

Twentieth Century Culture and Technology

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Introduction

A recent article on BuzzFeed ¹ inspired me to capture some of the cultural and technology elements I've witnessed or heard about firsthand from the 1950's to the 2000's. I've filled in some details here and there, but this is mostly based on my experiences.

I realized that a lot of older people had a wealth of experience that was largely lost when they died. My maternal grandfather was born in 1899 and lived to the early 80s, so he saw the emergence of cars, airplanes, television, space travel, and some computers. He was a soldier briefly in World War I. But I know nothing of what it was like for him to live through the Great Depression, or WWII, or other huge world events. I am the tail end of the Baby Boomers, so I'm the last generation not to grow up with computers and the staggering changes they have brought about.

Socialization

- I grew up in the era before computers or cell phones. We made friends by talking to people from school or neighbors near our age. We got together with them by going to their house and asking if they could play. This no doubt led to the trend of marrying "the girl next door" because she was one of the few people you could meet and shared similar culture.
- My best friend in the mid 70s was a few doors down from my home, and in the same grade. He had a younger sister, and admitted doing a bit of "I'll show you mine if you show me yours" with her. I had no idea about female anatomy. Oblivious until after high school.
- I read voraciously from middle school (junior high) to the middle of high school. I once pledged to read 20 books during a school year, and actually read 40.
- We could buy little paperback books from the Scholastic Book Fairs, typically 75 cents each. I loved two versions of Two Minute Mysteries, very short stories for you to figure out what didn't add up. Another favorite was a book called The Happy Dolphins, which fueled my love of dolphins.
- A story repeated on The Brady Bunch TV show in the 70s was a riddle about a child coming into the emergency room and the doctor exclaiming that they couldn't operate on them. The doctor wasn't the child's father. How was this possible?
Yes, it was that rare for women to be physicians, that no one would guess the doctor was the child's mother.
- I learned about the world by reading the second half of the Sears catalog (I ignored the clothing sections) and memorizing the Guinness Book of World Records. I desperately wanted to know what was outside my little world, and what the extremes of nature and people were.
- I thoroughly embarrassed my parents in the mid 70s when I checked out a ton of books about sexuality from the library. There was a lot of nervous laughter and awkward silences. I hadn't reached puberty yet, but the amount of information I got from school was nil. My "birds and the bees" talk with my father was a good five minutes.
My brother years later pointed out that in school we got a basic anatomy talk in fifth grade and learned about contraception in 11th grade. He surmised that they were very trusting of us during the intervening years.

¹ <https://www.buzzfeed.com/briangalindo/people-over-50-on-what-work-culture-was-like>

- I went through major orthopedic surgeries five times while growing up, so at school I was often the “cripple” and therefore a social pariah. As usual in the Midwest, the athletes and beautiful people were the “in” crowd. I never dated through high school, never went to a school sporting event, and therefore never learned basic social skills like most people did.
- My first elective in grade school was in junior high in the mid-70s. My dad signed me up automatically for wood shop class, but I really wanted to take home economics too. Not sure why it had to be an either/or proposition. The classes were wordlessly strictly gender specific.
- While I was not a straight A student, I knew I was intelligent, but my social group consisted of the nerds and the stoners. In junior high school, I earned sympathy cred by getting a D in a history class. I was so bored in class I had trouble staying awake.
- I knew my high school classmates often went to a local park to smoke and hang out, but I never did. Skipping class was unthinkable, no matter how boring. I started reading less in my later high school years, because I had read everything in the school library that I wanted to. I took naps in the library during study hall.
- When I was in high school, we had a special trip across town to hear the Vice President talk. The Secret Service chose the other high school because it was older and had far fewer entrances than my high school. The day after the talk I couldn’t remember the VP’s name. That’s how moving his talk was. It was Walter Mondale, the VP under President Carter.
- I probably would get a lot of trouble now, given some of the assignments I did in high school. I took a very good Speech class. My topics included describing the gun used to assassinate President Kennedy and a design for a nuclear weapon. I was fascinated by books from the 60s about preparing for nuclear war. It takes about three feet of soil to provide good protection from nuclear radiation. Sitcoms like *Happy Days* (1974) took such topics very lightly, but I wouldn’t want to have to decide if I’d let a neighbor into my shelter.
- Gender roles were very clearly defined and traditional 1950s-60s. My father was the primary breadwinner. My mom worked full time, but also did all the laundry and dinner was ready at 6 pm pretty much every day. Sometimes mom would leave instructions for my brother and/or I to put a roast in the oven at a certain time. Occasionally we would remember to do so.
- Since I had little to no social life, I was not too shocked when a high school class asked us to estimate how many hours per week we watched TV. I was around 80 hours. I’ve always been a night owl, so other than dinner I often watched TV after school and all evening until midnight or so. I never dated until I was 18, and then rarely.
- The big social topic every Monday in high school was what happened on *Saturday Night Live* (1975) that weekend. It was very new in the late 70s and got away with skits that would never be allowed today. Today it’s a sad shadow of its former glory.
- Speaking of never allowed, I love a lot of comedies that would never be made today. *Blazing Saddles* (1974), *Young Frankenstein* (1974), much of *Airplane* (1980) for examples. Child nudity and adult themes in *Blue Lagoon* (1980) and *Pretty Baby* (1978) would cause riots.
- Corporal punishment for children was the norm, mostly a spanking by hand in my world. My father was a powerful man and in Army Special Forces in years past, so even a hand spanking was very effective. He has a large gold class ring from West Point, but he never wore it for fear it would cause a lot of damage. I was quite afraid of him much of the time, even though we were close in other ways and went fishing and hunting together.

- In the early 70s my brother and I had friends next door. When they were bad, they had their mouths washed out with soap. That was a standard punishment. The girl got it done with room temperature water, and expressed gratitude that she didn't get it with hot water like her older brother did. I was grateful to never find out either version.
- Mom was afraid of her own potential and had most of the stereotypical jobs that women could have; dental hygienist, secretary (now an administrative assistant), real estate agent, and hospital lab technician. Tired of earning so little money, she went to college in her 40s and became a nurse for the last 15 years of her working life.
- When my mom was working for a podiatrist as secretary, the doctor got a very fancy computer system for keeping track of his clients. In 1980 this computer was a small but expensive beast, tens of thousands of dollars. He had a fairly small solo practice, so a computer system wasn't really needed. Why did he get it? All the other podiatrists in town had computers. Peer pressure. My mom had to learn how to use this computer system without a raise in pay.
- My father never used a computer until he was age 40. He hates technology. He has often said if he didn't need to use a computer for a few things, he could live quite happily without one. He doesn't have a cell phone, much less a smartphone. He carried a pocket watch for years but stopped after retiring. He still has a watch I bought him 40 years ago.

Race and Religion

- Most of the places I grew up were very white racially and Christian, so I learned very little about systemic racism or antisemitism. Both were widespread, but rarely chastised or recognized. Some of my relatives in Texas told the most racist "jokes" imaginable. The only Muslim person I was aware of was the famous boxer, Muhammed Ali, so I assumed most Muslims were black.
- Races in my world were simplified to white, black (African American), red (Native American), and yellow (Asian). I was surprised when I recently met someone who was livid about saying white versus Caucasian. They never articulated which they thought was bad, but apparently Caucasian was coined by 18th and 19th century anthropologists.
- The races based on physical appearance were: Australoid (Australian Aboriginal Group, 4% of world population at the time); Caucasoid (white, 55%); Mongoloid (Asian, 33%); and Negroid (black, 8%). Since then, dozens of other factors which could define "race" have been identified.² Caucasian is meaningless because it covers people from Europe, the Middle East, North Africa and India with many other differences, and has stunningly little to do with coming from the Caucasus Mountain region. Notice that this classification completely omits native people from the Americas.
- Racism and sexism were common in humor. People still told Polack jokes. I learned a lot of bad terms for black people from the *Hair* (1979) movie. No one complained if you made fun of a handicapped person. Crying was strictly forbidden or ordered to quit ASAP. The biggest insult for a male was to say they were feminine. Pu\$\$y, c**t, gay, etc. I had very tender feet from always wearing leather shoes growing up, so that was seen as weakness. Likewise, not being able to handle hot items with bare hands was chastised as being feminine. My ex-wife made fun of me for using a high-pitched voice when I was hurt. I showed them! (I didn't come out as transgender until much later.)

² <https://www.mathetis.org/topic/the-origin-of-races/>

- The Vietnam War ended in 1975, and as a result some 60,000 Hmong immigrated to Minnesota. While Minnesota has good schools and strong industries, I couldn't help but wonder how hard it was to adapt to the new climate! Most Hmong settled near Minneapolis, so I didn't see many of the newcomers.

LGBT Issues

- I was so isolated socially that I didn't know gay and lesbian existed until high school circa 1980. Shortly before that I was at a party with my dad and some of his professor colleagues. The party was held in a very flamboyant French teacher's home, and someone made a comment about it being unusual for women to be in his home. I had no idea what they were implying.
- "Queer" was an insult. Women in the military were rare and not allowed in combat areas until 1983, so "your mother wears Army boots" was an insult, implying she was not feminine.
- My dad went to West Point, and they started allowing women cadets in the late 70s. He still thinks that was a mistake.
- When I first recognized that homosexuals exist, I confused them for a while with pedophiles. Apparently, many people today still can't tell the difference.
- In college in the mid 80s, I heard rumors that the Men's room in the student union was a hot place to get a very brief date. I never tested that.
- In the late 80s I saw that a women's empowerment conference was being held very near where my mother lived. I told her about it, and she got very embarrassed, saying that she wasn't interested in that sort of thing. I think she equated feminism and empowerment with being a lesbian.
- I watched reruns of shows like *Laugh-In* (1968) and had no idea how gay many of the stars were. I had zero gaydar.
- The only concept of transgender I had as a child was when I could tell "transvestite" from "transsexual." The former was different clothes ("vest"), but the other was a "sex" changed person. I knew of no one who was a transvestite, and the only transsexual was "the tennis star who went to Denmark for a sex change operation." I later learned that Renée Richards was that tennis star, and she transitioned in the mid-70s. The correct terms now are cross dresser and transgender.
- At the end of college in the mid-80s, I was attending my first pagan ritual, and afterwards one man was clearly making a pass at me. I thought I was straight and male then, so I had no idea how to react. He soon backed off.

World Events

- I was born less than twenty years after World War II. As a child I thought that was a long time, but now I recognize it was still very fresh in people's minds. My brother and I were born in West Germany because our father was an Army officer, stationed in Bavaria waiting for "the balloon to go up." That phrase meant that the Russians were attacking through East Germany, which thankfully never happened. It was well known that anyone within 40-50 miles of the East German border would be overrun if the balloon went up. It would take a while for enough forces to be massed to slow or stop the invasion.

