

The Origin of the Smartphone

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ABSTRACT

The iPhone celebrated its 10th anniversary as the most successful product ever... supporting one trillion dollars in iOS revenues for the most valuable company in history. It's no wonder that many people thought that Steve Jobs invented the smartphone.

But, of course he did not. Its foundations had been on the market for years. What Jobs did so brilliantly was package his device with an operating system, an app ecosystem, an awe-inspiring design and a totally unique business model to create something the world had never seen before.

If these are the advances Apple made, what are its foundations? On whose shoulders did Steve stand? In technology lore, large corporations, AT&T and Motorola, get much of the credit for the advent of cellular. But in actuality, a handful of entrepreneurs were the first to commercialize the innovations that made the iPhone possible. Here is their story.

THE FIRST CELLULAR NETWORK

The smartphone is built upon three pillars: 1.) a cellular network and 2.) a pocket-sized phone with 3.) wireless access to data. Let's look at some pivot points for each of these pillars, those points in time when the raw potential became the real thing.

We start with the fundamental basis -- the cellular communications network. Where did it come from? The discovery of radio transmission by Guglielmo Marconi kicked off a century of broadcast innovation. One of the most impactful applications was the mobile two-way radio, invented at Bell Laboratories in 1924.

In the following decades, mobile telephony subsisted on niche markets. The Detroit police

for instance, used early mobile phones to combat the Mafia by making emergency calls from transmitters in the trunks of police cars. Walkie-talkies, Citizen Band (CB) radios, and similar mobile devices gave soldiers, truck dispatchers and rural workers remote connection with each other. Many of these phones came from major firms like Motorola and RCA, but the 'Cadillac' of the industry, the high-end radio- phone, came from a small business in Waseca, Minnesota, the E.F. Johnson & Co., run by a Swedish American. The prowess of E.F. Johnson & Co. was such that all three Presidents during the 1970s (Jimmy Carter, Gerald Ford and Richard Nixon) advertised on its behalf — all while still in office.

Not only did E.F. Johnson & Co. make the high-end phones, but also, with the acquisition of Rydax Corporation, it made mobile transmission equipment as well. Martin Cooper, who developed the Motorola cell phone, commented on the role of Rydax in pre-cellular telephony:

*"The development of public radio telephone in the U.S. was led by Bell Laboratories with its creation of Interim Mobile Telephone Systems (IMTS). Claude Davis at Bell Labs, Chandos Rypinski of Rydax and I led the IMTS industry."*¹

Rydax founder 'Chan' Rypinski made several crucial contributions to mobile networking in the early days, before and after he joined E.F. Johnson & Co. He patented the first automatic switch for mobile central offices (which he licensed to Bell Labs), and he invented a method to 'hand-off' calls from one radio tower to the next — the two switching keys to cellular. He worked on the "first cellular order for mobile radios with the cellular supervisory logic" and the transition from ITMS to the Advanced Mobile Phone System that became the first cellular standard in the U.S. He wrote: "from that procurement, the real definition of the mobile equipment emerged."² In short, while the giant Bell Labs came up with the concept, Rypinski and the firm he joined, E.F. Johnson & Co., were major forces in the formative years of cellular.

As these foundations for cellular took shape, Mr. Johnson did something else that had an enormous impact on the global rollout of the cell phone: he teamed up with another Swede, a blonde-haired entrepreneur named Jan Stenbeck. No one grabbed

the opportunity more vigorously than Stenbeck.

He started with a bang by forming a U.S.-based venture named Millicom Inc., and by acquiring Comvik – the only private mobile telephone operator in Sweden. He promptly converted the 2,500 customers to the new cellular format by deploying six E.F. Johnson-Rydax automated switches.³ Although neither fully cellular, nor fully automatic initially, this conversion allowed him to launch, on October 1, 1981, “the world’s first cellular system in commercial operation,”⁴ beating the much vaunted Ameritech (Bell Labs) to the market by two years.

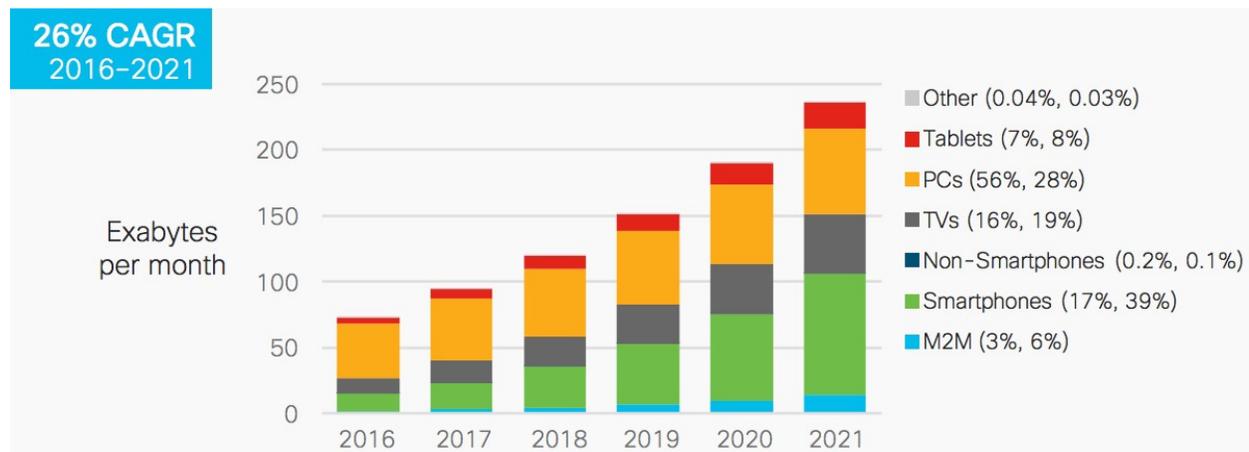
Some argue that Nippon Telephone and Telegraph had a working cellular system prior to Comvik.. Though the Tokyo service was launched in 1979, it was “more out of technical curiosity rather than serious commercial intent.”⁵ More importantly, the NTT phones were not portable; their phones were tethered to a vehicle and thus mobile only in the sense that an automobile is mobile.

