

Final Paper  
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In general I would consider myself to lean in the favor technology more often than most and to be a techno-savvy person. While I do love technology I know that even my own dependency has become unhealthy at times. The world as we know is changing wether we like it or not, the lines between the digital and the real world are becoming blurrier year by year. Augmented reality is bringing the digital world into ours, meanwhile virtual reality is bringing us into a digital world. The advancement of these technologies will continue to make these lines between worlds fade. The technology and in particular our networks behind this are not just necessarily magic though as we may assume them to be. The structural side of technology is very real, but our almost inseparable connection to this thing we call the internet is making it all seem like it is truly just a cloud. In reality we rely on a physical backbone to keep so many aspects of what we consider to be essential to our daily lives available and functional. Our reliance on technology has become scary in some ways. With the lines of the virtual and real world blurring, our reliance on our networks continues to become greater.

Most of the population chooses to simply view our modern technologies as almost magic like. While people may understand there is a physical underlying component, many still don't understand the true grandeur of it all. When people connect to their Google Drive, OneDrive, iCloud Drive, or any other similar service they simply choose to call it 'The Cloud'. There is this image in the minds of so many of our actual data being lifted into the sky and stored somewhere up in 'The Cloud'. I've heard it first hand working in IT support myself. People don't understand where their data is going, yet they often seem to have no problem trusting these services with some of the most important information about their lives.

In my line of work I see the true dangers this can pose to an uneducated user. Users depend on these technologies for all sorts of things, but they aren't necessarily always looking at how dependable and secure they really are. I once saw a lady who stored all of her credit card information in a shared spreadsheet with her family members so that they could have instant access to purchasing information at any time. To her and so many others this may seem reasonable. Why not trust this system that seems secure with my financial data? But what happens when someone does finds their way into in that file which is in the grand scheme of things rather insecure. Her dependency and trust on this technology may just end up costing her in the end. Where are these systems really being run, where was that credit card data being stored, and how did those numbers in that spreadsheet get from one computer to another?

What really is 'The Cloud'? 'The Cloud' is not just some magical location, in reality when people are referring to 'The Cloud' they often are actually referring to servers which are enterprise grade computers providing some sort of service to the requesting device. Servers are often connected to giant arrays of physical storage all of which is most likely to be located in some giant datacenter. When people think of all of this they still most of the time don't seem to understand the most critical piece of all of this which is the physical infrastructure that is transmitting data from host to end point.

Andrew Blum illustrates the true dependency we have on the physical infrastructure in *Tubes*. Blum himself had no clue what the internet was until one day a squirrel decided to chew through his incoming line from his internet service provider (ISP). This intrigued Blum to learn more about the physical layer of the internet. Anyone with a networking background knows that everything is based on the physical layer. In the Open Systems Interconnection model for

networks there are 7 layers the first and most basic layer being the physical layer. Everything beyond that builds and relies open that first physical layer. Blum (2012) was shocked to find that this thing he had become so reliant on was all subject to “crude physicality”. He understood that he was connected, but didn’t quite understand how or through what. I personally didn’t have much of an idea either until up to about 2 years ago when I started working in the world of IT and networking. The physical part of the internet is much larger than I believe most people realize. Blum (2012) stated, “I have confirmed with my own eyes that the Internet is many things, in many places. But one thing it most certainly is, nearly everywhere is, in fact, a series of tubes” (p. 16). Millions of miles of these tubes carrying ethernet and fiber cabling are buried beneath our feet and laid across our oceans transporting almost every bit of information we transmit and receive.

Our dependency on this physical internet in particular has become almost dangerous. I look at the current outbreak with COVID-19 and it is more prevalent than ever. Parts of our nations public education system have failed due to a lack of infrastructure in their surrounding neighborhoods. Still around 20% of students in the U.S. do not have broadband access at home. The Executive Summary of The National Broadband Plan from the FCC (2010) does state “every American should have affordable access to robust broadband service, and the means and skills to subscribe if they so choose” (p. 14). The issues with this is that we don’t simply need access anymore we need at home accesses. The next time schools are forced to go remote we can’t rely on every student having access somewhere in their community, but rather should be treating broadband access much like other public services. Working in a school myself I can say this is not just an issue simply of money. Some families just depend more on the internet than others.

Some families still are able to remain fairly separated from the internet at home. Even a number of families at a private school here in Hawaii that cost over \$25,000 a year to attend don't have internet access at home. The schools dependency on every student having access to the internet to complete the school year required them to rush purchase additional hotspots to distribute to families. What would we have to do though if the infrastructure failed? Some schools resorted to simple paper and pencil having to distribute packets of papers containing the remaining reading material and activities for the year. While schools may have the ability to go back to simple paper and pencil some are so deeply bought into technological resources that they couldn't easily make the conversion back. Increasingly more and more schools are moving to online textbooks. If the school I worked for was forced to go offline because of a failure of infrastructure we would have been in a panic because many of our students main resources are all based on the web. The conversion back to paper and pencil would have taken weeks if not months. It's not just education though. What would happen to shipping if sections of the major carries networks went down? Once again, they could go back to paper and pen, but this would cost lots of time and money. Is it doable? Sure we lived without modern networks being widely available until around the 1990s. The issue is that we have become so reliant that these changes would take time just as it took time to change from pen and paper to digital services.

