10 Trillion Texts

Five billion people sent almost 10 trillion texts last year. Even more remarkable is most of those texts got to their intended recipient within seconds. It is hard to explain to people born *after* Bill Clinton was President how it wasn't always this easy to instantaneously communicate with anyone, anywhere. (We can debate the merit of all that technology being used to send billions of "LOLs" or cat videos another time.)

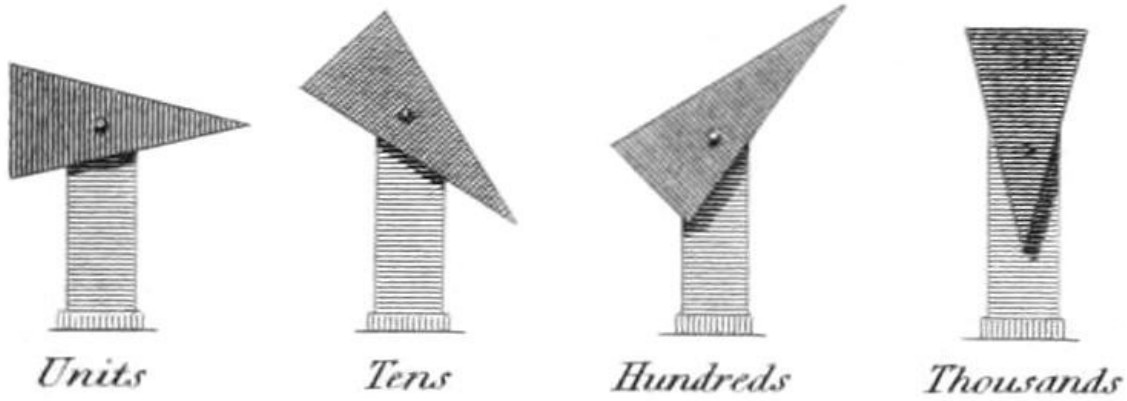
For millennia, a message got to its destination only as fast as a horse or camel could gallop - and it had to be face-to-face. If you were lucky, perhaps a neighbor was heading in the right direction and you could tell them what to say to your distant friend. Saves a trip but now a third person knows what your Aunt Linda did at the bazaar. Or they don't… quite… repeat the message verbatim. They forget a word or two which changed the message. Something about your Aunt Linda *being* bizarre? So, to improve accuracy, the message got written on animal skin or papyrus. Assuming they can read your handwriting, the recipient gets the message you intended.

In the 600s, during the Tang Dynasty in China, written communication got an upgrade with printing from letters carved from wood, called *type*. Later, in 1439, printing on a mass scale became possible with the twin inventions of the moveable press and metal type, both developed by goldsmith Johannes Gutenberg. Delivery still had to be by hand, and your message was still vulnerable to prying eyes, but metal type ensured that neither handwriting nor worn wooden type would render the message unreadable. (Of course, there's still that nagging problem of prying eyes. They've always been a problem. Archeologists found evidence as far back as

1500 BC of a potter who protected his glazing recipe with a cipher. Funny to think hackers were a problem even in ancient Mesopotamia. We'll talk more about security in a later post. For now, let's focus on speed.)

Credit for the first fast-as-light communication system goes to the defenders of China who, as far back as 800 B.C., realized one could see smoke from a distant fire. Soldiers along the Great Wall used pre-arranged signals to send messages hundreds of miles through what can best be described as relay stations.

The next leap forward comes from an Anglo-Irish inventor named Richard Lovell Edgeworth. In 1767 he placed a bet with a friend that he could receive the results of a distant horse race in just one hour. Edgeworth's system, according to the Wikipedia entry on **Semaphore**, used "a large pointer that could be placed into eight possible positions in 45 degree increments. A series of two such signals gave a total 64 code elements and a third signal took it up to 512." (Not unlike how the Matt Damon character in "The Martian" initially communicated with earth using a Surveyor lander.) Edgeworth's system was based on a proposal made one hundred years earlier by Royal Academy member Robert Hooke, who presented a plan for a network of signaling sections erected on high ground which could be observed from one station to the next by means of a telescope. It was never built.



