Exam 2012/2013 Part 2

Question 1

Wideband wireless transmission have two main problems: high demands in therms of bandwidth and noise that can cause ISI.

OFMD (Orthogonal Frequency Multiple Access) makes use of overlapping sub-streams that significantly reduce the required bandwidth. They also make use of the circular convolution to reduce ISI. There is also the possibility of reduce the usage of higher frequencies that reduce high frequency attenuation.

DSSS is a technique that consists in spreading the information across the frequency spectrum. It multiples the original signal by a code that aims to reduce ISI interference. By spreading the information, it is less prone to be affect by narrowband interference.

Question 2

802.11 is a protocol used for wireless transmissions of mobile devices, which have constrains regarding battery. The main idea is that if the transceiver is not being used, then it goes to sleep to save power.

Stations will wake up periodically and simultaneously. They will listen to the beacon to know if they are expecting to receive something, in which case they stay awake to listen. If it wants to send something, it stays awake until it sends its packets and then goes to sleep.

In an Ad-hoc network, the principle is the same, but stations can also sends beacons to the rest to signal them that they want to transmit something to them.

Although it may reduce the bitrate and increase the delay, it makes mobile transmissions much more efficient and enables long battery life for the devices.

Question 3

The metric Airtime Link Cost for 802.11s is a metric that related the bitrate of the channel as well as the PER associated with it. Therefore, a channel with very high bitrate but also very high PER will produce a big airtime cost, while a smaller channel with very low PER might have a smaller airtime cost.

It is a better representation of the channels quality than hop count, as hop count does not consider the channel characteristics. One hop might force retransmission multiple times due to errors while 3 hops might have a very high success rate and therefore be faster.

Question 4

GSM to GPRS

The main objective was to simplify the access to the Internet and improve the network efficiency, achieved by adding packet switching to GSM, where data is transferred as packets.

Two new network elements were added_

- SGSN, Serving GPRS Support Node, for authentication, switching, mobility and accounting.
- GGSN, Gateway GRPS Support Node, for IPv4/IPv6 internet routing.

GPRS to UMTS

The main objective was to provide a standard way for personal communications to support large quantities of users. Makes use of WCDMA, where all users share the same time and frequency domain.

Two new components where added:

- UTRAN, Provides and manages the air radio interface for entire network.
- Core Network, Provides all management and central processing of the System (new Network switching subsystem).

UMTS to HSPA

Routing Information Protocol

HSPA to LTE

Routing Information Protocol

Question 5

Let us consider a scenario where the UE is connected to source eNB. Based on UE metrics, the enB decides to request an Handover to the Target eNB. After admission control, the source eNB signals the UE about the handover. While synchronization between the Ue and the target eNb is happening, the source eNb forwards all the packets to the target. After the handover is completed and confirmed, the UE starts to communicate directly with the target eNB.