- I recall seeing stickers for POW and MIA on the front of our church in the early 70s, Prisoners of War and Missing In Action. I felt the hostility of people against the returning Vietnam veterans and couldn't understand why they felt that way. The politics of the War were way over my head. I remember reading a Christian graphic novel about a Vietnam pilot who found god after being shot down and becoming a POW.
- In the early 70s we lived a year in central West Germany. The main church in town had been bombed during WWII, and the spiral steeple was damaged and tilting to one side. After the War, they decided to support the steeple in that position as a reminder of the War for posterity.
- During that time in Germany, my family went to East Berlin. Having been an officer for the USA, my dad was nervous about his safety to do so, but it was an important trip. West Berlin was still part of West Germany, but very isolated. My strongest memory was taking a bus tour into East Berlin. We passed through Checkpoint Charlie, where the bus had to slowly navigate around barricades in a slalom fashion. From a distance the barricades looked like they were made of wood, but when we got closer it was clear they were each several feet of solid brick. Tease people into thinking they could just drive through them.
- In junior high in the mid 70s, we briefly covered the Korean War. I innocently asked why we didn't use nuclear weapons there. I was told that option was considered but deemed too dangerous in terms of escalation. About that time, the Vietnam War was ending and that seemed to make a lot of people happy.
- In 1976, eccentric billionaire Howard Hughes died. There were running jokes about finding his will with suspiciously biased heirs who coincidentally happened to find it. I took the world so literally that I didn't understand at first that they were jokes.
- Soon after in 1977, Elvis Presley died. I never was a fan of his music, but the outpouring of grief from millions was palpable. Recent similar responses have been for Freddie Mercury of the band Queen (1991), Michael Jackson (2009), David Bowie (2016) and Prince (2016). I've had such a scientific mind that I find it interesting that no one feels much when a famous scientist or engineer dies, but performing artists evoke incredibly powerful emotions.
- I got to see Queen in the early 80s. I thoroughly enjoyed their music but was too young to appreciate how talented Freddie really was.
- I was taking a modern dance class when Michael Jackson died. It was an evening class, and we were taking a break halfway through when several girls checked their phones and announced the news. Jackson was odd and creepy enough that I wasn't particularly affected, but millions disagreed.
- Bowie confused me. I knew about his music since the 70s, but his drastic changes in appearance and gender bending left me confused. I had been carefully taught rigid gender roles. In the mid 80s I saw a poster for an upcoming show by Grace Jones, titled a "One Man Show" and showing her with a short flat-top haircut. I was baffled.
- I lived in Minneapolis when Prince became famous, and his purple mansion in the suburbs. I enjoyed some of his work, but I've never connected with jazz funk very strongly. I also didn't get the whole business he did with changing his name to a symbol, so everyone called him "the artist formerly known as Prince" for several years. ♀
- Ronald Reagan was elected President in 1980, and he scared me to death. He spoke so aggressively about Russia that I was terrified he would start World War III. He had a folksy

grandpa vibe, which accounted for his huge popularity. I calmed down after a couple years, when it became clear that he was saber rattling to sound tough, but really wouldn't do anything. There were many rumors in the pagan community that Nancy Reagan was heavily into astrology and she had a strong influence on his presidency, especially in later years when he was clearly in decline mentally. Nancy was in LaLa land as far I was concerned, with her "Just Say No" anti-drug messaging. That's about as effective as telling teenagers to be celibate. Ever notice that the states with the strongest sex prohibitions have the highest teen pregnancy rates? It's very hard to compete with raging hormones, curiosity, and the draw of forbidden fruit.

- In the mid 80s I went to Germany for a summer session. No major disasters happened, but one feature of the program was frequent trips on the weekends. One weekend we stayed away overnight, and spent two days touring the still active border between East and West Germany. The purpose of the wall was to prevent East German citizens from escaping to the West. A talk was given by a gruff Army officer who I thought was American at first, but later realized that he was German but had learned a lot of English in our Officer's clubs. He told us about the Berlin Wall being put up in 1961, and was soon raised to 3 meters tall, about 10 feet. In the countryside, the border included mine fields in frequently plowed strips of land, large amounts of razor wire, and the officer bragged that the West had recently negotiated to remove the machine guns that were activated by trip wires.

Oddly enough I later learned that East Germany allowed people to leave freely ... after they retired. They didn't want to have to pay their pension and not get anything else from them.

- The Challenger space shuttle disaster happened in January 1986. It blew up 73 seconds after launch because of a failed O-ring in the rocket motor. I was working full time out of a trailer in the Mojave Desert, when someone came in and told us something had happened to the space shuttle. Our trailer had no TV, so we went to a nearby building that did. Nobody knew anything except that the news kept saying the same few minutes of information over and over, showing the explosion with it each time. I was horrified. I had recently finished a degree in aerospace engineering, and loved aviation and space stuff, and the disaster was a horrible knife in the space program's heart.

Even worse, it had the teacher on board, Christa McAuliffe, who was all ready to do experiments in space and broadcast them to students everywhere. The search for the perfect teacher to go to space had been huge news for a long time. Her students were attending the launch in person and had to be whisked away as soon as the explosion happened.

Years later I worked for Hughes Aircraft Company and learned that an engineer on Challenger was Hughes employee Gregory Jarvis, an expert on lasers. President Reagan championed a space defense system SDIO usually called Star Wars, so Jarvis was probably going to do an experiment related to that.

In the late 80s I was in an engineering management class at Berkeley. They mentioned the Challenger disaster, and said it was clear the engineers knew the ability of the O-rings to hold up under sub-freezing temperatures was not known and wanted to delay the launch until the weather warmed up a little. After all, southern Florida isn't usually that cold! Management overruled them because of pressure to not have another launch delay, and seven astronauts died as a result. The shuttle program was on hold for years until the problem could be fixed.

- I was in Berkeley, California attending graduate school in 1989 when the Berlin Wall fell. I was subletting a room from a very damaged man, so I usually stayed in my room most of the time

and only emerged for the bathroom or kitchen. He was recovering recently after spending half his life on various drugs, so his maturity was closer to a 15-year-old than thirty. Not great for your landlord. I was in my room doing homework when he came to my door and said I might want to see this. I walked into the living room and saw people on TV dancing on the Berlin Wall and others hitting it with sledgehammers. My jaw hit the floor. I never expected to see this in my lifetime. I didn't know it was possible.

A few months later, I saw a man selling jewelry near campus. He had pieces of the Berlin wall for sale, with graffiti still on them, with a photo of him harvesting them from the wall with a jackhammer.

- A month earlier I was affected by the Loma Prieta earthquake. It hit in the southern end of the San Francisco Bay, so I was quite a long ways from the epicenter, but it could still be strongly felt. The timing was amusing. I had just gotten approved for a scholarship to finish my Master's degree, and then the earthquake happened an hour or so later. I tried to call my dad but got no answer. I called my mom to tell her of the news, and while on the phone noticed that the power had gone out in my apartment.

After getting off the phone, I confirmed that power was out in the neighborhood. Thinking of perishables in the fridge, I walked to a small convenience store nearby. I thought for sure there would be a rush on food, ice, and beverages, but there were just a few people hanging out and chatting. I walked in casually and got some ice, went back home, and saved the delicate fridge items.

We got power back the next morning about 8 am. My housemate shouted with joy that the power was back just in time for making toast for breakfast. Being the engineer that I am, I cringed at the thought of using a high-power appliance right away after the power came back, but said nothing.

The earthquake affected the south bay a lot and made the Bay Bridge sway a little too much. The bridge had a long flat section that was on concrete pillars, but then the steel part that formed the pretty arches was far less rigid. As a result, I later learned, the section of bridge between the concrete part and the steel part opened too much, and the upper section of roadway collapsed. They had designed it for up to 4" of movement. The bridge was closed for a month while they brought in huge airbags to center the bridge back onto its foundation and replace the fallen section. A huge number of commuter ferries to cross the bay popped up while the bridge was closed, and disappeared just as fast after it was reopened. Don't take away our cars!

There was a short section of Interstate Highway 880 in Oakland. It collapsed during the quake, flattening several cars under its top section. The road was never rebuilt. Months later, I was driving to an event in Oakland, and after a crowded section of small businesses came across an eerie wide section of grass extending both directions as far as I could see. I shuddered when I realized that was where the 880 had been. They had removed all the rubble and just planted grass in its place.

The earthquake happened at just after 5 pm local time on a Tuesday, which would normally have been a very busy rush hour time. Fortunately, that day happened to have a World Series game in San Francisco, so traffic was much lighter than normal. As a result, only 69 people died from the Loma Prieta quake.

The day after the quake I had four classes scheduled to meet. Three of them met normally, after the professor made a quip about "nice to see you could make it" or something like that. The

university had many students who lived in San Francisco, and some were in the Fisherman's Wharf section, which had extra damage from the quake. Many of the buildings there were built on landfill to build up the San Francisco Peninsula. In an earthquake, landfill wiggles like Jello, which is extremely bad for the houses on it. Several collapsed, some fires started from broken gas lines, it was a mess. The students were expected to show up for class the next day as normal. Why didn't the university close the next day? Money. As a state-owned school every day of classes is worth millions of dollars they receive from the state to operate. If they closed, that money would be gone.

- Northridge 1994
- Columbia 2003
- sss

Smoking

- In the late 70s, I was a waiter in a 24-hour family restaurant, like a Denny's today. The no smoking section was very small, and right next to the smoking section with no barrier between them. Every time I came home from a shift, I utterly reeked of smoke.
- Similarly, airplanes used to have a smoking section, generally in front of the no smoking section. I later learned that air flow in a commercial airplane goes from front to back, so everyone got second-hand smoke. Flights in the USA have been smoke-free since 1990.
- As a child I kept wondering why cigarettes were readily available in vending machines. Weren't they supposed to be age-restricted?
- I visited Germany in the mid 80s and was surprised to see that everyday smokers were rolling their own tobacco cigarettes (not marijuana) to save money. Cigarettes there were about \$3/pack, whereas here they were about half of that. Nationwide cigarettes here now average \$8/pack, and I've seen over \$10 frequently.
- When I was working as a new engineer in the mid-80's with people the age of my parents, some 25 years my senior, they pointed out that it used to be quite normal to smoke at your desk. This led to a lot of trashcan fires, so they only had metal trashcans!
- As the dangers of secondhand smoke became more widely known, smoking in public has decreased substantially. Now I can go to restaurants, bars, bowling alleys, and movies without choking. If a public place allows smoking, I'll leave.

Gasoline

- My family traveled around a lot when I was young, so I appreciated the need for gas early on. I recall in the early 70s in Nebraska seeing painted on the side of a barn, the gas price of 24.9 cents per gallon. I think the actual price then was higher, but they didn't bother to repaint the barn.
- The "gas crisis" in the mid-70s didn't affect me directly much, but I remember seeing long lines at gas stations and hearing huge concern about the increased prices. The crisis was brought about by a drop in gas imports of only 5%, but getting consumers to cut back on consumption took a big jump in prices. We were thoroughly addicted, and our dealers knew it.
- Most mid-20th century cars used leaded gas, because the small amount of lead in the gas (Tetraethyl lead, to be exact) helped lubricate the engine. As people realized the danger of lead

in the air and in household paint, unleaded gas started to become the norm. Leaded gas started to be phased out in the mid-80s and was formally banned on the road in 1996. General Aviation uses a small amount of lead in gas, but that's a tiny fraction of the amount of gas used by cars.

- By the time I got my first car in the mid-80s, it had twin 15.5-gallon tanks, and I soon noted that if gas was over \$1.26/gallon, it took more than \$20 to fill one tank. In 2021 it took over \$90 to fill a similar-sized tank.
- I've always been disgusted by the quiet monopoly on gas prices. Whenever there was a decrease in supply, the prices go up immediately, even though it takes weeks for the new gas to get to us. But when the supply goes up, prices take their sweet time going down. The petroleum industry clearly has massive power in Washington, DC, so I assume this will never be addressed.
- The COVID-19 pandemic led to shutting down much of the country to avoid widespread infection, so gas prices dropped due to lack of demand. Prices rose slowly, until the Ukrainian invasion by Russia in 2022 led to a spike in prices. After the initial shock of the invasion eased, prices came down in the mainland USA to around \$3/gallon, but for some reason the prices in Hawaii have stayed above \$4.50/gallon. It doesn't cost \$1.50/gallon to ship fuel to Hawaii.