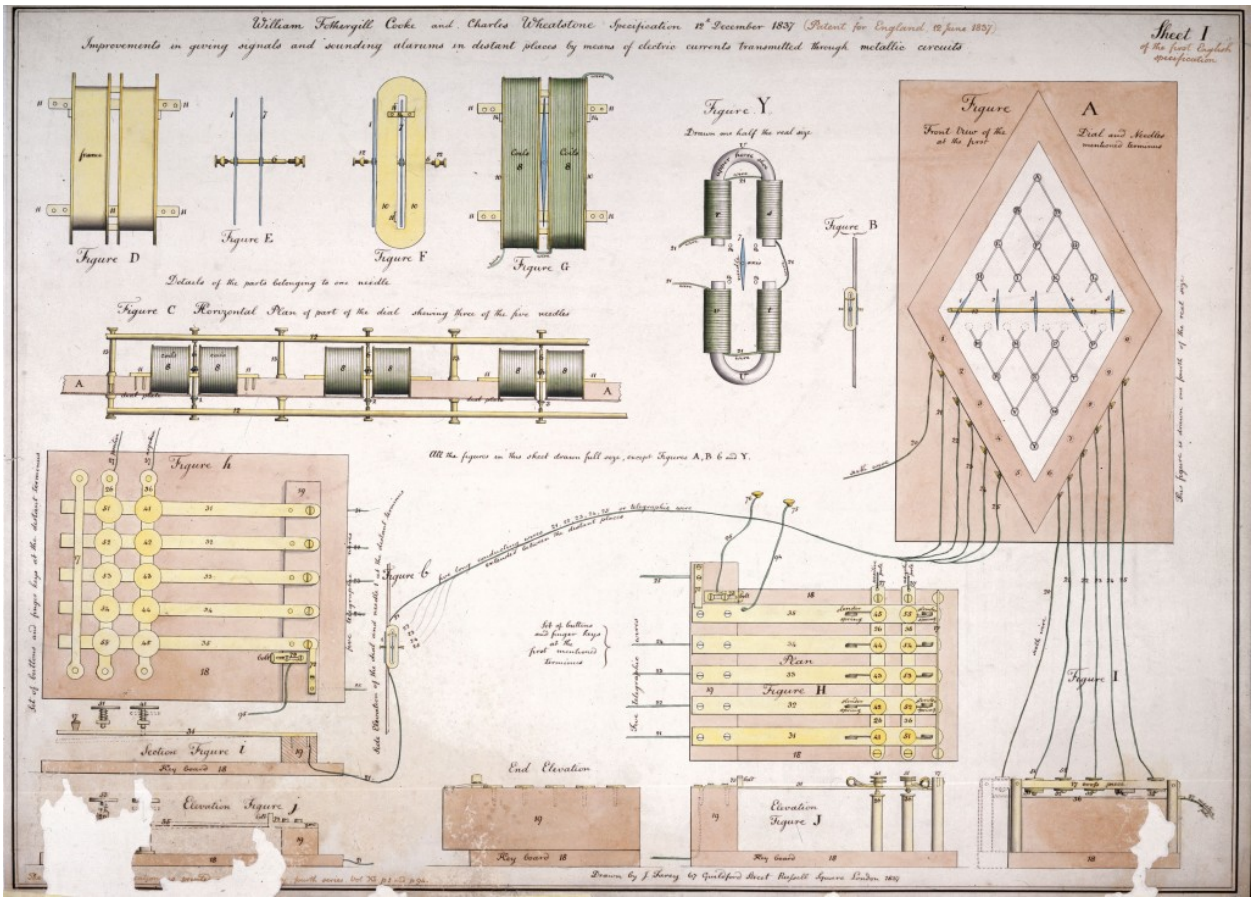
Edgeworth's proposed "optical telegraph" signaling system for Ireland. Image from Rees' Cyclopedia

A few years later, across the Channel, French engineer Claude Chappe and his brothers used a variation of Edgeworth's system to set up a network of 556 semaphore stations across France. This was a tremendous leap in speed because, for the first time, messages had the potential to travel long distances instantaneously. Though the Chapp system was unusable at night and unreliable in a fog or during a storm, it stayed in use until the 1850s.

