Timing over 4G mobile network

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In our previous work[1], various characteristics of time transfer over mobile telecommunication networks were investigated. Using the NTP technology, it was demonstrated that the most important role in computer (PC) clock synchronization over a 3G network is played by network asymmetry, not the absolute delay time. In the present work, we focus on the investigation of timing and synchronization of PC clock over 4G (LTE) mobile network. We use a similar experimental setup as in the previous work. Mobile Testing System (MTS) was constructed using single-board computer "Raspberry Pi" Model B (RPi) and "Huawei E398" modem connected to the RPi via an USB interface. The "Raspbian Wheezy" operating system, with Linux (kernel v.3.6) and LinuxPPS kernel module (PPS API (RFC 2783) implementation) was running on RPi. Second pulses (PPS) generated by UTC(LT) traceable clock were time-stamped according to the internal RPi clock, which was synchronized to the UTC(LT) clock using NTP (daemon v.4.2.6p5) technology via 3G and 4G mobile networks.

The results of the ntpd synchronization are shown in Fig. 1 and the following table:

Network	Mean of delay	Std of offset
3G	32,5 ms	10,1 ms
4G	1,85 ms	0,67 ms

As results show, delays in 4G network (see Fig. 1a) are shorter due to simpler data channel setup (no need for multiple consequent control channels as in 3G case) because of substantially shorter allocation of 4G data channel. Delay distributions in 4G networks given in Fig. 1b are narrower due to both substantially lower delay, fewer data channels involved and almost no need to buffer signals (it was necessary in 3G case due to heavier network load and lower maximum data speed of data channels).

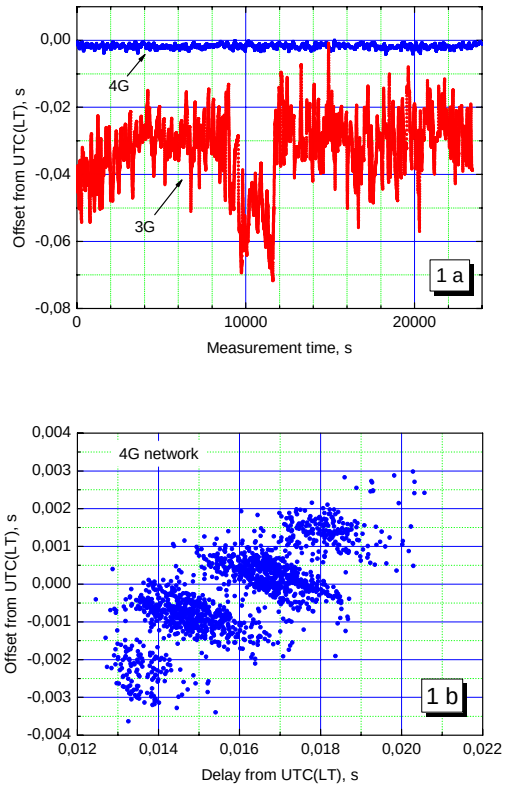

Fig. 1: Results of PC clock timing over 3G and 4G networks.

[1] R.Miškinis, D.Smirnov, E.Urba, B.Dzindzelėta, "Improving timing capabilities in 3G mobile networks", Proceedings of the 2012 European Frequency and Time Forum (EFTF), p. 368-370.