35L Presentation

MIMO

* Definition Figure 1
* Contrast
  + Figure 1 & 2
* Method. Frequency, decaying degree, and direction.
* Benefits: increase the capacity of each base station.

Test

* Korea
  + Samsung claim to supply the greatest number of 5G base stations
* US
  + 30 cities(not specific). Chicago and Minnapolis
* China
  + Government guide the three operators, and have the largest 5G trial network

**Test**

Ok, enough about theory. Let’s talk about realistic applications.

The application of 5G in mobile communications has become a global race among all big nations. South Korea is the one claiming to be the pioneer of wide installation of 5G. Samsung is the major provider of 5G base stations to South Korea operators, and it has launched wide commercial consumer services on April fifth, twenty nineteen.

US, a little bit behind South Korea, has installed 5G services in certain parts of Chicago and Minneapolis among 30 cities to be applied 5G in this year, provided by Verizon.

However, Verizon hasn’t announced which cities will be on the list, so we currently don’t whether or not we can use 5G this year in Los Angeles.

China, different from other countries, developed 5G under government guidance. Large-scale networks has been deployed in dozens of cities including Beijing, Shanghai, and Shenzhen. Hence, China Mobile claims to have the world’s largest 5G trial network.

**Downside**

Like all the other technologies, 5G also has its significant dark side.

As discussed before, the millimeter wave has limited range due to its high frequency. According to testings of 5G service, the signal can only reach 500 meters from the tower.

Besides, millimeter waves also cannot penetrate obstructions and can be absorbed by rain and plants, which needs the deployment of 5G stations every 2 to 8 buildings in the city.

Therefore, the cost is of great concern. Without government subsidy, operators can hardly install that so many 5G stations under the cost of 4G stations. So a lot of negotiations and business among government, operators, and industries are going on with a market of about 50 billion dollars.

Health issues, like always, is a problem of the technology. Due to the ultra high frequency and ultra high intensity of the millimeter waves, the radio frequency radiation would have more serious threats to human body compared to 4G. Besides, the more densified deployment of small cells around people will make everywhere covered with similarly dense radiations.

Finally, the security of 5G is discussed widely. Since 5G has not faced web attack yet, we do not know whether or not 5G is more vulnerable than 4G. However, it will eventually connect many more devices, so protection from malign actors becomes a larger concern.

The U.S. and some other nations fret that Chinese 5G equipment, chips and software could be outfitted to spy on customers in other countries. Hence, Donald Trumps actually signed many policies boycotting imported 5G technologies, which slowed the pace of US’s 5G development.

**Applications**

Lastly, let’s look at the future applications.

While now 5G is mainly applied to mobile phone, there are a lot other mobile devices that can use 5G technology. For example, wearable devices. Have anyone used running apps like Fit or Keep? You must noticed there is latency which compromises the precision of our exercise. With 5G smart watch, however, you can monitor your body condition more accurately.

Besides, automatic car is a field that will widely apply 5G. By calculation, a connected car traveling at 75 m/hr would travel over 10 feet(3m) further before applying the brakes if the system was experiencing a 100-millisecond delay. And that’s a lot. Human life can be saved with low latency applied in automatic car, which is super significant.

If you’ve played pokemon go, you must noticed that the AR is not that so fluent when you are using a 4G outdoor, because the 3D modeling takes a lot of data. 5G can solve that problem, and hence many new outdoor AR games or apps can be developed.

Today, real-time translation can already be achieved with AI application. However, many translations would happen under scenarios when you are outdoor, like traveling abroad. By wearing a smart earphone, 5G connection will ultimately  allow people to understand any foreign language without any delaying, which makes our communication much more efficient.