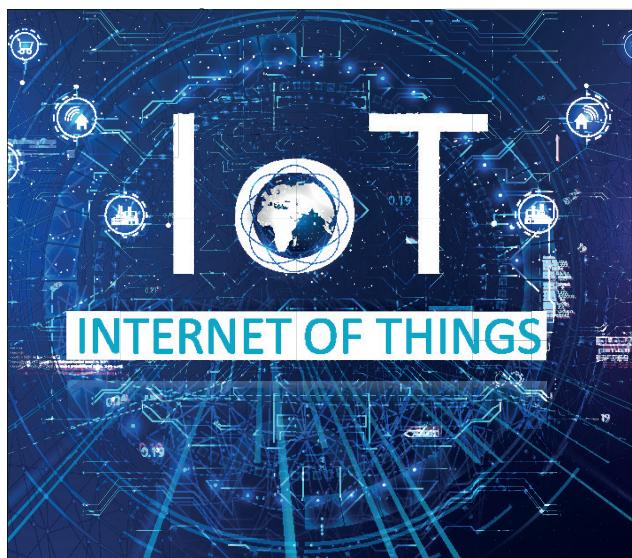




THE DRAWBACKS OF IOT

Though the effects of Starlink adoption appear largely beneficial, a global network of satellites would create some peculiar issues, first being a possible obscured view of the constellations. Astronomers are concerned about the impact satellites will have on visibility of celestial objects. Due to the reflective nature of the satellites, light from the Sun may make these satellites appear in the sky as stars, potentially complicating scientific processes of star observation.

Starlink is relatively expensive with a set-up fee of \$599, plus monthly payments of \$110 USD or more. These prices are standardized across all countries, ensuring a fair experience for all Starlink users. Subscribers also receive a fraction of the speeds achieved by traditional fiber optic cables, averaging just under 100mb/s, significantly slower in comparison to the 1000mb/s speeds offered by the major Internet Service Providers in Canada. It should be noted that Starlink download speeds are improving at an astonishing rate, with a reported 58% boost in download speed for Canadian regions in 2021 and 2022, however, upload speed saw a significant decline of -36% during this same timeframe. Download speed refers to your connection's ability to retrieve data from the internet, while an upload speed is how fast your connection can send a device's data to the internet. It is worth mentioning that once the Starlink network is fully deployed, it can effectively replace separate home and mobile internet plans with one full plan, which may lead to long term savings and a more convenient user experience.



Starlink will be operated and maintained by a single corporate actor, leading to fears of potential platform abuse or monopolistic tendencies to emerge. International security may be a concern to some since worldwide data will be routed through a shared common network. If there were to be a network compromise, that may have far greater implications on the Starlink network as it would affect all users around the globe. Starlink satellites may also be susceptible to solar storm interference, and may become victim to asteroid impacts.

Concerns are arising in regards to the potential space junk that will be produced as a result of the nearly 5000 satellites being sent into orbit. Conversations regarding this issue will likely gain traction as competing brands begin to offer global internet solutions, and state interest in space operations continues to grow.

EMERGING MARKETS



Driven by fierce competition and major optimizations of the manufacturing process, consumer electronics are reaching unimaginably low price points. The marketplace Wish.com has enabled the sale and purchase of computing devices for as low as \$1 USD. Although the user experience is far from optimal, budget devices provide a means for those who are restricted by price, to begin using the internet for an endless amount of activities, such as communication or learning.

Expanding the worldwide web userbase will likely prove beneficial for online vendors, content creators, and anyone who conducts international business operations online. Selling your products and services

will soon be possible in currently untapped markets. Meaning that certain product options will be uncensored for those connecting to networks such as Starlink, allowing one to purchase products which may have been blocked by their government or internet service provider.

Additionally, customers who live in rural areas will now have reliable internet access at home, further adding to the pool of potential new customers and advertisement targets. Overall concurrent use will likely lead to a spike in e-commerce activity and social media engagement, due in part to the convenience of access in combination with the ability to connect in areas which may have been previously inaccessible.



REALITY FICTION

The decision to name the company Starlink was inspired by the famous book by John Green, *The Fault in Our Stars*. While SpaceX, the company that created the service Starlink, was originally inspired by writer Isaac Asimov's *The Foundation Trilogy*, a series of science fiction novels centering a post-apocalyptic world that births a new society "dedicated to art, science, and technology." As Asimov states in an interview with Rolling Stone in 2017, "The lesson I drew from the 'founda-

tion' saga is you should try to take the set of actions that are likely to prolong civilization, minimize the probability of a dark age and reduce the length of a dark age if there is one." The Starlink project is a direct result of this goal to prevent a return to the dark ages, by casting a "world wide web" around the globe. It appears that Elon Musk aims to prolong society by providing equal access to information for decades to come.