Telephones

- My grandma was in the same little house in Cheyenne, WY until nearly the end of her life, from the 50's to the early 2000s. She had a rotary phone from AT&T. She got very sick one day, and my dad had to replace her phone. He discovered that she had been paying to *lease* that phone for over 50 years!
- My brother and I were born in the early 60s while our father was stationed in West Germany. Yes, we were born in a country that doesn't exist now, since East and West Germany reunified in 1990. When we were born, our parents sent a letter to our grandparents to tell them the good news. Yes, a letter. Transatlantic phone calls were far too expensive.
- It was a common anecdote in the 70s that Albert Einstein was weird for not knowing his own phone number. His response was allegedly that there was no reason to remember it when he could just look it up. At that point children were told at an early age to learn their home phone number, and everyone had to remember key numbers or keep a phonebook. A common business phonebook was a brand called Rolodex. It wasn't until cell phones became common in the late 90s that people no longer had to remember phone numbers.
- In high school in the late 70s, the school phones were answered by a receptionist who was the wife of my church's pastor. She sat at a switchboard, took incoming calls, and plugged in the correct physical cable to route the call to its destination. She was quite efficient at her job, and I assume she had long since memorized where everyone's line was located on the switchboard. The school was old at that time, but even so a private telephone exchange (PBX) was dated.
- The 1979 movie *The Jerk* included Steve Martin's character celebrating when he first appeared in the phonebook. When I was first on my own in the mid-80s, I celebrated a bit less obnoxiously when I was first in the local White Pages phonebook. A little later I learned that most single women only used their first initials in the phonebook (Smith, A. G.) to avoid being stalked. Having been raised male I had no idea.
- There was a horror story in the 70s based on getting repeated threatening calls when you're home alone. The punchline was that the call was coming from inside your home. It was that rare for a home to have more than one phone line! It was even uncommon to have more than one

extension (physical phone) for a (single land) phone line, and they were typically far apart like on separate floors.

- Pagers were a big deal in the late 70s and early 80s. If you had a pager, you were really important and on call, like a doctor. You might see a movie from that time period where everyone at a party put their pagers in a bowl so if someone's went off they could find it easily.
- In the mid-80s I bought my first phone, a beige push-button landline for \$30. The only really good thing about it was being powered from the phone line itself, so when I was affected by the 1989 Loma Prieta earthquake in California, I could still use it when house power was down. That and I didn't have to pay to lease it!
- Early in my professional career (late 80s), I heard that being a secretary was the most stressful job in most businesses. This made sense, because incoming phone calls gave no indication who was calling or what they wanted, but you had to respond appropriately and quickly whether it was a wrong number or the President calling.
- I test drove a lot of cars in the early 90s, discussed in detail later. I drove a late model BMW, and their big feature was having a car phone. You were *really important* if you had a car phone, probably middle or upper management. Cell phones didn't exist yet.
- In the mid 90s I started a long-distance relationship with my now ex-wife. I was in California and she in Pennsylvania. We spoke every day, often for hours at a time. We each had phone bills on the order of \$1000 per month. I soon moved to Pennsylvania since my job was falling apart anyway.

Radio, Ham, and CB

- In the 70s I had a couple of transistor radios, as they were called. Hand sized and cheap, they got the standard AM and FM bands, often poorly. They were usually powered by a 9 Volt battery.
- I realized that my dad prefers to listen to the radio at home. He grew up in the 40s and 50s, before television was common, so even now he listens to news and classical music on a radio.
- In the late 90s I got a shortwave radio. Those were designed to also pick up channels usually used by Ham radio operators, but receive only. I didn't use it enough to remember any channels of interest.
- Ham or Amateur radio was the first long distance voice communication method, using long antennae and powerful transmitters to be able to send and receive signals from hundreds or thousands of miles away. Not kidding about the antennae, you can get a 180' tall tower to hold your antenna. A license is needed to operate, and any but the weakest licenses need knowing how to send and receive Morse code. Yes, dots and dashes, that Morse code (1838).
- The main use for Ham radio now is as a hobby or for emergency communications when phones and power are not available. The huge advantage is that Ham radio operators can use 26 bands of channels above AM and FM. Even in the age of the Internet, Ham radios are often the first means of communication after a large natural disaster.
- A cousin of my father's got REALLY into hobbies, but never seemed to stay with any of them for long. At one point he had a rack of radio equipment in a corner of his basement, and had sheets of practice gibberish in Morse code, not actual words. The other reason for Morse code is that stations have an identifier in Morse code. Some will recall that the movie *Independence Day* (1996) used Ham radios to communicate worldwide when everything else was not available.

- On a local level, I saw the rise of CB (Citizen's Band) radio in the 70s. Originally used mainly by long distance truckers, CB radio had very limited range, maybe a few miles, but you could talk with anyone within range. Truckers used it to stay awake, warn others of accidents and bad weather, and after the 55 mph nationwide speed limit (1975 to 1995), warn each other of police. Truckers are paid by the mile, so high speed is highly desirable.
- CB radio emerged into public awareness with movies like *Smokey and the Bandit* (1977) and *Convoy* (1978). People were anonymous, hiding behind a "handle" or radio name. The radios were fairly cheap around a hundred dollars or two. CB radio was a great introduction to anonymous real time communication, setting the stage for text-based computer bulletin boards (BBS) and then Internet chat applications.
- I never had a CB radio, but I was amused by the rebel attitude and the power of big trucks. The appeal of CB radio faded as computers took over.

Television

- TVs were first sold in the US in the late 1920s and early 30s. They used many vacuum tubes internally, plus the black and white display (CRT, Cathode Ray Tube) was also a big vacuum tube. Color TV didn't emerge until the mid-50s but wasn't widely broadcast until the mid-60s. TVs started to switch from small vacuum tubes to integrated circuits in the late 60s but still used CRTs for decades.
- Earlier generations had legally mandated objective news broadcasts because of the 1949 Fairness Doctrine. It was repealed in 1987 under President Reagan. That's why TV stations can now present very biased information, with no need to present opposing views or do fact checking.
- The recent result of that repeal was the lawsuits against Fox News for lying about the 2020 election results. They were successfully sued by Dominion voting machines and awarded \$768 million for defamation. Fox News was found to know they were pitching lies about voting machines and the election results, but refused to back down because they made a lot of money from it.
- TVs were a big piece of furniture in the living room through the 70s, as my grandma and her sister had. They were quite expensive for the time, hundreds of dollars, and often included a radio and record player. The largest color TVs were 25" diagonal measure, but you could get them as small as 7-13" for a bedroom or the kitchen. I remember ads on TV for the last brand of TV made in the USA, Curtis Mathis, until the mid-80s.
- Other than local broadcast TV, satellite TV started in the mid-70s. They needed huge dishes (10' diameter) to get signals. A good friend had a huge dish in their backyard. To use it they had to know the latitude of the satellite they wanted to receive. Now the dishes can be much smaller (10-20") and the main services are DirecTV & Dish Network. There are also specialized satellite services such as TracPhone, which give near-global TV, Internet, and phone connectivity.
- Educational TV started in the early 50s, leading to creation of American Public Television in 1960, the feeder for PBS. Other channels like ESPN, CNN, and MTV didn't exist until the late 70s and early 80s. MTV used to play music videos 24x7. That made a lot of careers, but also put a lot more emphasis on visual flash and less on musical talent or insightful lyrics.

- Flat screen TVs didn't come around until the mid-2000s. Before that you could get a projection TV, which projected the images onto a small movie screen, but most of them could only be seen clearly if you were directly perpendicular to them; much to the side the image faded quickly.
- My parents had a vacuum-tube black and white TV. I inherited it in my bedroom in the late 70s. We didn't have aluminum foil on the antenna, but you did have to hit the side of it often to get the picture to come back. It received three channels, ABC, NBC, and CBS.
- When I was in the hospital for a while in the mid-70s, they had the same channels. I developed a pattern of TV programs to watch, mostly cartoons and sitcoms. With so few choices, you either watched what was on or nothing.
- At about that time Radio Shack was famous for selling individual electrical components (resistors, capacitors, etc.). They had a vacuum tube testing machine and sold replacement tubes for your TV or radio.
- While playing D&D in the late 70s, a leader of the local scene was an older single man. He hosted games in his apartment occasionally, and I noticed that he had a VCR. They were still very rare at that point, and I knew from magazines they were something like \$1200. It was a huge machine, nearly two feet wide, over a foot deep, and probably six inches high. I didn't get one until the late 80's, when a stereo VCR was still about \$450.
- When I was first on my own in the mid-80s, I moved from Minnesota to California using the mail for almost everything I owned. Since I had no address at my new job yet, I mailed everything to General Delivery at the Ridgecrest post office. My first apartment was sparse. A neighbor saw how little I had and gave me a black and white TV from a bedroom closet shelf. They had just bought a \$2000 entertainment system: a big TV, stereo system, speakers, turntable, the whole works, so I guess they felt a little guilty.
- At my first professional job in the mid-80s in the Mojave Desert, I was walking around a possible test site with colleagues and came across a plywood box that had been there a very long time. It had baked in the sun so long that the glue holding the plies together had dried out, leaving curled sheets of wood next to each other. Near the former box were a few vacuum tubes, and a very senior colleague recognized exactly what model tubes they were. I felt very young.
- The TV I had been gifted died at the end of the 80s when I was at Berkeley, CA. I went to an electronics store to replace it, and was slightly surprised that one could no longer buy a black and white TV. I got a 13" color TV for about \$160 and was startled at the difference when I watched Star Trek.
- I bought my first computer in 1991 and got a low resolution 14" monitor for it for \$450. It was awful, so I soon upgraded to a high resolution 15" monitor. That was the best that the built-in video could support. To get a 17" monitor and video card would have been \$1500. Monitors peaked at 21" size for normal computers and Sony Trinitron was typically the best brand for a few thousand dollars.
- I later (mid-90s) worked for the FAA on a new radar system for air traffic control, and it used gigantic 28" Trinitron monitors for display instead of the round green screens you might see on old movies. Those monitors weighed 200 lbs and cost \$20,000.
- When I got away from my ex-wife in 2007, I made the jump to only flat screen TVs and computer monitors. No more CRTs!

Games

- In the early 70s my grade school had a yard that was mostly sand. I played marbles with classmates. At one point I got a bunch of marbles for a deck of cards with information about European cars on each card. That was not my wisest decision. I soon lost the marbles, and the cards were from Germany and irreplaceable.
- As a child in the 70s it was still normal to play games with friends near home such as football (American football, soccer was invisible to US culture), softball, rode bikes around the neighborhood, stuff like that. I was in hospitals a lot and learned card games such as the mindless game War, gin rummy, and solitaire. Sometimes nurses and even doctors would come by and play a hand or two with me. I was amazed by a doctor who could bridge cards while shuffling without a table. I soon taught myself to do that too.
- At lunch during high school in the late 70s I played a card game called Buck, which was like a speedy version of bridge, only using cards 9 to Ace of each suit.
- After learning computer programming, I wondered how hard it would be to make a War card game application. After all, there is no strategy, so a computer could play against itself!
- I explored model rockets in the mid-to late 70s and thoroughly enjoyed that. Estes and Centuri were the big brands, but apparently the latter went out of business in 1983.
- My brother got into Dungeons and Dragons (1974) in the mid-70s, and I followed suit soon after, probably to his dismay. I kept playing until the end of high school and quit expecting not to have time for it while in college. I had a set of six original D&D books that predated Advanced D&D (1977-1995) and sold them for \$500 recently.
- My parents and I played a game called Tripoley (1937) with neighbors once in a while. It's a little gin rummy, a little poker, and a few other games in one. I enjoyed playing it, but we rarely coordinated schedules to do so. We gambled with it using pennies, so after a good night you might be ahead \$1.50.
- By the late 70s we got the game Pong (1972), yes the legendary 2-D ping pong game and I played it on a black and white TV. After the TV finally died we gave the game to our church.
- I worked at Mount Rushmore the summer after high school and learned the card games Spades and Hearts there. I still play the latter once in a while, now on a computer of course.
- I played a lot of arcade games in the early 80s, especially when I was first in college. Asteroids (1979), Joust (1982), and Pac-Man (1980), plus pinball games such as Eight Ball Deluxe (1981). I used them for study breaks in college and went through many rolls of quarters that I got from the dorm receptionist. Each game was 25 cents. Arcades, like you would find in a mall, had a few games that were 50 cents, but they were rarely worth it.
- At work in the early 90s, someone found an original version of Tetris. The one with the Russian background. I was pretty good at it, but our other female engineer had crazy dexterity and went well beyond anyone else's scores.
- By the mid-90s I was exposed to console games that my soon-to-be step kids played, especially Super Mario Brothers (1985). I liked playing it, but never mastered the skill of activating the game on the Nintendo NES (1985) hardware. I even later tried Guitar Hero (2005) but could rarely get access to it to play.
- I've never bought a gaming console.

