

## Global Telecommunication Network

Have you ever wondered as to what is the largest and the most sophisticated engineering feat ever undertaken by the humanity? Is it the first lunar exploration in 1969 or the international space station? Of course, they are great achievements, but as also acknowledged by the United Nations (UN), the global telecommunication network (GTN) is the largest and the most sophisticated engineering achievement of all time. Why is it so important?

It is the global telecommunication network that enables daily telephone conversations with our loved ones, social media activities between friends in multiple continents, emergency communications on land, in sea, and in sky, and also TV and radio broadcastings. GTN is made up of access networks, backhaul networks (based often on optical fibre), and also satellite and underwater communication networks. These constituent networks and links can be either wired or wireless, but due to their ease of operation and maintenance, wireless networks and links have been replacing many wired counterparts.

Wireless communication from a transmitter to a receiver is not as simple as it sounds. A signal transmitted from a transmitter does not reach the receiver straightforwardly, but it hits many obstacles around the transmitter and the receiver. Typically, the receiver does not receive a clean signal, but a jumble of delayed and attenuated replicas of the same signal along with noise. Extracting the desired signal from this untidy mixture of signals is an extremely delicate and difficult task, and even after over half a century of wireless communication research, the humanity does not know the best way to do it. The difficulty significantly increases in the presence of co-channel interference and relative motion between the transmitter and the receiver. The amount and complexity of science and technology required to enable mobile wireless communication when one travels at 100-200kmh is mind-boggling. Modern wireless communication is a melting pot of concepts from electrical and electronics engineering, physics, mathematics, statistics, computer science, and computer simulations.

The humanity does have a fairly good knowledge to successfully communicate wirelessly on land, under water and in outer space. However, these achievements alone do not warrant a happy life, and complete our duties. The ever growing demand for mobile wireless and complex consumer habits put significant strain on the delicate global telecommunication network. It should constantly be evolved to cater growing consumer demands, and requires constant attention and renovation. As readers read this piece, many thousands of scientists, researchers, engineers and graduate students pour their blood, sweat and tears day-and-night to study, model, analyse and develop ever more complex technologies and algorithms to push the known boundaries of modern digital wireless communication. The ultimate aim is maintaining the very fabric of modern life built upon the sleeping giant of global telecommunication network.

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