Communication v2.0

The next upgrade in communication came from a true wonder of the age: the telegraph. We Americans like to credit Samuel Morse but, like so many groundbreaking inventions, the telegraph has many fathers.

Building on the theories of Michael Faraday (along with other pioneers of the field of electromagnetism) Baron Pavel L'vovitch Schilling built a working telegraph as early as 1832. Four years later medical student William Cooke watched as his teacher, German physicist Georg Wilhelm Munke, demonstrated Schilling's device. Cooke was so taken with the telegraph's possibilities he quit Medical School and returned to England, where he partnered with inventor Charles Wheatstone. Together they built and marketed a device using needles to point to letters of the alphabet arranged in a diamond pattern. Two needles at a time would point to each letter as it was received.



Schematic for the Cooke & Wheatstone Five Needle Telegraph System

The most brilliant feature of their device was that the message could be read by anyone. No training needed! It also differed from the Chapp system in it was not subject to the impediments of bad weather. Cooke and Wheatstone made a tidy sum selling their telegraph-based system to several British railway companies. However, these complex devices were tough to repair. They also required three separate wires between devices, adding to the cost of installation. Operators were also forced to watch the device in “real time” so they could transcribe the letters.

In 1844, as the Cooke and Wheatstone device was being installed along British Rail lines, American R.E. House was at New York’s Mechanics Institute demonstrating a device with two big advancements. To begin, his machine only

needed for one wire between stations, cutting installation costs considerably. But the real breakthrough was that the device, which looked very much like a piano, was so easy to use. Messages were sent by pressing the keys of the "piano," and when received were printed out on a strip of paper.

A 1900 Russian version of House's telegraph text device

The advantages of the Printing Telegraph were outweighed by its complexity and tendency to break down - a lot. It was also very slow.

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In 1832, just as Cooke, Wheatstone, House and others were testing, building and selling their electrically-based communication devices, a young Yale-educated painter was sailing home from Europe. The legend says that a conversation with a fellow passenger sparked (no pun intended) the idea of sending messages along a wire. Lacking a proper understanding of electromagnetism, Morse partnered with