- I played a couple of first-person shooter games, and only got a headache from them within minutes. Yes, my age is showing. 😊 Side scrolling games or omniscient viewpoint games are it.

Photography

- As a child in the 70s, film cameras were the only choice. Cheap cameras used 110-size film canisters, but good cameras used 35 mm film. I never used the cameras with expansion bellows, but I saw a cube-shaped Kodak Brownie camera. The Brownie cameras were very popular in the 50s and 60s. We never had film for it.
- The 110 film cartridges were created in 1972 and held from 12 to 24 photos. It was easy to use; drop in the cartridge, take your pictures, and take it out to be developed.
- A 35 mm camera let you see exactly what your subject was (single lens reflex, SLR) and was more complex to load, shoot, rewind, and develop the film. It also went up to 36 exposures per roll. Given that large a capacity, it was easy to go months between taking film in to be developed.
- Getting pictures back from the drugstore was kind of like Christmas, since you often forgot what pictures you had taken. After my father remarried in 1990, I was shocked that someone brought developed pictures from the ceremony to the after party. They had gone to a one-hour photo development store. Such fast turnaround was very rare for me.
- When I started to have a little discretionary income in the late 70s, I wanted to get a camera, but my dad warned against it. His little brother got one decades earlier, and just took tons of pictures of his pets. At a time when I earned a whopping \$2.50/hour, each picture cost 75 cents to buy the film and get it developed.
- My first camera was a cheap 35 mm camera (\$75) that wasn't SLR. It had four or five fixed focus settings for different distances, so the pictures were often somewhat out of focus. I got it in the early 80s when I was leaving home for the first time. After that I graduated to a couple of 35 mm SLR cameras until the digital revolution took over.
- The Polaroid SX-70 camera was released in 1972 and was the first instant camera. You could take a picture and see it developed in a few minutes. I read about it in magazines but didn't see one until several years later. The camera was bulky and expensive, but instant gratification made them popular. After my father-in-law died in 2003, I found racy instant pictures in a dresser drawer, presumably of a lady friend in the 80s. That market probably accounted for a lot of the target audience. You can still get film for them if you don't mind paying up to \$20 per photo.
- Digital cameras were ironically pioneered by Kodak in 1972 with a huge heavy camera that had 0.01 megapixel (Mpx) resolution and saved image data to a cassette tape. Kodak worked on improvements to it for about six years but didn't see a future in digital photography. Ooops.
- Digital cameras can use a charge-coupled device (CCD) sensor instead of film, and modern ones save data to a memory card and might use a CMOS sensor instead of CCD.
- Consumer digital cameras didn't exist until 1990, and the first digital SLR camera in 1994. My family had our first digital camera around 1998. It took two AA batteries for power, and took 640x480 pixel images, about 0.3 Mpx (Megapixels).
- I got a magazine devoted to CCD Astronomy, which only existed for a year before everyone realized that digital photography would become the norm. Technically most large telescopes are just big cameras, you can't look through them directly.

- Now a high-end digital camera can have a resolution of around 45 Mpx (e.g. 8368 x 5584 px), can store images to a 1 TB SDXC memory card, can also take high resolution video, cost \$15,000 with one lens, and output via HDMI connector, Wi-Fi, or Bluetooth. That's a camera still the size of a film 35 mm camera. The best cameras are mirrorless instead of using SLR technology.
- There's a lot more to digital camera resolution than the number of pixels, things like pixel size, optical quality and size, and many more. That's well beyond my expertise.
- Higher resolution digital cameras still use the old designations of medium format or large format. Medium format can go up to 100 Mpx and over \$30,000. Like many fields, there is little upper limit to prices.
- Digital cameras are compact enough to fit easily into smartphones and tablets, so now your phone could include a 10 to 50 Mpx camera or more precisely, several cameras.

Bicycles

- Bicycles were my first love. During the early 70s I paused at a magazine rack in a drugstore. The *Bicycling* magazine caught my eye. It was the first topic-specific magazine I ever bought, unlike Popular Mechanics, Popular Science, and similar.
- The magazine opened me to a new world beyond the Sears catalog. I devoured every page.
- As I learned more from magazines, I started hanging out at a local bike shop near home after school. It was called Cooper's Big Wheel. I spent hours there, studying their inventory and chatting with their mechanic. The owner wasn't there very often, but I soon knew their products better than he did. Some customers wondered if I was his kid. I was there so much that after a few months the mechanic and a friend of his physically picked me up and carried me into the street between parked cars. No harm, just sending a message.
- I planned out the ideal bicycle on paper. Then 10-speed bikes were all the rage, and a basic one was about \$100. After over a year of pouring over magazines and catalogs, I used my life savings to buy a Viscount bicycle for \$288. It was a little-known British brand, calling themselves The Aerospace Bike. For comparison, a top of the line Schwinn Paramount was over \$500.
- About that time there was a little startup company called Cannondale, that made bags and other accessories for bikes. They are still around and started making entire bikes some years ago.
- That time also saw the rise of a new kind of bike, with 20" wheels and very sturdy to ride off road and over jumps. Based on heavy cheap Schwinn bikes, it evolved into the BMX movement that is still around.

Cars

- We had simple cars while I was growing up. In the late 60s my parents got a station wagon. Huge, fake wood panels, the works. The car died in a rollover accident was had in Yellowstone Park in the early 70s. We landed upside down with the hood crushed by a boulder. No one was wearing seatbelts, so we were all tossed around a bit. I felt an unknown liquid dripping on my head and cried. We were all fine except my mom was the driver and cut her right ankle on the pedals. My dad had to pay for the car to be towed 200 miles to be assessed by the insurance company, only for it to be immediately totaled. It wasn't like we could take a picture on our phones and email it to them.

- Our Pontiac Ventura suffered from being bought in 1974, right after the start of the gas crisis. Massive emission controls were put on it to make it cleaner, but they also killed its performance. On a long straight road, I put the gas pedal on the floor and waited. Barely got up to 80 mph eventually. Also got dreadful mileage, about 9-10 mpg for a compact car.
- My dad drove a '75 Chevy pickup around then, which was great for his outdoor activities. The interior could only be described as Spartan but functional. It and the Ventura both had manual transmissions, partly because it cost hundreds more for an automatic. Great for me to learn that obscure skill by today's standards. Manual (crank) windows and locks too. They didn't have air conditioning, but we were in Minnesota, so that wasn't a high priority.
- When my mom got into real estate, she bought a huge Pontiac Bonneville, a 1980 I believe. It could seat six people who didn't like each other. I think I drove it once to move it from the street to the garage. The early 80s were the worst time for real estate, inflation was well over 15% per year, and mortgages had gone from a normal 6-8% up to 13%, making buying a home nearly impossible. I distinctly remember buying some small thing immediately because I was afraid the price would go up if I waited until next week.
- I waited until the mid 80s to get my first car, a pickup truck with huge dual gas tanks. A few years later someone pointed out that they were a really bad thing in a side collision. Spraying gas everywhere is not recommended. Like my dad's, it was Spartan inside, but I had automatic transmission and air conditioning, the latter badly needed in the Mojave Desert. I had no credit rating right after college, but Chevy had a buyer incentive for recent college graduates. It was a nudge over \$11,000 new. Back then you could still buy a truck with just a front seat, and an 8' bed. Now it seems like every truck has an extended cab and a short bed.
- In the early 90s I was in southern California and considered trading in my truck. I test drove almost every SUV on the market, they were really in vogue then. I even tried a high-end minivan, and the salesman was completely confused why I was looking at it when I wasn't married and did not have children. The Dodge Viper was brand new then, a ten-cylinder sports car, and a local dealer had one. I had read some car magazines, and knew it was listed for \$50,000. I asked the dealer how much it was. He said \$125,000, and he knew he could get that for it. Yikes. The largest Toyota SUV, a Land Cruiser, was apparently also in demand, and the dealer added \$8,000 of dealer markup because they could.
- I loved the technology of the rotary engine used by Mazda. A girlfriend had an RX-7 (1978) around 1990 and I loved the way it purrs on the highway. I got to test drive an RX-8 (2002) around 2008. The doors were unique, because there was no fixed B pillar between front and rear seats; there was a tiny passenger door that incorporated the B pillar and put it back when you closed the door. The salesman drove it first from the San Fernando Valley into a canyon road, and I noticed him going 100 mph in a 50 zone. He warned me I was responsible if I got a ticket, and that I would never exceed what the car could do. I was much better behaved behind the wheel. I only did 90 in a 45. I had never driven a sports car before. I was amazed how stable it was in turns, hugging the road and going wherever you want with only a hint of effort. Sadly the RX-8 was discontinued in 2012 due to poor sales and the cost of having a unique engine for one model.
- The huge Hummer truck/SUV was new on the market in the early 90s, and I test drove one. This was the original model from the military, before they had the H1, H2, H3 series of much more comfy models. The original Hummer was \$55,000 and had the world's most wimpy 150 HP V-8

diesel engine to power a 6,000 lb vehicle. It was over six feet wide, because the engine was in between the front seats. I got it on the highway, and it struggled to get over 70 mph. On the other hand, it had enough ground clearance to drive over a fire hydrant without touching it, and you could adjust tire pressure from the cabin. As I was leaving the dealership, a man was taking delivery of his Hummer. He was in his late 50s I guessed, and clearly a retired military man, the perfect audience for the Hummer. GM bought out Hummer and made it much nicer and more powerful, and that led to the H1 to H3 series. The H1 was shelved in 2005 due to poor sales and rising gas costs.

- My ultimate car test drive was a 1988 Rolls Royce. It was five years old and had depreciated \$100,000 to only \$70,000. The salesperson was very nice and let me drive it around as long as I wanted. It had a deceptively large amount of power under the very large hood (I later learned around 300-350 HP), and the ride was so soft and floaty that I swore I could never own one because it would put me to sleep. Hence the need for chauffeurs.
- A related story. In the late 80s a friend was teaching English in a private boy's high school in ritzy Orange County. When kids wanted to borrow something, she insisted that they give her something as collateral. One boy came up and gave a keychain for collateral. A Rolls Royce keychain. He explained that dad had his Jaguar and mom had the Mercedes, so they figured that the big Rolls was a safer car for him to drive. To high school.
- I went to a Porsche dealership, and they didn't give me the time of day. They were the only brand that wouldn't talk to me.
- I kept my truck until the late 90s and over 200,000 miles. Next switched to a more comfy choice, a two year old '98 Cadillac Catera. It was the smallest Cadillac, but was much more plush than the truck, and had a 12-CD changer in the trunk. It was \$23,000, a bargain since the new ones were over \$40,000. The ads on TV for it were really cute, they had a red plush duck as its mascot. I got one and put it in the steering wheel sometimes.
- I nursed the Caddy along until over 150,000 miles but had to replace it in 2008. That was a time of extra high gas prices (\$3/gallon), so efficient cars were in huge demand. I had just left my ex-wife, so I wasn't in a great place financially. I got a new 2008 Toyota Yaris, a little-known model about the same price as a Corolla. Mine was loaded and about \$17,000. Now I just had a single CD player in the dash with the radio, and it wasn't very comfortable for long rides. I had moved to Philadelphia, so I chose the Yaris over the Corolla because it was three inches narrower and nine inches shorter. I knew I'd have to do a lot of parallel parking in Philly, so that was important! In the city I didn't have to drive much but moving to Hawaii motivated selling it. With only 75,000 miles, I sold the Yaris in 2021. I gave serious thought to shipping it to Hawaii, but the paint was fading, and it wasn't worth the \$1500 to send it 5,000 miles.
- I got ready to choose my fourth car after 36 years for the first three. I pondered my next car choice and realized that if I didn't get a nicer car now, I likely never would. I splurged and got a 2018 BMW X1, their smallest SUV, and a little older to take off some depreciation. It has a single CD player in the dash, but much better sound quality than the cheapie Toyota. I listen to a lot of music while I drive, so that was important. It has all the bells and whistles you'd expect from a BMW. When you open a front door, a light comes on to show the ground, a feature I learned many years ago is called a puddle lamp. Yes, it's to keep you from stepping into a puddle in the dark. The headlights turn on automatically, the rear-view mirror and side mirrors are auto-

dimming at night, it has all wheel drive, and the doors lock when you reach 15 mph. Life is good. It was about \$35,000.