Luckily a major part of nations network infrastructure going down is extremely unlikely. The nice part about modern networks is that we rely heavily on what is known as packet switching. Packet switching is performed by routers, "each router performs a path calculation function independently, and each relies on its own type of routing protocols" (Goleniewski, 2006, p.106). Packet switching makes it so that if one path that data may travel from host to end-

point has an issue the router can reroute the data to a different path. These routers do not know the state of the entire internet so there still may be failures where the time to live on a packet is exceeded. If a packet gets rerouted too many times it may be dropped. However, once again the people behind the TCP/IP protocol which is what the majority of the internet runs on put failsafes in place to try and prevent any message from not being received even if it takes a few tries . The rare cases in which we may run into issues is if sea cables were severely damaged. While Hawaii for example has multiple sea cables, if one has an issue our entire infrastructure will be affected as we will loose bandwidth. This reduction in bandwidth will for most just lead to a bit more delay and possibly a bit more packet loss. Because of all of this it isn't necessarily the networks themselves we have to be worried about, but rather an actual failure of a server providing a service. If a banks servers go down during a high demand period it could cause major problems. Big companies that rely on their servers working 24/7 have many redundancies in place and are able to switch all traffic that normally would go to a server located on the east coast to a server that provides the same service on the west coast. More and more business are moving to similar models as cloud computing services such as Amazon Web Services are becoming increasingly affordable.

When thinking about these physical networks people often worry about security and privacy. Once again it isn't necessarily the network that people should be worried about because in most cases intercepting data during transmission is not very common or easy. In the case of a fiber cable it is nearly impossible to incept data while it is in transmission. Personally the area most people I think should be worried about is the pesky terms of service and privacy policies

that the general population hardly ever reads. When do you think was the last time a non tech-savvy friend of your read a privacy policy for a website or other service they use was?

Personally I find our dependency on technology to be in most cases rational, but it's becoming scarier as people seem to be inclined to believe everything that they see and read online and in digital worlds. I find this to be one of the biggest threats in modern times. We can clearly see that different groups have been promoting their own interest online with no real evidence. Right now the biggest platform for this sort of influence appears to be social media platforms. Regimes such as those in China are using these technologies to their own advantage. According to King et al. (2017), "the 50c party engages in almost no argument of any kind and is instead devoted primarily to cheerleading for the state, symbols of the regime, or the revolutionary history of the Communist Party" (p.497). Special interest groups are using our inherent ability to believe what is online to be true to construct ideas in our heads. In a sense these groups are brain washing people. I believe the issue to be that most people just like to hear what they believe. In the end it is all the echo chamber affect. Once you have influenced someone, you use more and more propaganda to reenforce their ideas and make them truly believe they are correct. It doesn't matter what's true and what's not so long as you can keep the echo chamber going people won't change their views.

As the lines continue to blur between the fake and real world influence of the digital world on our real world and vice versa could become even more dangerous. The advent of the rise in AR and VR technologies in recent years is accelerating this meshing of worlds. Loomis (2016) stated, "consider a high-quality teleoperator system whereby a robotic head with high-resolution cameras and omnidirectional microphones provides a continuous stream of high-

fidelity video and audio to an observer wearing a head-mounted display. Further assume that the robotic head is driven by signals tracking the observer's head so that there is no measurable lag between the observer's head orientation and that of the robotic head. With sufficiently high-fidelity sound and video, the observer receives auditory and visual information from the remote environment equivalent to what he would receive if actually present at the location of the robotic head. Aside from the knowledge that he is using a teleoperator system, the observer will have the same perceptual experience (presence or telepresence) with the teleoperator as he would if there in person" (p. 173). Loomis is describing how in a perfect VR system experience we would not have any different perceptual experience than we would have if we were in the same experience in the real world. Now think if the 50c party mentioned earlier was using VR. They could fabricate fake digital scenarios where they design their enemies to perform atrocious or vile acts in a virtual space. If they placed the same person who would read their current propaganda online in this virtual world, the impact could be much greater. The user would feel as though they were a first hand witness. As first hand witnesses to certain events in the real world we may be left with emotional scaring or a rage against the cause of something we deem to be unethical or against our viewpoints. This form of technology could be used for serious manipulation in the real world. Serino et al. conducted a study on the effects of Pokémon Go an augmented reality game. Serino et al referenced a study conducted by Lampen which found, "Several first-person accounts posted on social media sites have emphasized how the game's immediate reward system has provided an incentive to interact with others and to increase their activity, actions that otherwise were difficult for individuals with depression and other psychological conditions" (p. 675). While in this case a light hearted game brought positive effects to its players, we can see



just how powerful this newer technology is. I try to be rather optimistic, but this stuff does truly scare me because I do believe a number of people in this world are inherently evil. With evil intentions and the right skill set any group could easily use AR and VR to create artificial experiences that feel as if they are real life experiences that could be created to target other individuals, groups, objects, ideas, ect.... One of the main uses of VR I'm aware of is in the case of non-profits using VR to put people into a first person experience of what they are trying to fix. From what I have heard it is an extremely effective tool as people tend to be more emotional when presented with reality up close.

I don't know what is going to happen with our technology in the future, but that's part of the fun of it all for me. More than anything though, I'm concerned. I'm concerned about our dependability on our physical networks and systems. We can look at all the ways in which people have thought of those what if scenarios, but there is always something unexpected just around the corner as COVID 19 has taught us. As technology becomes more advance will we become so reliant on digital worlds to influence our perception of the real world that the real world begins to become the digital worlds created by the few who designed them? Will those designing the next generation of AR and VR design it for the betterment of the world or will they design it to benefit themselves only? We are putting so much trust and faith into these things that many of us don't truly know that much about. I try to remain informed on the technologies I'm using as it is part of my career, but I still am always wondering what I'm overlooking. Technology can be healthy, but we have to keep ourselves informed and understand the line between what is real and what is not. Technology forces us to think about reality and in the end how do we even know what reality is and if we ourselves are even real?

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