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President's Corner

The Technology of Resiliency (or, The Resiliency of Technology)

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Things are tough all over. Each of us is subjected to difficult conditions throughout our lives. How well we withstand or recover from these difficulties indicates our resiliency. Change seems to be the only constant, with far too many changes detrimental in nature. We are all dealt obstacles to overcome each day, some trivial and some overwhelming. How we deal with the inevitable misfortunes that come our way will help determine our ultimate success in life.

We often have technology to help us deal with our problems. It helps us in our daily quest to care for ourselves and others, learn and grow, protect ourselves and provide for our futures. We use it to enhance our relationships, create the lives we want, keep us healthy, cure our illnesses and prolong our lives. Technology is our best hope for curing cancer, feeding the world's population, protecting the environment, and mitigating or perhaps reversing the effects of climate change. We depend on it for so much, and yet it can fail and disappoint us as well. If we are to be resilient, we will need our technology to be resilient as well.

It seems misfortune, error, and even conflict and hostility are inevitable, so we need to have the systems and devices we use to be as robust as is practical. Nothing can be perfect, totally free from flaws and always effective, but reliability is essential, especially when a lot is at stake. For example, we all travel by motor vehicles because we perceive them to be safe and reliable. We would be more reluctant to use them if there was a significant chance we would not complete our trip successfully or if a failure would likely result in severe injury or death. Everyone perceives risks differently, however. Some may engage in behaviors generally understood to be unsafe (smoking, illegal drug use, impaired driving), while others may apply an outsized risk factor to specific activities and unjustifiably avoid them (commercial air travel and vaccinations, for example). We should always use science and reason to choose the most robust solutions to our problems, weighing the need for reliability against the risks and costs involved.

If you Google "resilience," you can find lists of ways to increase your personal resilience. To increase the resilience of your technology and the functions it performs, you will need to consider what is important to you, the functions and devices you use, and how robust you need them to be (risks of failure compared to the costs involved).

One way to increase the resilience of things is to make them inherently more reliable and robust. Having fail-safe factors built into products and systems helps make them more resistant to catastrophic failures. Since this can be costly, it is often done where a failure could be dangerous. For example, modern automotive braking systems have a separation between the front and rear hydraulic systems, so a loss of brake fluid pressure (leak) in the front brakes would still allow partial braking function in the rear. NASA engineered the Perseverance Mars rover to be robust and reliable, with many cameras for redundancy and lots of pre-launch simulation, analysis, and testing to improve the odds of mission success. This, of course, came with significant investments in time and money.

Since reliability is usually not a parameter that can be adjusted on existing products, it is mainly accomplished through the choices made in the tech you buy and use. Buying reputable products with favorable reviews is an excellent first step. Researching your needs with reliability in mind can help. For example, to improve the connectivity of your smartphone, select a service provider with the best coverage and ratings. Consider a wired Ethernet computer network to avoid Wi-Fi connection issues. If Wi-Fi is necessary, consider a mesh router for better coverage. For the greatest resilience, provide both wired and wireless capabilities where possible. These are examples of the reliability decisions we can make to improve tech resilience.

A lot of resilience can be gained in the way technology is used. Money spent on the most reliable equipment is wasted if it is used irresponsibly. Failing to follow safe cybersecurity practices, not protecting personal information, and using weak passwords can undermine our online activities. An effective backup strategy is necessary to protect our most important data against all threats, not just malware attacks but also physical disasters and hardware failures. We should avoid activities that put us at risk for hacking and data theft or loss and have a plan to recover when the worst happens.

Another way to improve the resilience of our activities is to have multiple ways to perform critical tasks. Duplication of capabilities and redundancy can be important ways to greater reliability and robustness. NASA launched twin Voyager space probes to explore the outer planets in 1977 as the planetary alignment they were to exploit would not occur again for 175 years. Two identical rovers, Spirit and Opportunity, were sent to Mars in 2003. While effective in increasing success, duplicating devices and systems can be costly.

I try to look for cost-effective ways to duplicate critical capabilities wherever possible. For example, my wife and I have different vehicles, which some might consider duplication, but she sees as necessary. I have multiple, low-cost vehicles that I drive so that I have fewer concerns about breakdowns. When my wife wanted a new car, I kept her old car (it would not have yielded much in a sale anyway). The insurance and registration costs are low on the old vehicle, and I've managed to keep it going for 245,000 miles.

I try to do the same for my computers and other personal and home technology. When I buy new computers, I try to keep the old computers if they have valuable capabilities. If the old computers have obsolete operating systems, I use them without a network connection for security. I'm writing this on my old XP computer because I prefer its older, simple version of Word, but I have three or four other computers I could be using for this task if necessary. My wife and I have our primary Windows 10 computers, as well as a couple of Chromebooks and a laptop for connecting to the web. Since Windows 7 support ended in January 2020, I used a Win10 desktop machine as my primary computer. I bought a Win10 laptop that spring but never got around to completely setting it up. A few months ago, I had a hardware failure on my Win10 desktop, so I was forced to "transfer the flag" to my new laptop. It didn't take long to get the laptop set up to take over most of my computing needs.

I use duplication and redundancy in my data storage as well. For example, my most important data is stored on three identical encrypted USB hard drives. I use one as the working drive and periodically copy to the other two as rotating backups, one of which I store off-site to protect against loss should something happen to my home. In addition, I back up my computers to external USB drives, which are left unconnected, to prevent corruption should I suffer a ransomware or other malware attack.

I have several smart home devices, some of which provide redundancy. The security cameras I use come from four different manufacturers, increasing the odds I'll be able to connect to at least one at any time (though this does require four different phone apps). I have a mesh Wi-Fi router for more robust coverage. With all the computers and smartphones in the house, we can connect to the Internet through wired computers, wireless (Wi-Fi) computers, smartphones, and cellular data. We still have a (relatively costly) landline phone connection as an alternative to the cell phones. Finally, I have a UPS (uninterruptible power supply) power back-up for my wife's desktop computer. Still, I have not yet felt it necessary to buy a home generator to cover an extended power outage.

Though I consider it more for operational ease than redundancy, we have dual monitors on our primary computers. They are great when having multiple windows open and could provide resiliency should one monitor fail. My wife has hers in the traditional side by side configuration, while I use an external monitor with my laptop, having it above the laptop screen.

Since technology is such an integral part of our lives, it makes sense to consider how the essential capabilities our devices provide can be made more resistant to failure and robust in recovery. With hardware failures, service interruptions, and external attacks as real possibilities, increasing the resiliency of your technology can only help you be more resilient, secure, and capable.