Aviation

- Aviation was and is my second love. I love their graceful lines and the freedom of flying.
- In the early 70s we lived in Lincoln, Nebraska. The pastor of our church owned a small airplane, a Cessna as I recall. He promised me to take me flying one day and did so. That lit the spark of flying for me.
- My dad taught me how to make balsa and paper model airplanes, and I spent a lot of time through high school (through early 80s) making various models. I never flew them, just enjoyed making them.
- My high school was blessed to have an aviation teacher, and in my sophomore year I took his class. It was designed to prepare us for the (very difficult) FAA written exam for Private Pilot, which I took and passed that spring.
- I started flying lessons that summer and earned my pilot's license ten days after turning 17.
- My mom was too afraid of small planes to fly with me, but my dad and a colleague of his did. We flew over the lake where we went duck hunting in the fall. They never knew, but when we came in to land, I greased the smoothest landing I ever made. I continued flying occasionally but stopped in the mid-80s because of the cost.
- As I was learning to fly, aviation was reinventing itself. Unpowered hang gliders existed, and someone decided to add a motor and propellor behind the pilot. Ultralight aircraft were the result. Before long people kept trying to improve performance and range, but then realized that they were reinventing regular airplanes. The FAA stepped in and started regulating ultralight aircraft, though you don't need a regular Private Pilot's license to fly one.
- My love of aviation led to my first college degree, a Bachelor's degree in Aerospace Engineering and Mechanics. Much later when I worked for the FAA, I looked up my aviation teacher from high school and let him know one of his students was now at the FAA.
- I tried to get back into flying in the early 90s, but my poor color vision would have prevented flying at night. I wanted to fly for Angel Flight's volunteer medical service but had to give up.

Skydiving

- While in college in the early 80s, I was intrigued by skydiving. A man was selling a used parachute rig for \$250. I gave him a deposit as a downpayment, and somehow he thought I was paying to hold the rig until I paid the full price separately. I sued him to get my \$50 deposit back but was way too timid before a judge to be credible. I gave up.
- In the mid 20-teens, I saw that a friend was checking into Facebook often from a skydiving drop zone in southern New Jersey. One December we had an unusually warm day (about 65 F) and I went to the drop zone and did my first skydive, a tandem with the senior instructor (a gruff German Army veteran named Range) strapped behind me. I didn't pay enough attention to our altitude as we were in freefall, so the instructor had to pull the pilot chute for me. We flew around under the main canopy for about five minutes, and he brought us in for a landing. I had THE BIGGEST ADRENALINE RUSH OF MY LIFE after we landed.

- It was silly to start skydiving lessons in the winter, so the next spring I did so. Close to earning my license that fall, I made a herd of mistakes and landed in trees, breaking my left lower leg. I came back the next year and finished my license. I kept skydiving a little, and even bought my own rig for about \$4000, but finally gave up because it was a long way from having a license to being accepted as a competent skydiver.
- New rigs can easily run \$6,000 to \$10,000 and each jump costs \$20-25, so it's not a cheap hobby. The other issue was that the weather requirements are strict (safety first!) so you can't jump if it's overcast or too windy or raining, so even a "nice" day can put you in a "weather hold" to wait for conditions to improve, which could take minutes or the rest of the day.
- Spoiler alert: when you see a movie and they clip a parachute chest strap and jump, yeah, not good. When the canopy opens up you lose about 90 percent of your falling speed, and the leg straps take most of that stress. The chest strap just keeps you from falling forward. Without the leg straps the whole rig would just slide over your head. Bye-bye!
- It was good that I didn't get the parachute rig while in college. The quality and reliability of parachutes improved a lot, and the three-ring release system was only invented in 1982. The three-ring release allows the skydiver to "cut away" or get rid of the main parachute quickly in case it isn't usable. Bill Booth of New Jersey invented it and made it publicly available instead of proprietary, another example of an inventor doing something huge for the public good instead of just trying to make the most money from it.
- Apparently, safety wasn't a high priority in earlier decades. I heard rumors that in the 70s and 80s that some drop zones would allow a beer keg in the airplane so they could have a drink before jumping. Even worse, there was a time when they held contests to see who could open their parachute the LOWEST. It doesn't take a rocket scientist to tell that is an epically bad idea. Now drinking is strictly prohibited until after everyone is done jumping (generally after sunset), and main canopies are opened at 5,000' for early students, and maybe as low as 3000' for experienced skydivers. That gives plenty of time to resolve issues if there are any.
- The instructor Range was safety obsessed, as he should be. After I was active, he passed having done 30,000 jumps without a single major injury. For comparison, the highest level of amateur license requires 500 jumps, and most dedicated skydivers don't get to 5,000. The instructors who do tandem jumps can do 15 or more jumps in a single day, on a beautiful summer weekend. They literally take a passenger up (who was prepared and set up by ground crew), land, get another rig (packed by a person known as a "packer"), and repeat all day. Ideally a single jump is under 30 minutes: 15 minutes to climb to altitude, 6 minutes for the jump, and a little time before and after for loading the plane, taking pictures afterwards, etc.
- Skydiving gave me some incredible sights. During freefall you go from stepping out of the airplane at about 13,500' altitude and fall for about a minute to more like 4,000'. That means a few seconds after leaving the airplane, you are falling at about 120 mph. One fine summer day, we had some big fluffy cumulus clouds with enough room in between them to jump safely. As I fell, I was right next to a huge cloud, and was able to look inside it to appreciate its intricate beauty. I was in awe and got to look inside that cloud in freefall for a vertical mile. Wow.

Music

- My father has been a huge musical influence on my life. Always a performer, he has a recording of him singing at West Point in the late 50s. He was always in church choirs and other ensembles

while I was growing up. When he was about age 40, he picked up playing the baritone horn, which he had done decades ago, I think in high school. He still plays, but the community band he belonged to for another 40 years finally disbanded (no pun intended) recently.

- My father and the Looney Tunes (1958?) cartoons introduced me to a lot of classical music. I subscribed to the Philadelphia Orchestra for about a decade, and was in a cheap seat perched above and behind the orchestra, so I could see the melodies passed from one section to another not just hear them. The Orchestra raised prices a lot in the early 20-teens, so I finally gave up. When I started a 9-performance series was under \$100, and it doubled then tripled over the years.
- As discussed at length in an essay on music technology,³ before vinyl records were used, reel to reel magnetic was the first common music recording and storage technology. I played with a home reel to reel tape deck, but never learned how to use it. I assume it was from the late 50s or early 60s. The tape reels were 7" in diameter, and you had to manually feed the tape through the read/write heads on the tape deck and start winding them on an empty take-up reel.
- Barely before my time were 78 rpm records which were 10" in diameter and could only hold about 3 minutes of music because they spun so fast. I got one 78 rpm record from a great aunt's estate but had nowhere to play it.
- Record players in the 70s and 80s generally only had the 45 and 33-1/3 speeds. A record stored music in analog bumps in the vinyl which were read by a diamond-tipped needle. As a result, records would wear down with repeated play and the needles needed replacing sometimes as well.
- The 45 rpm records were two sided, one song each on the A and B sides. They were 7" in diameter and could play songs up to about 5 minutes long. I started buying occasional 45s in the mid-70s. I recall early choices like the song of the Red Baron, Le Freak by Chic, and other embarrassing choices. They only cost a dollar or two so it was an easy way to get a popular song without buying an entire album.
- The main way to get albums was with a 33-1/3 rpm LP (Long Playing) record. They are 12" in diameter and can hold about 25 minutes of music per side. Some of my newspaper route money went to buy records for \$5 in the mid-70s. Styx's Grand Illusion album was probably my first one.
- All vinyl records were easy to scratch or get dirty, so when you played them, you couldn't jump or do anything else that might make the needle jump and scratch the record. There was no way to fix a scratch. Wise people avoided touching the record tracks because oils from your skin could easily reduce sound quality.
- On the cultural side, my dad hates pop and rock music, so my brother and I had very clear volume limits because the only record player we had was a Pioneer system dad bought in about 1972 and was in the living room. My ears became very accurately attuned to the allowable volume. He still has that system, now in his basement.
- For portable music, we had 8-track tapes in the 60s and 70s. The tapes were large and bulky and had four short tracks on them in a continuous loop, but it was hard to get music to fit on each track nicely. The players were also very loud when changing tracks. I never used 8-tracks but heard others' a few times.

³ <https://socialsciencepapers.wordpress.com/2023/12/18/music-technology-impact-on-composers/>

- I went the route of cassette tapes in the early 80s, which had A and B sides and held 30-60 minutes per side. Albums were distributed on 8-tracks and cassettes, with the 8-tracks losing popularity by the early 80s.
- Vinyl and cassettes gave way to compact discs (CDs) starting in the late 80s. Vinyl started a resurgence in the 2000s by DJs and rappers. Some music purists prefer the sound of analog music as being warmer than digital.
- In the last decade, CDs have been dropping in popularity because of fast ubiquitous Internet connections and streaming music services like YouTube, Pandora, Spotify, etc. A young housemate laughed when she saw my collection of music CDs and movies on DVD. The younger generation prefers to stream media instead of having physical media.
- I like the comfort of having physical discs and not depending on 1) which movies are on Netflix or 2) if I can find a good copy of a song I want on YouTube and 3) have a steady Internet connection all the time. I have about 300 music CDs and listen to a few in my car.
- When I got divorced in 2007, my ex-wife separated out my vinyl from hers, and did very poorly. Several of my favorite records were missing. I donated my remaining vinyl and cassettes to a thrift store.

Money

- Before I needed a checking account, I had a passbook savings account in the 70s. You made a deposit in person at the bank, and the amount was written in the passbook by the bank teller, followed by their initials. When you deposited or withdrew from the account, it was done in person and initialed by the teller. That was the extent of security!
- My brother and I delivered newspapers outside Chicago in the mid-70s, the Chicago Tribune and the Chicago Sun-times. We had to get up obscenely early (often with parental vocal reminders) put together the newspapers (they frequently had several sections we had to collate) and then deliver them by bicycle. This made us each a massive \$30/month. My brother estimated that the job would take us two hours per day, so we were working for 50 cents per hour. As the December holidays approached, the Tribune got huge with sale ads. Once we weighed a single copy at 5.5 pounds.
- As a child I was allowed to roam quite a bit. In the mid-70s we lived near bike paths outside Chicago that were converted from abandoned railroad tracks. The paths rarely crossed city streets, so it was a safe way to explore. I rode my bicycle up to 10-12 miles from home on these paths. Once I stopped at a small convenience store and was appalled that I had to spend 35 cents for a can of soda.
- When I rode around town or on the bike paths, my mom kept reminding me to keep a quarter on me in case I had to call home on a pay phone. I never did since cash burned a hole in my pocket and had to be spent immediately. Duh.
- When I was in high school in the late 70s, it was common for people to use grocery stores to cash their paychecks. They would buy the week's groceries and pay by signing over their paycheck. That gave them cash, and they would go around town to pay utility bills and other expenses. Stores that didn't want to cash paychecks would put up signs saying, "no third-party checks." I suppose you could also cash a check from a private party, like a birthday check.
- When you paid for something in person with a check, it was impossible to validate the check on the spot. To try to get around this, some stores required that you have checks above a certain

check number, like 100 or 200. The idea was that you would hopefully be responsible after writing some number of checks. Another technique was to write your driver's license number on the check to make it easier to track you down if the check bounced (had insufficient funds).

