Networking Power

With new AI wonders being revealed daily, **strident alarms** have been issued and a **time-out** called by some big thinkers. Maybe now is a good time to pause and consider where we are. For it appears to many that computers can not only now think like humans but might soon outsmart us entirely.

This remarkable moment has been all due to the convergent evolution of computers and communications technology – but it was totally unforeseen. This is definitely *not* the way that sober intellectuals ever imagined that "thinking machines" would come about.

As vintage sci-fi illustrates, history could have taken many different directions. As it happened, *none* of the big names of science fiction ever quite predicted the internet. It is instructive to look at why that was, and what it means for our highly-connected future.

Figuring numbers, sending words

Mechanical means of calculating as well as communicating are quite old. The Romans used **abacuses** and sophisticated **signaling techniques**, but it was not until electricity powered both that they could work together.

Written messages were used to communicate through time and space since ancient times. Courier systems flourished for centuries, financed by kings and merchants: **mail** began in the 17th century and originally meant a "bag full of letters", often handled by family-run firms. But today's **international postal union** was forged mainly out of national networks run by 19th century states.

Postal systems have much to recommend them. Each piece handled has both a destination address and a return, with stamps that were bought for just the handling needed. Deliveries and collections usually happen on a regular timetable from centers linked to each other. The system has some built-in redundancies to prevent loss and it is always extendable, able to serve new addresses.

The Post Office is highly reliable but it is *slow*. The electric **telegraph** was close to light-speed by comparison. But the physics of electricity made it, and the later **telephone** system, work in an entirely different manner.

Whether carrying impulses of Morse code or the waves of human speech, electric communications depend on direct circuits closed at either end throughout the exchange. *Each conversation requires its own circuit*. This is why old photos show cities festooned with phone wires, and so many operators were constantly needed just to connect and disconnect calls, and how **party lines** worked.

Telephone networks spread like wildfires, leading to the discovery of **network effects**. As the number of phones grew, vastly increasing how many people could be called, each telephone grew in importance. The networks' growing value lured still more people in.

Network effects are why **Ma Bell** grew so huge. Those same dynamics have made Facebook and Twitter such powerhouses today.

While telegraph and telephone networks created real-time connections all around the world, electronic computers lagged far behind. They were not invented until World War II and the first links between them were to share data and computing power on big military problems like breaking codes, aiming artillery, and designing nuclear weapons.

Computers back then were not just big but dumb, with few input and output options. Piles of **punched cards** fed in programs and aptly-named "**terminals**" with dull monochrome screens and clunky teletypes allowed data to be entered and results displayed.

Connections between these giant mainframes went over special telephone lines and any kind of remote control was very difficult. So those speculating on the future naturally

thought that any intelligent machine would have to stand alone, relying on itself. Our inter-connected world was just unimaginable.

So they envisioned future worlds populated by individual robots with massive supercomputers that ran everything directly. But something unexpected happened instead.

The fear of nuclear war that might fatally result in **Skynet** first brought us the internet.

One network over all

The **internet** is a very strange thing indeed: a world-spanning mesh of computer networks composed of individual devices communicating through a postal system running over and parallel to telephone networks.

The internet is a peculiar hybrid contraption that only **ARPA**, an egghead thinktank doing futuristic military research, could have dreamed up. It was done for the same reason most things were during the Cold War: to prevail should it suddenly turn atomically hot.

ARPA scientists tried to imagine a postapocalyptic world and what could work in it. That drew them to the Post Office, which was believed to be one of the few institutions robust enough to **survive** in a functional form.

After a nuclear strike, many power grids would be knocked out along with cross-country circuits. But a postal-type system might be able to route around such damage. So they cleverly devised a new kind of network based entirely on electric **packet-switching**, where messages would be sliced up into small units and sent individually across the telephone lines to be reassembled at its destination.

They modeled the internet very closely on the Post Office and with their invention of **email** in 1971 had a killer app for it. When the **worldwide web** was created in the early 90s to display graphics and large amounts of text, the net as we know it today really took off.

There have been problems. Emails are like postcards – there is **no** inherent security. Indeed, privacy is the biggest problem facing users because they all knew each other when the system was first devised. That's why there are such headaches with hackers and false identities today. Not only that, but as well-

funded researchers, they also neglected to charge anything for basic services. Email is essentially free and unregulated; hence, nothing prevents **spamming**. Network effects have not yet helped the **internet of things** either as there are no standards for using them yet.

Other problems have been solved. With **IPv6**, the range of addresses is now basically unlimited. The net can even **stream video**, for which it was never intended. Other types of connections – such as **mesh networks** – are now possible, and the net even reaches probes deep in **interplanetary space**.

The internet is now a vital global resource. Yet some forces are acting to pervert the net's basic democratic rules. In 2021, Red China launched its "**New IP**" proposal, meant to rewrite internet protocols to support authoritarian regimes, which would tear the net apart.

As below, so above

Perhaps focusing on human threats or **generative AI**, which is causing all the current excitement, misses the big picture. Could the internet *itself* ever become conscious?

It's not such a crazy idea. **Artificial intelligence** is the product of long development. To allow computers to learn, scientists modeled them on brains, developing **neural nets** with artificial neurons. These are nodes that can be taught to recognize and process data.

Like living nerve cells, they accept input from others which influence their reaction. But the breakthrough came when they set up neural nets in **competition** with each other.

Unlike the phone system, the net cannot be run by switches alone – postal systems require some smarts to direct traffic. Millions of computers constantly talking to linked servers act a lot like neurons, so the internet is already functioning much like our own brains.

On a global scale, the net could be evolving on its own just like AI. If parts of it must compete with others, anything could happen.