A Brief History of Everything Wireless

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How Invisible Waves Have Changed
the World

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To Kirsi, Titta and Taru

Preface

We humans are a curious bunch, constantly pushing the boundaries of science, attempting to find something new and interesting. The discoveries we make often seem to be of no immediate value, only to create billion-dollar industries just a couple of decades later.

Adapting to all these novel inventions has changed our lives relentlessly over the last hundred years, and not least by the unshackling effect of wireless communications: if we so choose, we can now remain in contact with the rest of the humanity wherever we roam, and have the unprecedented power of instant access to up-to-date information, using devices that comfortably fit in our pockets.

We are now constantly surrounded by technology that "just works", but have become totally oblivious to the enormous amounts of research and development that got us here: the underlying physics and processes vanish behind the magic curtain of engineering and friendly user interfaces.

The amalgamation of wireless communications and computing technology is changing our society faster and more widely than anything since the introduction of electricity into our cities and homes. As a result of this revolution, personal wireless connectivity is now more readily available than access to clean, running water.

Smartphones are everywhere, and many developing countries have been able to skip the installation of costly wired networks and jump directly into the world of untethered connectivity. This is mostly driven by the worldwide deployment of cellular networks, but also through the abundance of Internet-connected Wi-Fi networks, which have become an indispensable feature in our homes and public places.

At the other end of the scale, complex satellite technology now enables connectivity for the most remote locations in the world, from isolated islands of the Pacific Ocean to the North and South Poles.

The history of wireless communications is full of intriguing stories of personal triumphs and stinging defeats: it includes highly public clashes between individuals, corporations, and even nations. The outcomes of wars have been affected by the use of wireless technology, and the societies we live in today would be very different if the application of these invisible waves had been delayed by just a couple of years.

The quantity of available detail in this line of history is enormous, and to keep it all on a palatable level, I have chosen to compile a selected set of interesting storylines of prominent events, individuals and companies, explaining the necessary bits of the underlying technology along the way. Therefore, as the title says, this is a *brief* study of the phenomenal progress that has followed from the harnessing of the electromagnetic spectrum—many interesting stories and details simply had to be left out.

My focus is in revealing the direct and indirect consequences that the deployment of these new inventions has caused on society, from the early days of radio to modern cellular networks. I have also included some of the more esoteric and not so obvious uses of wireless technologies, in order to stay true to the word *everything* in the title.

Following the storyline does not require prior knowledge of the underlying technologies discussed—the essential bits are explained along the way. In case you want to delve a bit deeper on the technology side, the text contains references to *TechTalk* chapters that can be found at the end of this book. These are directed at readers who want to have more information about the "magic" behind it all.

This is not a study book—I deliberately decided against including any mathematical formulas, sticking to textual explanations instead. When presenting quantities, I chose to follow the metric system, leaving out conversions to imperial units, simply to maintain the flow of the narrative. The only exception is the use of feet for altitudes when discussing subjects of aviation, as this is still the global aviation standard, with the notable exceptions of China and North Korea.

The US dollar still remains as the reserve currency of the world, and hence it has been used for any monetary values presented in this book.

The further into the past you delve in, the hazier the details become: sometimes, I found that even key dates, unit counts, personal histories of key people, and various "history firsts" were quoted very differently by different sources. As with any book with multiple sources, the writer has to make a decision on what to accept as the most plausible description of events. I accept responsibility for any glaring errors that may have resulted in from this approach.

Researching for this book took two years, and I had many eye-opening revelations during the process. I sincerely hope that the following thirteen chapters provide you with new perspectives on the history of wireless technologies, and that you will find it to be a worthwhile and entertaining use of your time.

For the latest updates, comments, discussion, and links to interesting sources of information, please visit *http://bhoew.com*

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Glossary of Units

Many of the following units are referred to across the text, so they are listed for your convenience here:

Frequency Units

Hz (hertz)	Oscillations per second
kHz (kilohertz)	Thousand (1000) oscillations per second
MHz (megahertz)	Million (1,000,000) oscillations per second
GHz (gigahertz)	Billion (1,000,000,000) oscillations per second
THz (terahertz)	Trillion (1,000,000,000,000) oscillations per second

Communications Speed Units

bps	Bits per second
kbps (kilobits per second)	Thousand (1000) bits per second
Mbps (megabits per second)	Million (1,000,000) bits per second
Gbps (gigabits per second)	Billion (1,000,000,000) bits per second
Tbps (terabits per second)	Trillion (1,000,000,000,000) bits per second

Data Size Units

bit	The smallest storage unit, either value "0" or "1"
byte	A group of eight bits
kB (kilobyte)	Thousand (1000) bytes
MB (megabyte)	Million (1,000,000) bytes
GB (gigabyte)	Billion (1,000,000,000) bytes
TB (terabyte)	Trillion (1,000,000,000,000) bytes