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IS AN UNHACKABLE SYSTEM A DREAM

As the time progressed, technology progressed along with it. There were instances where we thought that tech reached saturation but in each one of those darkest moments, inventions were invented that caused a BIG BANG and rippled through all the disciplines of science. New possibilities were unlocked, what old school scientists dreamed started to take shape. Dreams turned to reality. A few inventions like that are computers, transistors, optical fiber. One of the ripples that invention of optical fiber caused is Optical fiber Communication.

Optical fiber communication enables communication over long distances (coast to coast) with bit rates of 1000 Gbit/S [1]. With data transfer rates like that these and using multiple servers/memory drives to store the data (Cloud Storage). The Consumption of data is ever growing, so the need for privacy is even more especially when our personal data is being store somewhere else. The encryption algorithms are getting better by day but, people who want to hack/eavesdrop the data also have access to the same technology which is used to design the algorithm in the first place. I.e., as long as the design of encryption/decryption algorithm depends on mathematical/Computational/predictable methods there is always a threat to the privacy and the integrity of data.

Imagine a few scenarios- To get an abstract picture of our current situations regarding the privacy/integrity of data and the scenarios of what might happen if they are hacked/breached.

Hacking an autonomous System:

Most people love tesla cars because of their self-driving ability, these cars often get software updates, the software is updated via internet (Wi-Fi). Let us assume this scenario- A hacker plants a bug in the 'software update' which gives him back access to update the software. So now hacker can upload his own program, there are two worst possible cases that could happen

- The hacker can control all the tesla cars and can use them to cause damage – terrorist attack. It is like having millions of missiles ready to be deployed anytime. Just imagine, how scary would that be, all cars driving into buildings and people, hundreds of cars hitting all police stations at the same time and these cars can also be used as bombs since they have high-capacity batteries.

Modern houses these days come with smart central monitoring system, the ability to control almost anything in the house from anywhere. We might think that these systems are very reliable, but they are easily prone to decent hackers. Let us assume this scenario- A hacker can access your central monitoring system

- The hacker can eavesdrop on every conversation and can even make houses go up in flames (because he has access to Gas and electricity).
- Let us think that in one hundred years, every house has this technology, If the hacker can make ever electric appliance turnoff at the same time or even half of the electric appliances that would result in a blackout for days throughout the country. The electric grid will be severely damaged, and the power generation stations would go into a black out because of the steep drop in the load and it will take few days to weeks to bring things back to normal.

“There are currently 7,941 satellites orbiting our earth” [2] and “SpaceX has launched 1,740 Starlin satellites to date, with its first-generation system beginning launches in November 2019. Gen2 is planned to have nearly 30,000 satellites in total” [3]. Hacking a satellite is not as tough as people think all it takes is $300 equipment and a decent hacker [4].

- If one can hack a few satellites they can cause a chain of collision which can led to black out in communication worldwide and they can also be used as missiles – making them fall on the earth.

From the above scenarios we can clearly say that we need a unhackable system and researchers produced a system which can achieve that it is called “Quantum Internet.” “Quantum computers that take advantage of quantum phenomena to tackle massive problems are hailed as the future of computing. A quantum internet is actually in the works, with the U.S. Department of Energy recently rolling out a blueprint describing research goals and engineering barriers on the way to it. Although we’ve been working on it for about the last decade “quantum internet” is sort of hard to define. There is no clear meaning for it beyond “sending quantum signals back and forth, “and there are a few ways to go about doing it. Probably the method that is most in reach is by sending these quantum signals via photons over fiber optic cables. we already send our classical internet signals through optical fibers. How is this any different? The difference is these photons would have their polarization states manipulated to turn them into what are known as a qubit.

Instead of the pulses of photons representing a 1 or a 0, a single photon could represent a 1, a 0, or both simultaneously. This is due to a phenomenon called superposition. Sending information this way would be especially useful for security. It would be possible to use the qubits in the mathematical process of disguising data called encryption and detect if an outside party had intercepted the qubits and was trying to crack the code.

Eavesdropping on a quantum channel would be exceedingly difficult indeed. It could be made even more difficult by leveraging another quantum phenomenon called entanglement. Two particles or quantum systems that are entangled after an interaction are linked. Knowing the state of one will tell you the state of the other. And when one changes, the other changes too, and does so instantaneously. This means communication would be possible across vast distances potentially faster than the speed of light. And because nothing is sent through a wire, the message cannot be intercepted. But there is the issue of getting the entangled particles where they need to be in the first place. Once they interact, they still need to be separated. The current means of doing this still involves sending a newly entangled photon down a fiber optic cable to its final destination. And that reliance on fiber optic cables to carry messages or establish an entangled network is one of the first technical challenges a quantum internet has to overcome. Photons travelling in fiber optics can get scattered or absorbed along the way. Or they could reach their destination and fail to register with the detector. Using entanglement would eliminate most of those issues,

but right now, the photons that are generated during entangling happen to be at wavelengths that degrade quickly in optical fibers. Fortunately, scientists have found they can be converted using lasers to more suitable wavelengths and using this technique scientists have successfully set up entangled nodes 50 km apart. The Department of Energy's latest blueprint for a Quantum Internet in the U.S. has four key milestones: first to make sure quantum information sent over current fiber optic cables is secure. Then to establish entangled networks across colleges or cities,

then throughout states, and finally for the whole country. In February of 2020, the Department of Energy announced they had sent two entangled photons over two separates 42-kilometer fiber optic loops and had verified they were still correlated when they returned. They hailed it as a milestone on the way to developing a national quantum internet.

It is still a long way off though. The Department of Energy estimates a prototype sometime in the next decade. Even when it is all set up, don't expect to plug into the quantum ‘net. Unless whatever information you’re sending needs to be ultra-secure” [5].

But will we truly have an unhackable system or is it all just a dream! As long as we strive to build systems which can’t be hacked there are people who have access to the same or even greater technology. We humas always try to improve we build things we break it afterwards to see where it fails, and we repeat the same thing repeatedly. Hopefully someday the dream of total security/Unhackable system will become real.

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