THE FIRST POCKET PHONE

Stenbeck had a better idea.

He would let Comvik customers take their phone out of the car, “a radical innovation, as all phones at that time were quite large and could only be mounted in vehicles.”⁶ Since it debuted on an obscure Swedish venture, this breakthrough portable cell phone received little attention, but Jon Agar, Professor of Science and Technology at University of London, spotted it and recounted in his book *Constant Touch: The History of the Mobile Phone*: “In North Carolina, a small cellular company called Millicom adapted a phone made by the E.F. Johnson firm, producing the first portable cellular phone.”⁷

As the first few thousand of these landmark cell phones were being put into service, technology entrepreneur Kevin Kimberlin discovered Millicom had been selected by the FCC to demonstrate the viability of cellular.⁸ He met CEO, Orhan Sadik-Khan, also a resident of Old Greenwich, CT⁹ to hear their plan for a pocket-size version of the cell phone. Filed with the SEC in 1982 was their fairly comprehensive description of what eventually became the pocket-sized smartphone — and the network required to operate it.



In 2020, more internet traffic will be transmitted by “voice and data” phones than by PCs.

Source: Cisco Visual Networking Index

Millicom would develop a “VOice and digital, high speed DAta communications...portable telephONE (weighing 1-pound or less)...to interface directly with computers.”¹⁰ In other words, Millicom set out to make a voice and data phone small enough to fit in your pocket.

To gauge the size of that market, Kimberlin calculated that only 8% of the people in the world owned a telephone of any kind at that time, so he called Millicom’s idea for a pocket phone “the phone for the rest of the human race.” To pay for this vision, Millicom needed capital, but investors were scarce in the tight market of 1982, especially for a young firm with only \$131,000 of paid in capital. It has only five as-yet unpaid employees. One board member summed up the predicament: “Comvik and Millicom were having difficulty in finding others to invest in the idea. We were given the cold shoulder...It was difficult to raise money. Everyone is so wise today about how great the business is, but they weren’t so wise in the early days.”

Despite these tough circumstances, Kimberlin invested in the company and structured the funding that created the capital for Millicom.¹¹ His financing was an impetus to their U.K. joint-venture¹² called Racal-Millicom. It was announced in Kimberlin’s office in 1982 that Racal-Millicom had won a cellular license for the United Kingdom. ___ Went on to become the world’s largest communications company.

This venture put Stenbeck under enormous pressure to deliver the pocket phone he promised in order to earn a 10% royalty in Racal-Millicom.

To that end, E.F. Johnson & Co. slimmed down the first cell phone into the sleek ‘Lunch Box’ — so named since it looked like it could carry a thermos and a ham sandwich. The partners tried to further shrink the size of the mobile. “The plan was that Millicom, together with E.F. Johnson, Racal and others, develop a hand-portable mobile telephone” wrote British researchers John Metcalf and Uwe Cantner.¹³

However, the miniaturization effort hit a snag when Western Union, the 132-year old telegraph company, acquired E.F. Johnson & Co. The resilient Stenbeck quickly regrouped from this setback by obtaining the design and intellectual property from E.F. Johnson.

& Co. so he could continue his work with other manufacturers. Next in line was the Japanese firm that produced ‘the world’s smallest phone,’ but still, it weighed nearly eleven pounds. Racal also hoped to take the Millicom-Johnson design¹⁴ “for U.K. use and manufacture at its Seaton Plant in Devon and sent a team of engineers to the U.S. to carry out the necessary development.”¹⁵



Kevin Kimberlin with Millicom’s first CEO, Orhan Sadik-Khan

Meanwhile, competition emerged from the famous Motorola ‘Brick,’ the hand-portable that most people think of as the first cell phone. Shaped like a cowboy boot, the Brick was commercially released in October 1983 (after 10 years of testing). But, like the Lunch Box, it was unwieldy and heavy. For most consumers, the Brick and the Lunch Box were simply not practical, so Jan Stenbeck pressed on. Showing how desperate he was for a pocket- sized phone to earn that 10% royalty in Racal- Millicom, Stenbeck made a deal with a newly formed company with only three employees at the time, a venture named Technophone.¹⁶ On behalf of Comvik and Racal-Millicom, he commissioned the pocket phone, supplementing a grant from Britain’s Department of Trade and Industry.