Social media content and live streaming sessions are set to boom in popularity as sharing will be possible in remote areas which are currently unserviced by cell towers. The days of dropped phone calls or failed uploads/downloads may soon be no more. Geo-based online experiences such as Augmented Reality informational overlays are another exciting product of the 'always online' revolution. Wearable devices such as Rayban Smart Glasses, Snapchat Spectacles, or any brand of Smart Watches should be coupled with constant/high speed internet access for a seamless experience and real time updates. This may have an impact on individuals with health conditions which require accurate and consistently up-to-date information.

From Fiction to Reality



As a tool, the internet was developed to serve humans; however, as devices begin to adopt the ‘smart’ moniker, networking solutions are being forced to adapt to increasing traffic. Today, it is common for an individual to own a wide variety of internet connected devices, whereas, a decade ago many of these devices had limited communication with another device or restricted ability to perform multiple tasks. Fast forward to 2022 where the smart home revolution is in full effect where we have digital assistants, smart appliances, internet connected vehicles, smart locks/cameras, among many more technologies. These forms of devices are consistently processing new data, while relaying information to cloud storage centers, and sharing data between one another. This is the ‘smart lifestyle’ concept that is commonly referred to as IOT (the Internet Of Things).

We consume online media for the purpose of learning and accomplishing tasks, but the devices we own are in fact doing the very same thing. Faster networks and Artificial Intelligence-assisted systems have allowed for complex learning to take place in normally commonplace items such as microwaves and refrigerators. The purpose of this enhanced learning process is to improve automation while increasing the reliability and accuracy of the provided information.

The Internet Of Things aims to connect devices together, which in turn will aid in optimizing multivariable dependent systems pertaining to both the consumer and enterprise markets.

One such example of a complex multivariable system which may be used by a business or individual is the self driving vehicle:

INTERNET EVERYWHERE



SELF-DRIVING CARS

One of the more disruptive technologies which has been gaining traction as of late is the “autonomous” or self driving vehicle. Complex systems composed of sensors and cameras process data in real time to direct the vehicle, without the need for input from a person behind the wheel. To ensure the safety of drivers and occupants these systems are required to operate with the utmost precision. Any slight deviation or miscalculation on behalf of the vehicle could lead to serious accidents with detrimental consequences. The AI embedded within the self-driving vehicle must react accordingly to any given situation while operating on the roads, to make the safest decision following specific road

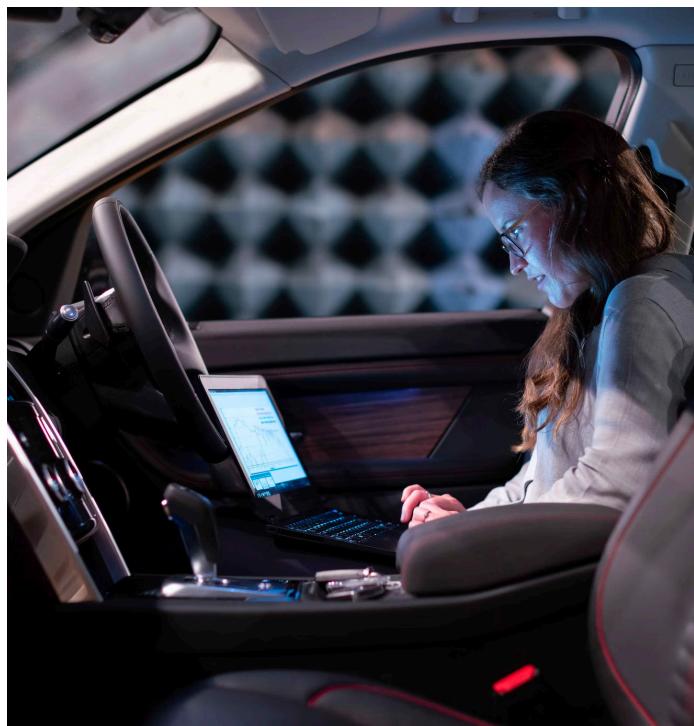
rules. The autonomous driving system must coordinate the data it receives from each individual sensor with its central processing unit, all while ensuring that data is in check with other readings. For example, something as simple as dirt or debris covering a camera sensor may provide inaccurate data to the vehicle as it blocks the vehicle’s visibility.

It is crucial for this computing system to be capable of determining if certain components are faulty and recalculate its decision to adjust for the absence of data. Additionally, mapping data has an essential role for guiding self driving behaviors, requiring that satellite data be relayed efficiently and accurately (you

wouldn't want your car to navigate you automatically into an inaccessible area).