- College in the early 80s was my first extended time away from home. I had saved spending money from working at Mount Rushmore the previous summer. My parents generously paid for my brother and I to get our Bachelor's degrees, so I didn't have to pay for tuition, dorm, or the cafeteria program. I wrote checks at a tiny convenience store near my dorm to buy Pepsi and munchies. Years later I found the check register and saw that I had written dozens of checks for \$10 or \$12.
- Speaking of tuition, my first degree cost about \$1350 per academic year for tuition in the early to mid-80s. Expensive text books were around \$30-40 each. My Master's degree around 1990 was more like \$1700 per year and books were more like \$50-60. Those were both state universities with in-state tuition rates. I didn't go for my PhD until 2005, and tuition was up to around \$1000 per credit at a private university, and books could reach \$150 for a single course. Fortunately, as faculty in the same University (but different school), tuition was essentially free after I defended my dissertation proposal after 2-1/2 years. My last degree a few years ago was \$47,000 for one year's tuition at a private university, and books for the year were over \$1500.
- When I was on my own in the mid-80s, credit was VERY tight. You had to get and use gas station credit cards and department store credit cards for a couple of years before you could get a Visa card with a limit of \$250 or \$500. I built up a credit line of over \$5000 with my JC Penney credit card, and had two or three gas station cards before I got a Visa card.
- Eons ago, like before 1971, many countries linked the value of their money to the price of gold. This produced a logistical nightmare since the price of gold isn't steady, and the USA doesn't control most gold mining in the world. Nevertheless, there were bills printed in the early 20th century labeled Silver Certificate or Gold Certificate at the top, promising that they could be redeemed for their face value of that metal. I had a few Silver Certificate bills.

Calculators

- My father went to West Point Military Academy in the late 50s. He was an engineering student, which was easy to identify because they carried a foot-long slide rule in a leather case on their belt. He still has it and remembers how to do a couple of things.
- My mid-80s coworkers told how they eagerly bought the first electronic calculators when they came out in the early 70s. It could add, subtract, multiply, and divide. It cost \$1200.
- In the mid-70s, my brother bought a scientific calculator, which was quite an investment at the time, maybe \$60. I followed suit and bought a slightly different one. Mine was worn out in a couple of years, but his still works. If you entered a complex problem, the screen would flash gibberish for a few seconds before it displayed the answer.
- In the late 70s, I was learning to fly. We used a circular slide rule for converting distances and other calculations. Aviation calculators were just starting to exist but weren't legal to use during the FAA pilot test, so we didn't try to use them. I was working for a net pay of about \$2.50/hour and renting a four-seat airplane was \$34/hour, so flying time was precious. I understand a similar airplane now rents at around \$160 per hour.
- I got a small Sharp scientific calculator during my senior year of high school (early 80s). I still have it, and it still works on the original battery.

- In college in the early 80s, many engineering students got an HP scientific calculator because it could multiply data matrices together. At over \$100, I never tried to get one. You also had to learn RPN, which was often called Reverse Polish Notation after its Polish inventor. To make it easier for the calculator to work, RPN made the user enter equations very oddly. So instead of entering “4 + 5 =,” you had to enter “4 Enter 5 +.” It had no equals sign. RPN got very messy for complex equations. Apparently, there is one calculator still made that uses RPN or Postfix Notation.
- To give an idea how revolutionary an electronic calculator was, one of my great uncles got into banking, partly because he was a human calculator. He could skim down a column of numbers and add them as he went.

Typing

- My father was in the Army in the early 60s. Copy machines didn’t exist yet. If he needed a copy of a document, a secretary had to retype the entire document, and as an officer he had to sign off that it was an accurate copy of the original.
- My father did his PhD in German in the early 70s, so he got a manual German typewriter to be able to type each draft of his dissertation. The typewriter had the vowels with umlauts (ü ö Ä Ë, etc.) and switched the Z and Y because German uses Z a lot more than English. My mom was trained as a secretary, so she could touch type, but she couldn’t adapt to the German keyboard to help type his drafts. I was quite young at the time, and just remember needing to be VERY QUIET when my dad was typing his dissertation.
Yes, he had to manually type every draft of his dissertation, including citations. Every sheet had to have a separate page behind it so he could tell when he was approaching the bottom margin of the page. When I first saw word processing, I was sure he would have killed for that technology!
- Through the 70s, the only way to type multiple copies of a document at once was to use carbon paper between the copies. That meant the typewriter had to press through several layers of paper and carbon paper, so the lower copies got fuzzier and fuzzier.
In middle school, I recall using a mimeograph machine to produce a school newsletter we wrote. Each page of the newsletter was typed on a stencil page, then spun on a drum that pushed ink through it onto blank paper. That was the extent of copying technology until copy machines were invented.
- At home in the late 70s and early 80s, I frequently typed up notes that were important to me.
- When I was in high school, electronic typewriters were state of the art for creating professional quality documents. The IBM Selectric was king. It had a ball with your font on it, and usually people had one 10-point font and one 12-point font. To change font, you removed one ball and installed a different one. I think there was also a third ball for Greek characters, mostly used by secretaries. Those were your choices unless you hired a graphic designer.
- Only women were expected to be able to type. My engineering coworkers were from the era where you wrote a document by hand and gave it to a secretary to type up for you. They still did this in the late 80s. When personal computers were introduced, I heard one engineer complain that they would turn us (engineers) into our own secretaries. He wasn’t wrong.

- Those secretaries typed up all sorts of technical reports for my department, including ones that were classified. If they were told that a particular document was extremely sensitive, they had the ability to type the document without retaining any conscious memory of its contents.
- My first girlfriend was part of a typing pool for a state agency in the early 80s. She had a tiny table just big enough for the typewriter, and clips to hold the document she was typing from. She was one of a dozen or so women in the pool, and their manager would give them each another document to type as they finished the previous one. You had to type at least 30 words per minute to be in the typing pool.
They got a word processing program, which was very exciting. It even had special characters to allow you to do a superscript or subscript, but it was so dumb that it counted those special characters as part of the line width. As a result, a short word at the end of the line would get pushed to the next line even if it shouldn't.

Computers

- My engineering colleagues were working in the late 60s and through the 70s, well before client/server technology made computers easier to access. Early on, the only mainframe they could use in the Los Angeles area was 20 miles away from their office. As a result, to run a program, they generated a stack of punch cards, put a rubber band around them, and left them outside their office at the end of the day. Someone came around with a cart and collected the punch cards, drove them to the mainframe location, ran them, and printed the output. The output was bundled with the cards and returned to the office of the engineer. That's how they ran programs. Once a day.
- When I was getting ready to leave that organization, I found some technical reports from the late 60s. The programs were typically very short, maybe one or two dozen lines, and they generated tables of output for design trade studies. That way the engineer could manually interpolate on the tables to find the best design point. Each report included the source code used to generate its results.
- Punch cards were a normal data entry method until the 70s. My company had file cabinets that were specifically sized for punch cards, and still used them to look up data history until the early 90s. I asked at one point why we didn't take the cards to the card reader we still had and transfer the data to a more useful medium. My answer was that we didn't have a charge number for doing that. By 1994 the office was moving from southern California to Tucson AZ, and they had to throw out all the punch cards because there was very limited room in the new facility. We transferred data from magnetic tape to 128 MB mini CDs. We couldn't read the older 7-track magnetic tapes (mid-70s and earlier) and found there was a company in Florida that could transfer them for you for \$1 per MB. I think we just threw them out.
- I discovered the magic of magazines in the early 70s, and by the late 70s started learning about computers. I still have copies of Popular Science and similar magazines, from before specialized computer publications. I learned about computer kits you could get from Radio Shack and solder the parts together yourself. Music cassettes were used for storage by some systems. I was aware of very early consumer computers like the TRS-80 ("trash 80") but didn't play with any of them. I read about them and started learning the language of computers.

- In high school (late 70s), we had an early Apple computer, and I remember you could draw simple shapes if you told it the exact pixel coordinates of each corner in the shape. And you had 16 colors to choose from. Go crazy.
- In high school my computer teacher passed around a sample of magnetic core memory. That memory was used from the 50s through early 70s; his sample probably from around 1960. Magnetic core memory used a 2-D matrix of tiny ring magnets with wires running through them horizontally, vertically, and diagonally. Currents through the wires could read the state of a single magnet or change it from zero to one or back. Yes, every ring magnet stored a single bit of binary data. That's why computer storage was extremely heavy and expensive until disk drives were invented. Around 2000 I found a sample of magnetic core memory on eBay and added it to my technology collection.
- To see how much computer memory needs have grown, consider the guidance computer that got our Apollo astronauts to the moon and back in the late 60s and early 70s. The software to do guidance took only 1300 lines of code. For comparison, all of Apollo 11 needed 145,000 lines of code, a decade later the Space Shuttle needed 400,000 lines of code, Windows XP in 2006 needed 45 million lines, and the Macintosh operating system OS X in 2006 needed 86 million lines.
The Apollo guidance computer stored 69,000 Bytes of data and had RAM of 3840 Bytes, and that was enough to get them into orbit, get to the moon, land, take off, and get back home. Now we measure computers in TB of storage and GB of RAM only 55 years later.
- In high school I had the privilege of learning computer programming in Basic. Not Visual Basic, just Basic. We had one terminal and one printer, which connected to a mainframe computer 80 miles away via a 300 baud (bps) modem. You put a telephone receiver into the modem cradle, and it dialed up the computer, which we shared with hundreds of users in the region. A 300 baud connection was 300 bits per second, or 37.5 characters (letters) per second. A single line of text could take 2-3 seconds to receive.
Even more fun, we stored our programs on 1" wide paper tape. The printer had a paper tape reader and writer. Writing the tape meant punching holes, one row of holes per ASCII character, up to eight holes per row. ASCII was a 7-bit code that could express Western European text. We fed a tape back through the machine to read it. You could tell who was in computer class because we had a lump of rolled up tape in our shirt pocket. I later learned that the paper tape was standardized in 1963.
- It wasn't until 1981 that the IBM Personal Computer was released. It couldn't do much, so the business world pretty much ignored it, but consumers jumped at the chance for this new technology. I used similar computers through college in the early 80's, mostly computers in my dorm computer room to prepare assignments. I think I saw exactly one person who had a computer in their dorm room. That computer cost more than a year's tuition.
Funny mistake: Some operating systems could let you keep previous saved copies of a document, and you gave a command to delete the extra copies. At one point I tried the command PURGE on a DOS-like computer, and nothing happened. After a while I figured out that I had deleted the computer! No warning messages, nothing. Just gone.
- Personal Intel-based computers were designed to be used at home, so networking was an afterthought at best. Macintosh was more aimed at schools, so they thought of networking from the start.

