**Wireless Multimedia Systems**

Fall, 2015 (HOMEWORK 1, Due Day: 9:00 AM Sep 30, 2015)

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<http://wmlab.csie.ncu.edu.tw/course/wms>

1. (A) The need to support the mobile data traffic explosion is unquestionably the main driver behind 5G. Explain 5G target goals for aggregate data rate, edge rate (or 5% rate) and peak rate. (B) Describe the “big three” 5G technologies get to 1000 X Data Rate (for the most part, be achieved by combined gains by three categories). (C) Current 4G round trip latencies are on the order of about 15 ms, and are based on 1ms sub-frame time with necessary overheads for resource allocation and access. Describe 5G latency requirement. (D) Explain the possible challenge to support machine to machine communications in 5G. (E)
2. At the start of 21st century, the wireless mobile markets are witnessing unprecedented growth fueled by an information explosion and a technology revolution. (A) Explain (1) the trend in the radio frequency (2) the trend in the mobile network area. (B) The first-generation cellular wireless mobile systems were analog and were based on frequency-division multiplex (FDM) technology. Explain why it was once projected by some that the cellular industry could only see limited growth. (C) Describe two major boosts to the second generation cellular wireless mobile system (D) To facilitate the rapid development of 3G wireless mobile standards, two programs were launched to deal with the UMTS (W-CDMA) and cdma2000 standardization. Both of the system could utilize 5 MHz in each link using frequency-division duplex (FDD). Can you explain why the initial CDMA2000 system utilizes 1.25 MHz bandwidth in each link? (D) To deliver an Internet connection wirelessly, good packet-switched networks are desired. This raises the question as to whether voice over IP will be feasible and an all-IP wireless network possible for efficient delivery of both voice and data once data traffic is comparable to or more than voice. Provide the major challenges for an all-IP wireless network for both voice and data?
3. (A) Fixed cellular wireless technology provides a means to offer broadband access to multimedia services without requiring extensive copper or fiber subscriber plant. Relatively wide unused spectrum at frequencies above 20 GHz has led to the development of fixed broadband wireless access system operating in these bands, such as LMDS (Local multipoint distribution system. Can you explain why LMDS does not turn out to be one of the major broadband solutions as ADSL? (B) In order to fully utilize spectrum resources, describe how “***cognitive radio technologies***” and “***ultra-wideband radio technologies***” share the spectrum with existing wireless systems. (C) Describe the major reason mmWave spectrum lies idle.