How Networks Work – the Need for Base Stations

Mobile phones have been available since the mid-1980s but are often thought to be a relatively new invention because of their recent high-profile consumer popularity. They use radio waves in the same way that radio waves have been used in the operation of many other telecommunication devices for decades, such as televisions and radios used by emergency services, the army, taxis/couriers and broadcasters.

Across the world, governments have granted licences for 2nd and 3rd generation digital mobile phone services based on the GSM family of technologies (GSM, GPRS, EDGE and 3GSM) to several companies to provide mobile communications in an exclusive part of the radio spectrum. The fast evolution in electronics and informatics during recent years has enabled the consumer to continually benefit from modern, effective and essential mobile communications.

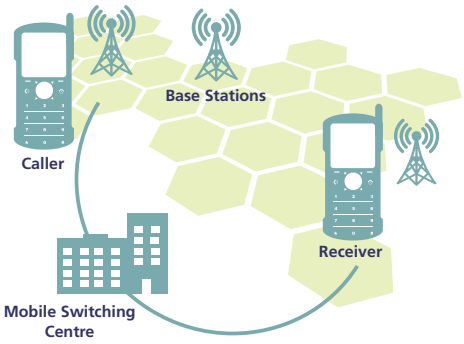
Building a network – obtaining coverage

- Mobile phone networks are cellular networks. Each antenna of a base station covers a cell, which is a restricted geographic area of the country.
- To ensure that customers can continuously use a phone whilst on the move, cells need to overlap slightly. When a user nears the edge of a cell and enters the overlap area with the next cell, the network can hand over from one base station to the next one.
- The size of the cell depends on current and future customer call usage in this geographical area, and also on the physical terrain of the area. Radio signals are attenuated by man-made and natural obstacles such as buildings, trees, hills and valleys, and this has an impact on the quality of mobile phone coverage. Therefore, obstacles have to be taken into account during the cellular engineering of the network.

The need for radio base stations

How calls are made and received

- The microphone of the mobile phone converts voice into electric signals. These electric signals are then sent to the base station antenna. In the other direction, the signals emitted by the base station antenna are received by the mobile phone and converted into mechanical vibrations (sound) by the speaker.
- In order to have a two-way conversation without interference from other calls, each call must be allocated a radio channel at which to transmit and one at which to receive.
- Each base station uses a certain number of all the radio channels available to the mobile operator in its allocated frequency range.
- However, the limited number of radio channels available to each operator means that only a limited number of simultaneous calls can be made. If all radio channels are in use no further calls can be made.
- Once a call reaches a radio base station it is sent across the mobile operator's network to a 'switch' or exchange where it is transferred to the network of the destination customer.
- The call will be passed through an underground fibreoptic cable or via a 'point to point' fixed radio link between base stations, which require a direct line of sight.



Increasing capacity

- In order to increase the number of calls that can be made, the operator must reuse the same radio channel many times in other, neighbouring cells.
- The cellular engineers and the frequency planners have to do their job very carefully to prevent interferences in the network. If there is high customer demand in a 'cell', greater capacity can be created enabling more calls to be made by placing another base station in between the existing cells and creating more, but smaller cells.
- Therefore, to meet increasing customer demand for mobile telephony services in a given location, radio channels are reused again and again by increasing the number of radio base stations.
- As long as the base stations in these adjoining cells are not using the same radio channels, more calls can be made in the same area without causing interference.

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Where to go for more information

GSMA: **http://www.gsmworld.com/health**

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