Working feverishly in a small lab in Britain, Technophone CEO Nils Martensson--the third Swede in this saga--focused his team on three innovations: 1.) stacking 12 interconnecting layers in one circuit board, 2.) mounting with a new surface-mount production technique, and 3.) placing the electronics on both sides of the board. Hoping to solve the power problem, he promised his engineers a cash bonus for every milliamp they stripped from the phone’s power demands.

All these pieces came together in 1986 as

Martensson unveiled the first mobile phone to fit in a pocket, the Technophone M1. “An extremely influential phone in the history of mobile radio,” it “turned the hand- portable into the world’s first pocket-sized cell phone.”¹⁷ It took the cellphone out of the hand and put it in the pocket. With a trailblazing thin, rectangular shape, form and function — imitated in a myriad of styles by countless manufacturers over the following three decades — it was the leap to what we think of today as the mobile phone.



Kimberlin with his 1986 breakthrough Technophone M1 and a modern mobile phone. It shows this phone set the standard for size and form for the last three decades.

WIRELESS ACCESS TO DATA

Stenbeck at last had the pocket-phone in his back pocket, literally. Yet even after all this effort, he still wasn’t satisfied. His phone wasn’t smart; it couldn’t transmit data; it wasn’t the ‘voice and data phone’ he demanded. So Nils Martensson dove back into his lab. Less than a year later, he emerged with a pocket phone possessing storage and other capabilities far beyond the few phone numbers stored in the Brick. For instance, a two-line crystal screen on the M2, the width of a strip of Scotch tape, could display instructions on how to use the phone. On July 13th, 1987, The Daily Telegraph broke the news: the “intelligent portable telephone has been launched.”¹⁸

This Technophone M2 met all the specifications

that Stenbeck had previously established at the start of the cellular revolution. It was a 7 inch by 3-inch intelligent mobile phone that fit into a hand, a purse or a pocket. Kimberlin noted the weight advantage: it was 1/10th of the weight of the Lunch Box and 60 percent lighter than the Brick. Offering true mobility and a primitive sort of smarts, this precursor to the smartphone was well received; as the Pocket Phone “caused a small sensation in Europe.” Within four years, the company was Europe’s second largest mobile phone manufacturer by volume,¹⁹ with a 25 percent share of the U.K. cell phone market and 15 percent in America.

However, for technical and regulatory reasons, the cellular networks of that time could not transmit data. Here, once again, Millicom broke down the barriers. First, in Sweden, Comvik offered both data and voice services, albeit at first on two separate networks — a Millicom paging service for texting up to 1500 characters that ran in parallel with the cell phone voice service described earlier. Second, in England, the Racal-Millicom partnership changed its name to ‘Vodafone’ — ‘VOICE, DATA and telePHONE’ in recognition of Millicom’s idea about data transmission. They became technically feasible with the digital network upgrades in the early 1990s. When all of these innovations came together, Stenbeck’s vision was fully realized. On December 3, 1992, the first ever text message was sent on a cellular network. It was a 14-character message: ‘Merry Christmas,’²⁰ transmitted on the Vodafone network. As the first data connection between a cellphone to a computer over a cellular network, this text marked *the* pivot point in *the* precise moment, when the smartphone revolution began. From this beginning, texting became the most popular smartphone application, with some 96% of smartphone users sending texts — now at 8 trillion per year within 25 years!

Thanks to the appeal of data applications like texting and the convenience and portability of the voice and data pocket phone, “Vodafone” became the 5th most valuable brand in the Global 500 — a brand that helped the company grow into the world’s 7th most valuable company, and the largest communications company, in the world by the year 2000.

With this, the power of the ‘Voice and Data phone’ was finally recognized; the vision of Millicom, vindicated.²¹

By initiating these activities, Jan Stenbeck and Millicom played the legendary role in commercializing key elements that enabled the smartphone revolution. They: 1.) were the first cell phone company solely dedicated to developing the mobile phone and mobile operators around the world; 2.) commissioned the first cellular Pocket Phone and, 3.) created the venture that first transmitted data between a computer and a cell phone over a commercial cellular network. The group of entrepreneurs he assembled in Waseca Wisconsin, Old Greenwich Connecticut, Surrey England and elsewhere, led the transformation of the two-way radio from a niche product into an omnipresent, ‘must have’ essential of modern life. They led the inversion that turned the ownership of phones upside down — from 92% of people without a telephone when Millicom’s phone was introduced, to a 90%²² cellular phone ownership expected by 2020. The pocket phone really was the phone for the rest of the human race.

Steve Jobs figured that out too, and so he turned Apple Computer into a cell phone company. To do so, he stood on the shoulders of giants. For this reason, when Apple CEO, Tim Cook calls the iPhone “one of the most important, world-changing and successful products in history,” he might also, in the same breath, have tipped his hat to those who made it possible.



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