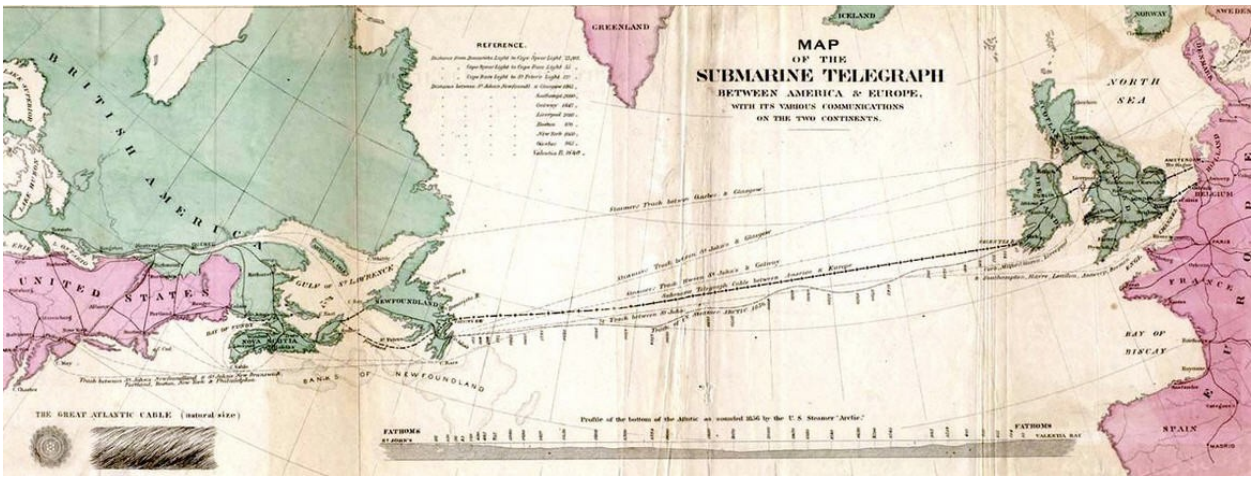
NYU professor Leonard Gale (who himself had been inspired by the work of Joseph Henry) and technician Alfred Vail. Together they solved the problems inherent in the Cooke/Wheatstone and House devices. Using a $30,000 appropriation from the federal government, they would string a line between Baltimore and Washington, D.C. On May 24, 1844 Morse, from the old Supreme Court room in the Capitol, dramatically tapped out a phrase from Bible's Book of Numbers, **What Hath God Wrought** to a waiting Alfred Vail, who was on the other end of the wire at Baltimore's train station. (The line had already had its inauguration 23 days earlier, when it was used to send the first news bulletin, the nomination of Henry Clay for President by the Whig party, from Baltimore to Washington, D.C.)

Since the government owned the line (it was their $30,000, after all) Postmaster General Cave Johnson was put in charge. Johnson was prescient in many ways. It was he who changed the collection of delivery fees from recipient to the sender. This led to his other great innovation, the postage stamp. But it was also Johnson who said "…the importance of [the telegraph line] to the public does not consist of any probable income that can ever be derived from it."

Once released to the public Morse's telegraph system took off and helped make many fortunes. As Tom Standage explained in his terrific book, The Victorian Internet, the telegraph completely changed the newspaper business. Before the telegraph the public accepted reading stories weeks after the event. By the 1850s any newspaper that hoped to compete for readers had to have a telegraph news service. World-shaking events were now being published mere days later, as opposed to weeks.

Stock and commodities brokers, always looking to get a jump on their rivals, were among the first to exploit the ability to instantaneously share information. By 1851 there were over 50 companies – each with their own set of wires strung across the eastern United States – competing for brokers' business. One of those financial service firms, later named Western Union, began buying up the competition. In a pattern that would be repeated in the Oil, Steel, and Railroad industries, Western Union was soon the 800-pound gorilla of telegraphy. In 1861, they completed the first transcontinental line, putting the riders and horses of the Pony Express (who took ten days to deliver a letter from coast to coast) out of work.

Even before the transcontinental telegraph line to California was begun one entrepreneur was looking eastward, with a plan to lay an underwater telegraph cable between North America and Europe. Using navy ships from both the United States and Britain, Cyrus Field completed the laying of a cable between Newfoundland and Ireland in 1858. The public went wild over the news, especially after President James Buchannan and Queen Victoria exchanged messages using the cable. Too bad it failed a few weeks later. Field eventually figured out the problem, and in 1866 he succeeded in laying a reliable underwater telegraph line which connected the New World to the Old. Brokers and journalists alike were more than happy to pay for access to international markets and news.



The laying of the transatlantic cable was a big deal in 1858

Meanwhile the government also found plenty of uses for the telegraph, notably during the Civil War. Abraham Lincoln famously spent countless hours at the War Department's telegraph office where he could count on getting the most up-to-date information from the front. Author David Hochfelder contends that the telegraph was as important a weapon for the victorious Union as any rifle or cannon. The telegraph, he wrote, "…handled some 6.5 million messages during the war and built 15,000 miles of line. In contrast the South used the telegraph in only the most limited fashion." (On the home front, the shortage of men during the war also provided an early opportunity for women to join the workforce as telegraph operators, according to Ronnie Phillips in a piece he wrote for the Journal of Economic Issues.)