- Years later I found an ad from DEC (Digital Equipment Corporation) for their “latest” mainframes in 1978. They had three models to choose from, with blindingly fast CPU clock speeds of 1, 2, or 3 MHz. Yes, Megahertz. Clock speeds now are about 1000 times faster, and many other improvements.
- In college I was an engineering major, and we had a lab using an analog computer, even though it was obsolete by the early 80s. Many problems in science and engineering can be solved by differential equations (calculus). An analog computer models the real problem with an equivalent electrical differential equation. So instead of outputting, say, the temperature over time, it would output voltage over time. None of my classmates or I could understand it at all, and the professor came by and fixed the settings in a few seconds, and I learned nothing. But we got the right result.
- In college my computer programming was in the FORTRAN 77 language, a popular third generation language for scientific programming. Those were the only computer science classes I ever took. Decades later, I was briefly an Associate Professor of Computer Science, to my considerable amusement.
- One of my professors in the early 80s wrote a program to calculate the shape of an airfoil based on its NACA code identifier, like NACA 2415. The number gave coefficients to define the airfoil. NACA became NASA in 1958. Anyway, the program was written in a very old version of FORTRAN and made extensive use of an abomination against humanity called a calculated IF statement. Normally a conditional statement (IF) would evaluate some expression into a logical TRUE or FALSE, and execute different commands based on that result.
- A calculated IF statement was given an integer variable. If the variable is less than zero, go to X. If equal to zero, go to Y. If greater than zero, go to Z, where X, Y, and Z are the labels for other statements in the program. This nightmare program used five or six calculated IF statements in the span of a half page program. The professor was very proud of this mess because it was so primitive that any version of FORTRAN could run it. I tried to rewrite the program, and just cried trying to follow its logic.
- In the mid-90s I wanted to get my programming skills updated. At that time, C++ was the big language, so I investigated it. Unfortunately, there was no standardization of C++, so each vendor had their own version of it. If you wanted to learn it, you had to gamble on which version was most marketable.
- Looking for a more standardized programming language, I found Ada, named for the first programmer, Ada Lovelace. Ada was developed in the late 70s and early 80s because the government was frustrated by the huge number of languages used in defense systems, around 400 of them. Ada was to be a general-purpose language that most projects could use and was based on the popular academic language Pascal with strong variable typing added. Ada had an international standard in 1983 and became an object-oriented language in 1990. The Dept of Defense mandated the use of Ada, which was quickly ended after considerable resistance. It is still used for high reliability systems. Ada 2022 is apparently the current version.
- At work in the late 80s, we used DEC mainframe computers using an operating system called VAX/VMS. We had a VAX 11/780 computer, which was a very popular mainframe. It was about five feet high, three feet deep, and ten feet wide. Mainframes were kept in heavily air-conditioned rooms (to offset the heat they generated) with raised floors so you had room to pass the power and data cables under them. The last upgrade for the 11/780 was well over \$100,000.

The computer had been used so long that when it was retired, they threw a retirement party for it. Nope, not kidding.

- The mainframe used magnetic tape, which I later learned was ½" 9-track tape on a 10.5" diameter reel. TV shows and movies from the 60s and 70s often showed these reels; they were just data storage. A single tape was up to 130 MB capacity, at a wimpy 6250 bpi, bits per inch of tape. My employer also had tapes from the mid-70s, which were 7-track. Open reel magnetic tape storage died out by the mid-90s, but today there are magnetic tape cassettes that can hold terabytes of data.
- Even though an engineer, I held off buying my own computer until 1991. A Macintosh IIsx, a mid-range system of the time, had 5 MB of RAM and a 105 MB hard drive. With a terrible dot matrix printer and cheap monitor, it was \$5000. Its CPU was a Motorola 68030 at 20 MHz, roughly comparable to an Intel 80386.
- For over a decade from the late 80s to the late 90s, an entry level home computer was \$2500, mid-range was \$5000, and top of the line was \$10,000, even as technology kept advancing. RAM or computer memory was \$40/MB for years and years, until one of two factories in Asia that produced it burned down, and prices went up until the factory was replaced. Then prices started dropping. For contrast, today you can get 32 GB of RAM for \$60, about 0.2 cent per MB.
- To give an idea of the leaps in computer processing complexity, the first Intel chip used in the early 80s, the 8088, had 29,000 transistors on its chip and the electrical paths were 3 microns apart. The first Macintosh computer used the Motorola 68000 chip, so named for its 68,000 transistors and had 3.5 micron feature size. CPU clock speeds were on the order of 4-16 MHz. Apple moved away from Motorola processors in the early 2000s. The Intel i9 chip in this computer runs at clock speeds of 2.4 to 5.3 GHz (2400 – 5300 MHz, has features 14 nm (0.014 micron) apart, and has about 4.2 billion transistors!
- The year 2000 was a terrifying prospect for many programmers. Some industries such as real estate or life insurance had to use four-digit years from the beginning, but a huge number of applications were written using two-digit years. Business and scientific applications started being written frequently in the 60s and 70s, and we've seen how expensive storage was. The Y2K problem was a great example of publicizing a huge risk and preventing it from being catastrophic. Untold numbers of applications were upgraded to use four-digit years, and many others were retired, and the data transferred to a new Y2K-compliant system.
- I was working for a defense contractor when 1/1/2000 hit. Everyone had been told many times to shut down their computers before midnight on 12/31/99. The government mandated proof that businesses were compliant. A friend did accounting for a small business using a very old DOS-based application. The business used Y2K to finally upgrade to a new application.
- I heard that an older accountant was going to be fined \$5000 for not proving that his system was compliant. He responded that he did not use a computer, and his brain was compliant.
- So what happened on 1/1/2000? Almost nothing. I saw on the news that a baggage claim display in the Philadelphia airport was showing the date as 1/1/1900. No big deal.

Networking and The Internet

- Commercial computers started as giant mainframes. You connected via terminals, which was just a dumb TV that displayed whatever text the computer sent it. For reasons I don't know, many terminals were green font on a black background, and could display up to 80 characters across,

like a typewriter. Printers could print 80 characters wide, or 132 characters. Early programming languages used those numbers for many limitations and assumptions in writing source code.

- Then they got modems to work, so you could connect to a computer using an analog phone line. That's what I used in high school, literally putting a phone receiver into a cradle to contact the mainframe 80 miles away.
- As computers got smaller and faster, local networking was needed. Connections to devices in the same room (printers, modems, magnetic tape drives) could use serial or parallel port cables, which were both very slow. Serial ports started under 100 bps (bits per second), and eventually worked up to 9600 bps, using a 9-pin RS-232 connector. Parallel ports were in the 150-300 kbps (thousand bits per second) range with a 25-pin Centronics connector. These have been superseded by various versions of USB (Universal SERIAL Bus) starting in 1996.
- The modern networking protocol Ethernet was invented on a napkin in 1973 and had an initial speed of 3 Mbps (million bits per second). The earliest versions used thick or thin cables, then switched to an 8-wire twisted pair cable in an RJ-45 plug, like a wide phone plug. Now it has been improved to operate at up to 400 Gbps or 400,000 Mbps, but 1-100 Gbps are more common.
- Phone modems went from 110 bps to 33,600 bps and couldn't go faster because of noise on an analog phone line. That meant at best you would get 4,200 Bytes per second, but realistically it was rare in the early to mid-90s to get even 4 kbps.
- My first modem for my Mac IIsi was 1200 bps in the early 90s. A 9600 bps modem was available, but much more expensive. I retired my first Mac when I upgraded to the newest operating system, then launched MS Word. It opened a blank document, normal for the time, and I typed one letter. I timed it as taking two minutes for that character to appear in the document. I later sold my Mac on eBay for \$1.
- Around the mid-90s, I went on the Internet for the first time on a friend's computer and saved a few small files to a 3.5" floppy disk. I clearly labeled the disk as "Internet files." I regret throwing away that disk.
- Around 1996 I started using AOL. Yes, I had an AOL username with no numbers or punctuation. Much of what I did was within AOL's world, but I finally braved going on the Internet. I got chills down my spine because I knew how huge this was going to be. I only kept AOL for about six months, because an even nerdier friend worked for a real Internet provider. My next computer was a Windows 95-based PC with a 33.6 kbps modem.
- I got two printed books in 1995 to help find free stuff on the Internet. They included going to now-obsolete sites like Gopher, FTP (not obsolete but rarely a direct target), and bulletin boards (not an Internet site originally). They gave email addresses to ask for paper catalogs from vendors testing the Internet waters.
- The movie *The Net* (1995) showed Sandra Bullock as a computer nerd who used the Internet to track down the bad guy. Spoiler alert: the critical IP address shown for the bad guy is not a legal address on the Internet. The movie shows her ordering a pizza online, which was not yet possible in 1995.
- I joined The Internet Society (ISOC) in the mid-90s. They are responsible for managing the protocols that make the Internet work worldwide, such as TCP, IP, HTTP, etc. The first standard they approved was in April 1969, after which the Internet predecessor ARPAnet connected four computers.

- The ISOC newsletter kept track of the status of Internet growth around the world. After all, north America, Europe, and Asia got on board fairly quickly, but South America and Africa lagged a lot. An example of a newcomer to the Internet was when a university in a country was able to access a satellite once a week to exchange email. That was it. That was their connection to the Internet for their entire country. Many African countries got email-only access well before full Internet.
- Now (October 2023) there are about 5.3 billion Internet users worldwide, about 66% of the entire world population. The United States has an estimated 319 million Internet users, about 95% of the population. Imagine the disadvantage of the 5% not connected.
- I was teaching online classes in the late 90s, and had a problem with a student in Montana, with me in Pennsylvania. They were supposed to download a statistics program called SPSS, which was a single file about 560 MB. They called tech support because their computer told them it would take 27 hours to download, and they couldn't keep a steady connection that long. They were using a modem for a completely online degree program. We mailed them a CD instead.
- Demand for faster networking as the Internet became huge in the mid-90s, soon connections were available from cable TV companies, the first connection (a coaxial cable) that didn't use a phone line.
- DSL (Digital Subscriber Line) Internet connections appeared by the late 90s. It used a dedicated phone line but sent digital signals across it. The speed you could get depended on how close you were to the connection point, called the central office or CO.
- A friend bought a house in rural southern New Jersey in the late 90s that was literally across the street from the CO. He got a blindingly fast 7 Mbps DSL connection. He salvaged leftover 16 GB hard drives from work and filled them with MP3 music files.
- Faster Internet connections led to converting music CDs into MP3 files, which a computer could play easily. Peer file sharing made it easy to download files from a stranger who had what you wanted. This was huge until the Napster lawsuit in 2000-2001. Unlike other peer applications, Napster maintained a central database of users and what they had to offer. The lawsuit brought peer sharing to a snail's pace after many individual people were sued for copyright infringement.
- I used a peer file sharing application called BearShare briefly in 2000. I think the biggest thing I copied was a version of the AutoCAD drafting program. Many other peer file sharing apps were created and died after Napster lost their case, including Gnutella, KaZaA, and Limewire.
- I've heard that "torrents" are the big file sharing tool now, such as BitTorrent, introduced in 2001. Using torrent sites in countries that have no or few copyright laws, one can download a new TV episode or movie about 20 minutes after it has finished broadcasting, with commercials stripped out.
- In the early 2000s I used Usenet groups ("newsgroups") to download text files and images *en masse* and look up technical computer subjects.

Computer CPU Technology

- There were two huge jumps in computer technology from my point of view, multiprocessing and multi-processors. Not the same thing at all!
- The first computers could execute one program at a time, technically called a uniprocessor system. The CPU did nothing until you gave it a command, and then it would execute that command. The first personal computer operating system, MS-DOS was this way circa 80s

through mid-90s. In DOS, when the computer returned to a command prompt (C:\) it was done with the previous command and you could shut it off safely.

