

# The main technologies forming the foundation of 5g

[Sociology](#), [Communication](#)



In order to comprehend what 5G actually is, we need to know about the five technologies that form the foundation of 5G

## **Millimetres waves**

All electronic devices and smart phones operate on a specific frequency in the radio spectrum band which is usually under 6GHz. Because of the increase in the number of devices the specific range of frequencies is being crowded and this is leading to slower services and loss of connections. The solution is to, broadcast signals on shorter millimetre waves those fall in the range of 30 to 300 GHz, which have never been used thus opening up more bandwidth for transmitting the data set. There is one major problem with these waves, they cannot travel through buildings and other obstacles and are usually absorbed by plants and rain. In order to overcome this, we use Small Cells.

## **Small Cells**

Today's network allows the usage of high-power large cell towers in order to broadcast signals over long distances. But these higher frequency millimetre waves have trouble travelling longer distances as they cannot travel through obstacles or can even get absorbed by the plants or by rain. Small Cell networks would prevent this problem by using plethora of low power mini base stations close to each other so that they behave as a relay team in order to transmit these millimetre waves around the obstacles. These are very useful especially in the cities. As the user moves behind the obstacle, his smart device switches on to the next closer base station within his device's range and hence maintains the connection.

## **Massive MIMO**

MIMO stands for Multiple Input and Multiple Output. Today's 4G stations has about dozen ports on the antenna that handles all cellular traffic. But the MIMO station can have up to 100 ports which would increase the capacity of the network by large factors. It also comes with a complication, which is, the signals are transmitted in every direction and hence when they cross each other there is a massive interference. In order to overcome this, we use Beamforming.

## **Beamforming**

Beamforming is analogous to traffic signalling system for cellular systems. Instead of transmitting the signals in every direction, beamforming would allow the base station to broadcast a focused stream of data to a specific user. This precision prevents interference and is much more efficient. Hence the stations can handle more incoming and outgoing data at once.

## **Full Duplex**

Today's base stations have a major setback, that is, the antenna can only do one job at a time, either transmit a signal or receive a signal because of the principle called Reciprocity. Reciprocity is the tendency of the radio waves to travel both forward and backward along the same frequency. In order to understand this concept, let us think of a wave as a train that carries specific data and the train track it travels on as frequency and if there is another train travelling on the same track in the opposite direction, then there is interference. Until now the solution has been for the trains to either travel in

one direction at a time or travel on different tracks (frequencies). Working around reciprocity a lot more efficient.

Researchers have used silicon transistor to create high-speed switches that halt the backward roll of these waves. Thus, enabling rerouting of the waves so that they can pass each other without anyone interference. This implies, faster transmitting of the data set across the same frequency without any disturbance. To sum it up, all of 5G is still a work in progress and can end up using other technologies as well.