It's easy to see why Samuel Morse's telegraph system became the global de facto standard for communication in the 1800s. It was simple to build and repair, and requiring only one wire between devices reduced installation costs. Best of all, in the skilled hands of experienced operators it was fast. As the volume of messages went up, cost plummeted. According to the Economic History Association,

messages sent over Western Union lines "…increased from 5.8 million in 1867 to 63.2 million in 1900. Over the same period… rates fell from an average of $1.09 to 30 cents per message." This reduced cost put telegrams within the reach of most people. (We should note that although no horse or camel was needed, one still had to go to a local telegram office – probably Western Union – to dictate and send the message. But now your reach was global.)

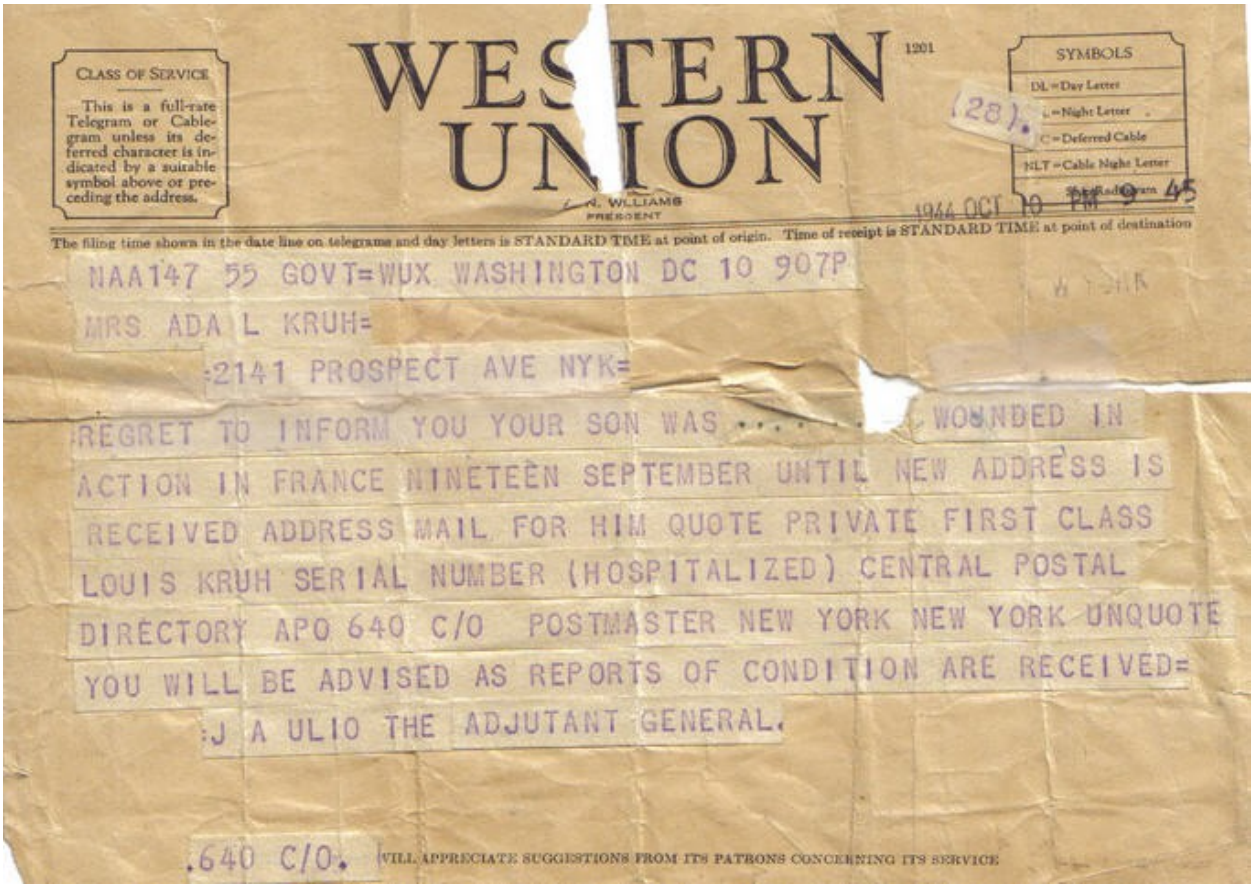
Communication v3.0

The success of the telegraph would bring about its own demise. By the 1870s telegraph poles were groaning under the weight of an ever-increasing number of overhead wires. And, as I explained in a previous EngineerZone blog, this created an urgency for someone to invent a way to send more than one message along a single wire. Research into this multiple, or harmonic, telegraph lead one experimenter - a "Professor of the Deaf" at Boston University named Alexander Graham Bell - to the invention of the telephone in 1875.

Telephones had many advantages over telegrams. First on the list would be that one did not have to know Morse Code and operate a telegraph key. All anyone had to do for instantaneous, person-to-person communication was pick up the receiver and ask the operator to ring your intended recipient. Another brilliant advantage of the telephone was – and still is – that you can have a conversation in real time. (Prying ears, whether the nosy operator or the NSA, notwithstanding.)

Phones themselves evolved, as all technology must. Rotary dials, tone pads, and wireless cell phones are all just different ways to do the same thing; enable an easy way for anyone to have real-time conversations with anyone else on the planet.