- I had an IBM midrange computer from the early 1990s, an AS-400, and was told it also could not do multiprocessing. That computer took up a six-foot tall 19" wide rack, and cost about \$250,000 new.
- Multiprocessing allowed the computer to run more than one process or program at a time. All modern computers can do this. On a Windows personal computer, the Task Manager shows which processes are running and how much of the CPU's attention they are getting. My computer is showing four applications running (including MS Word to type this) but also 129 other processes. Multiprocessing is why a computer since Windows 95 should always be shut down by a command, instead of just shutting off the power. The shutdown command lets the computer close (kill) all of the processes in an orderly manner.
- Multi-processors (new subject!) allow a computer to have more than one CPU. This was a huge step in computer development because computer engineers ran into the problem of a physical limit on the clock speed that runs a CPU. All processes in a computer start and stop in sync with the clock, so a faster clock makes for a faster computer. Computers in the 1960's had clock speeds in the kHz range (1000s of cycles per second), late 1970s mainframe computers were up to 1-3 MHz (million cycles per second), early 1990s personal computers were around 10-40 MHz, but clock speeds stopped growing around 3 GHz (billion cycles per second). The reason for the speed limit was related to how small the pathways could be in the CPU without electricity jumping to a different pathway.
- The only way to make a computer faster was to go to multi-processors, which required developing technology to assess incoming tasks and decide which processor (CPU) would get it. Windows NT (1993) was the first personal computer operating system to handle multi-processors. I got an estimate for a Pentium computer with two CPUs around 1995 for \$6000, over twice the price of a good single CPU system.
- As demand for faster computers grew, a few companies met the need with supercomputers. These computers were very large and used multiple processors to get the most performance possible. My first alma mater, the University of Minnesota, was the first to get a Cray-1 supercomputer in the early 80s, because Cray Research was located nearby. The computer was worth \$10-15 million. A roommate who was a computer science major worked on this computer and said it had up to 300 users at once, and no security to keep them out of each other's data. Security slows down a computer. The computer was a hexagon about six feet tall, and ringed by benches. The hexagon was to reduce the cable lengths needed to get to other parts of the computer. The benches were not decorative, they hid the massive power supplies used to feed the computer. In Minnesota in winter, the building that housed the Cray-1 was heated by the heat given off by the computer. I have two decks of playing cards with the Cray-1 on the back.
- Once you could have two CPUs, expanding to more was relatively easy. But the need for speed led to realizing that leaving the CPU to go to a separate CPU took precious time. Multiple CPU cores were the answer. Essentially having multiple cores on a CPU was having many little CPUs on the same chip. The first dual core Intel chip was in 2005. Now server-grade CPUs can have up to 64 cores on one chip. This essay is being written on a laptop using an Intel i9-10885H CPU with 8 cores, purchased in 2021.

There are excellent summaries of Intel chip history here⁴ (plus Intel itself) and computer CPU architecture here⁵.

- When the processors (CPUs) are all the same, it's a symmetric multiprocessor system (SMP). Often, however, computers will use separate processors to handle very specific tasks. In early personal computers, the FPU (Floating Point Unit) was such a processor to speed up math functions. My Mac IIsi computer had a card with its FPU, which added about \$200 to the price of the computer in 1991.
- More often now, a graphics card can have a very powerful processor and dedicated RAM to display engineering models (e.g. AutoCAD) or play real-time games. I sold a graphics card for a mid-90s Macintosh computer to get it from 2 MB of video RAM to 6 MB. The buyer went crazy with the improvement! Now a graphics card can have multiple processors on it called GPUs (Graphics Processor Units), 48 GB of RAM, and cost \$9,000.
- Other specialized processors can be used for data acquisition, real time audio processing, managing storage arrays, and many other tasks. Stock trading can be done on millisecond time scales, so top-of-the-line computers can be a competitive advantage.
- The power of a graphics card affects how many screens it can control at once, how fast it updates those screens, and the resolution of those screens. My first computer in 1991 could handle a single screen at 640x480 resolution, about 0.3 Mpx. The extreme graphics card implied above (NVIDIA RTX™ 6000 Ada Generation) can handle four screens at 120 times per second refresh rate and 8.8 Mpx each (4096 x 2160 px), or two screens at 60 times per second at 33.2 Mpx each (7680 x 4320 px).
- What has 33.2 Mpx resolution? The newest 85" 8K Ultra HD TVs. That \$9000 graphics card can support two 85" TVs which are around \$6-7,000 each! To put that in perspective, an analog TV had resolution of 432 x 520 dots, the cathode ray tube equivalent of pixels. That's about 225,000 dots or 0.22 Mpx. The 1987 Macintosh SE, with its 9" black and white screen, was 512 x 342 px or 0.18 Mpx, even lower resolution than a TV.

Computer Hard Drives

- A famous photo from 1956 shows a 5 MB "hard drive" being loaded onto an airplane. It weighed about a ton. Not sure if it was really a hard drive in the sense of having physical spinning disks with reading/writing sensors skimming over them.
- In the 1970s there were 8" diameter floppy disks (VERY floppy) but I don't know if hard drives were made that size. I used a very old Wang computer that had two 8" floppy drives. You used one for the operating system and the other for your data and a programming compiler. There was no hard drive, which was also common for many early personal computers. I wrote and used FORTRAN programs on the Wang computer that was so primitive that the only variable names allowed were one letter at most followed by one number. So A4 or H8 could be variable names. FORTRAN was one of the first third generation programming languages, created in 1953.
- I found an example of a hard drive from the 70s that used 14" diameter platters (discs). That device was the size of a dishwasher and held 10 MB. I was given a leftover platter that I think was 12" in diameter.

⁴ <https://www.businessnewsdaily.com/10817-slideshow-intel-processors-over-the-years.html>

⁵ <https://airconline.com/ijcga/V13N2/13223ijcga01.pdf>

- The earliest hard drives I saw used were still big. They could hold 5 or 10 MB of data, circa 1983. They were 5.25" disc size, and a new 10 MB drive was around \$4500.
- Computers used for classified processing needed to be able to remove any storage devices so they could be put in a safe when not used. Some disk drives had the disk in a plastic carrier, so you could remove the disk and hence the data. I saw 5 and 10 MB removable drives like that, but they were obsolete by the late 80s.
- I saw software education use a similar removable disk concept. To avoid high software license fees, they would configure discs with the software for more specialized classes like Adobe Photoshop or Microsoft Visio, then copy (or "ghost" or "clone") those discs for the number of students.
- My first computer in 1991 had a 105 MB hard drive with 3.5" discs. I had some discretionary income at the time and gave brief thought to buying a bigger external drive. A 330 MB drive was about \$1500, and a 1 GB drive was \$3000. At work we had catalogs from around 1988, when 330 MB was the biggest you could buy. Then more typical personal computers came with 20-40 MB hard drives. Now you can get a 22 TB hard drive for about \$600, that's 22,000,000 MB.
- In the mid-2000s, I bought a few used hard drives from 1999. They were the largest consumer drives I've seen, with several 5.25" discs in a steel case 3.2" high. It must have weighed about 55 lbs. That 3.2" height was called Full height, as opposed to 1.6" tall drives which were Half height. Those were common HDD heights from the early personal computers until the late 90s, with 5.25" or 3.5" disc diameters.
- Hard drives are now 3.5" diameter or less, and some under 0.5" tall for laptops. Some 1" diameter hard drives were made for handheld devices.
- When I got ready to buy a new computer system, I would look for then-common capacities and plot (\$ per MB/GB/TB) versus (capacity MB/GB/TB). To make it fair, I would pick the same disc size, interface, and brand, such as Western Digital 3.5" IDE drives. This usually forms a bathtub curve, high at the ends and lower and flat in between. I tend to buy storage near the higher end of the flat part. The highest capacities are not worth it for me, so I'm trying to get a cost-effective capacity.
- Many disc-based hard drives (HDD) are being replaced now by solid state drives (SSD). SSD have been around since the early 90s, but only became practical when flash memory became much cheaper, roughly in the last decade. A SSD does not have a disc and stores data in the same type of storage used in flash (thumb) drives. That makes them a lot faster than an HDD and less vulnerable to being dropped.
- Now a laptop or desktop computer will typically have an SSD if there is one storage device, or an SSD for the operating system and applications to use, and an HDD for data storage.

Motherboards and Buses

- The heart of any computer is its motherboard. The motherboard hosts the CPU(s), RAM or main memory, storage (HDD and/or SSD) and is likely to have USB ports, networking connections (Ethernet and/or wireless), video or graphics capability (usually on the motherboard only for servers, also called "onboard video") and may have expansion slots on desktop or servers.
- Motherboards come in several standard sizes for desktop or server systems such as Micro ATX, ATX, and Extended ATX. Laptops and smaller devices tend to have less standardization.

- The motherboard gets power from the power supply. Servers might have redundant power supplies in case one fails.
- It holds the CPU(s) which must fit in the same socket type as the motherboard. The name of a socket often tells how many pins it has to fit in the motherboard. Intel desktop examples include LGA 1150 up to LGA 4189 where LGA is the type of CPU design. AMD CPUs are the other main brand, and have more obscure socket names such as sTRX4, AM4, AM5, and sWRX8. For instance the AM5 socket has 1718 contacts, and the new sTR5 socket has a staggering 4844 contacts. More contacts implies more ways for data to go in and out of the processor.
- In contrast, the Intel 80286 CPU from 1982 used 68 pins. The 50 MHz Intel Pentium CPU from 1993 used Socket 4, which had 273 contacts. Its cousin the 200 MHz Pentium from used 296 contacts. Macintosh computers before 2000 used Motorola CPUs. The Motorola 68000 CPU, used in the first Macintosh desktop computers, used 64 contacts. The 1990 Motorola 68040 processor used 179 pins. The last Motorola CPU used by Apple was the PowerPC 970 from 2002, then they switched to Intel processors.
- The CPU and the motherboard determine what type and amount of RAM can be installed and used. Small desktop systems might have one or two DIMM slots to hold RAM; servers can have 16 or more. The CPU also limits the capacity of each DIMM. My 1991 Macintosh could hold four 16 MB chips with 30 pins to connect to the motherboard. Like CPU contacts, the more connections between RAM and the motherboard, the faster the RAM can be accessed. Typical desktop or server RAM now has 288 pins.
- The CPU and RAM and everything else digital connect via the Front Side Bus. (The power supply isn't digital.) Here is another case where the speed has improved dramatically. In the early 80s I heard that supercomputers were not limited by how fast the CPU was. The limiting factor was how fast data could get in and out of the CPU. That's partly where the bus comes into play. The bus speed is less than the CPU clock speed, and is also measured in MHz. The Intel 80286 CPU bus started at 4 MHz and grew to 25 MHz. The best Pentium CPUs used buses running at 50 or 66 MHz. Motorola doesn't seem to specify their bus speeds. My laptop uses a 2933 MHz bus speed. A top-of-the-line 2023 AMD CPU uses a bus speed of 3200 MHz. A top Intel Xeon CPU can use bus speeds up to 4800 MHz. Notice that the CPU and RAM both have to be compatible with the bus speeds supported by the motherboard.
- The CPU and motherboard both can limit the size and amount of RAM supported; size as in the capacity of each chip and amount as in the total on the motherboard. My laptop's CPU can support up to two 128 GB RAM chips, but currently has two 32 GB. Large servers can typically handle 1-4 TB of RAM with individual chips up to 256 GB.
- The bus allows communication using a bus protocol. A protocol is just a language for electronic things to communicate with each other. Early Macintosh computers used SCSI buses exclusively until 1998, which was faster than buses used by PCs but more expensive. PCs used ISA buses on the earliest personal computers circa 1981. Early Macintosh computers used ADB (Apple Desktop Bus) (1986). IDE (Integrated Drive Electronics) buses started in 1986 and rarely, the EIDE (Enhanced IDE) in 1994, soon both called ATA. We got PCI (Peripheral Component Interconnect) in 1992 and SATA (Serial AT Attachment) in 2000. Many variations on PCI have been developed, including PCI 1x, PCI-X, PCI Express, "PCI Express 4.0 x16" and more. Confused yet?
- The point is that the bus protocol and speed need to be matched to your CPU and RAM. The protocols differ in how many bits of data are sent at a time (8-bit to 64-bit), the clock speed of

the bus as noted earlier, and the data transfer rates possible with that bus (8.3 MB/s to 960 GB/s).

- Expansion cards are sized based on the bus type. Earlier computers needed an expansion card for networking, another for graphics card(s), another for sound output, and maybe more for external storage arrays, other high-speed connections like Firewire, etc. Now sound and networking are often built into the motherboard.
- This is why most normal people buy a computer off the shelf, instead of trying to put it all together yourself. A goal for this section is to help understand what all the acronym gibberish means, and how to meaningfully compare computers to each other and understand the differences.