Self driving vehicles are learning and improving constantly, thanks to the Artificial Intelligence (AI) systems employed. User data is constantly being stored and used to improve the decision making algorithms which are at the heart of systems, such as Nvidia's Drive Chauffeur, or Tesla's Autopilot system. Though very unique in the way each of these companies delivers the 'self-driving dream', both share a similarity in their dependence upon data processing and network transfer abilities being near real-time. This is one example of how IOT technology and widely available internet will benefit the everyday person. Self driving cars will undoubtedly see improvements with the introduction of Starlink's Omnipresent wifi network, as vehicles will be able to communicate with one another in real time, and may increase the rate at which each vehicle can learn from the real world. Communication is a valuable tool for people, and it is equally valuable for machines; perhaps one day aiding in the alleviation of your early morning, traffic-induced headache;

Heavily interconnected networks of autonomous vehicles are one of the few "truly viable" solutions to the age-old issue of traffic congestion. This irritating phenomenon is the result of inconsistent speed among vehicles, specifically sudden deceleration. This domino effect is commonly referred to as a 'traffic snake' or 'traffic jam.' One method of illuminating traffic congestion is to control the speed of each vehicle such that they maintain a consistent speed, and come to a stop gradually. Syncing up traffic speed with the timing of stop lights is yet another way in which IOT systems might lead to fewer traffic jams. Additionally, inter-vehicle communications may one day allow for mutual crash avoidance.



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A Situation for Clarification

Vehicle A and B are traveling down the left strip of a three-lane highway in the same direction, one following very closely behind the other, and both moving at very high speeds. Both persons behind the wheel are experiencing a drive with a self-operated non-communicating driving system. Suddenly, a deer leaps onto the highway directly from the forest and freezes in front of vehicle A. The leading vehicle's light detection and ranging (LIDAR) system spots the deer instantly, and vehicle A is forced to make a decision; either veer off into the right lane, attempt to make an abrupt stop, or continue straight on its trajectory into the deer.

Unfortunately, vehicle B's LIDAR system and cameras are blocked by vehicle A,

leaving it blind to the deer. Vehicle B is completely unaware of what is happening ahead.

In a scenario where these vehicles can communicate with one another, vehicle A can utilize its gathered LIDAR data and share crucial information via a network to vehicle B. Vehicle B can evaluate its surroundings and determine what the next decision will be for the safest outcome.

Accidents which occur, similarly to the situation mentioned above, require high levels of automation to deal with. This is exactly where The Internet of Things shines as a concept for enabling a smarter and safer lifestyle.



STARLINK IN THE REAL WORLD

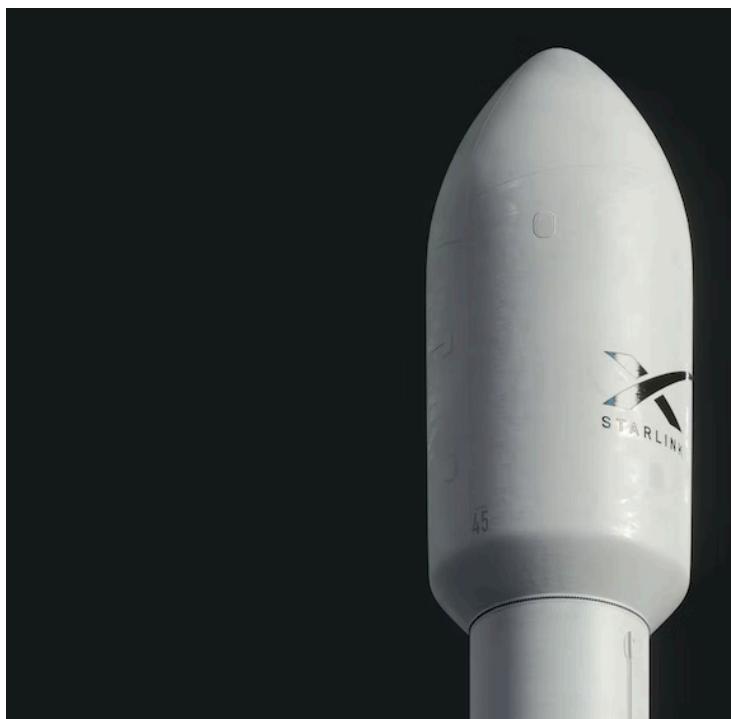
We spoke with Zoom Developments Inc Owner and Founder, Jason Han, regarding his opinion of fully global access to the internet, and his personal experience with the Starlink service in Niagara, Ontario.

Residing in what he described as a rural environment, Jason was intrigued by Starlinks potential benefit due to the primary focus on providing high-speed internet access and reliable upload and download speeds to homes located in remote areas which currently have limited access to fiber-optic internet.

Mr.Han agrees that the current pricing of Starlink internet is higher than expected and the operation could entice new households if the cost was lower than \$100 per month for an all inclusive package. As new competitors emerge, hopefully, Elon Musk will decide to fluctuate the prices of his well known satellite network to be affordable for all class civilians.

When we asked Jason Han if they would recommend Starlink to our audience and the general population, he replied with a confident, "Yes definitely! I would recommend Starlink to anyone, especially in rural areas. It is easy to set up, simply download the app and follow the instructions."

This indicates to us that even the non-tech savvy will find the service easy to set up, allowing for a wider audience of users to reap the rewards of widely available, consistently priced, and uncensored internet access.



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