Morse Code is still used today by hobbyists like me, although here in the States it is no longer *required* for a ham radio license. Western Union is still around, but the bulk of their business is the wire transfer of money. There are also few brave souls who deliver "signing telegrams" but they are few and far between. Thanks to old movies and the memories of our parents and grandparents, the arrival of a telegram is still imbued in our culture, usually as a harbinger of bad news. This telegram was received by my grandparents after my father was wounded in Europe during World War Two. (My grandfather, not wishing to upset his wife, "redacted" the message by erasing word "seriously" from the telegram.)



WESTERN UNION

1201

CLASS OF SERVICE

This is a full-rate Telegram or Cablegram unless its deferred character is indicated by a suitable symbol above or preceding the address.

SYMBOLS

DL = Day Letter
NL = Night Letter
LC = Deferred Cable
NLT = Cable Night Letter

(28).

1944 OCT 10 PM 9 45

The filing time shown in the date line on telegrams and day letters is STANDARD TIME at point of origin. Time of receipt is STANDARD TIME at point of destination

NAA147 55 GOVT=WUX WASHINGTON DC 10 907P

MRS ADA L KRUH=

2141 PROSPECT AVE NYK=

REGRET TO INFORM YOU YOUR SON WAS ..... WOUNDED IN ACTION IN FRANCE NINETEEN SEPTEMBER UNTIL NEW ADDRESS IS RECEIVED ADDRESS MAIL FOR HIM QUOTE PRIVATE FIRST CLASS LOUIS KRUH SERIAL NUMBER (HOSPITALIZED) CENTRAL POSTAL DIRECTORY APO 640 C/O POSTMASTER NEW YORK NEW YORK UNQUOTE YOU WILL BE ADVISED AS REPORTS OF CONDITION ARE RECEIVED=

J A ULIO THE ADJUTANT GENERAL.

640 C/O.

WILL APPRECIATE SUGGESTIONS FROM ITS PATRONS CONCERNING ITS SERVICE

During the Civil War telegraph operators, needing a way to indicate the end of a message, used the number 30. Journalists and press agents adopted the convention, sometimes adding a # or - character around the number. If you've ever gotten an

email from me, you'll see -30- as part of my signature. I do that as an homage to the telegram and to the skilled telegraphers who were a critical part of the network that linked the coasts of my country and America with the world.

-30-