RAN CAPACITY INCENSEMENT IN SMARTPHONE ERA; SCENARIO AND TECHNOLOGIES

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The paradigm shifts caused by smartphones brings two aspects to mobile communications. One aspect is a "chance" for mobile operators and OTT players to easily provide new value added services by using customized applications on the common platform. Another aspect is a "risk" of mobile operators suffering drastic incensement of data traffic. Some reports say that total amount of traffic will increase up to hundreds times within a decade.

To cope with such a traffic explosion, now mobile operators are facing big challenges. In this presentation, expected scenarios and some key technologies for that problem are introduced.

Traffic offloading by WiFi is one of an effective way to reduce the traffic burden on mobile network. Currently many mobile operators are actively constructing WiFi hotspots in public places. Thanks to the common frequency band (ISM band) usage, cost of WiFi equipment is very low. While in general, its coverage area is very limited, and almost no mobility is supported in reality. In this sense, WiFi offload seems to be effective in nomadic computing, but not enough to accommodate all mobile traffics.

Small cell enhancement based on LTE-A is considered as a promising way to enhance the network capacity. By further exploiting space domain, it is expected to increase network capacity about 7 times than macro-cell systems. In contrast with WiFi, it employs centralized control manners which enable effective mobility support and interference mitigation. In addition, interworking with macro cell is also easier than WiFi, thus seamless connectivity and small amount of hand-over signaling can be expected.

From radio access technologies' points of view, advanced interference mitigation and non-orthogonal multiplexing are likely to be key issues for future systems. Currently 1-cell frequency reuse is used for effective radio resource assignment.

In addition, small cells make a distance between a base station and terminals shorter than macro systems. Thus the capacity of RAN can be said as 'interference limited'. Fortunately, coordinated multi-point transmission (CoMP) mechanism has already applied in LTE-A. By enhancing the CoMP to such a HetNet environment, further improvement of SINR (Signal to Interference and Noise) can be expected.

Non-orthogonal multiple access (NOMA) is investigated as a potential technologies for capacity improvement. It can be regarded as one kind of MUD (Multi-User Detection), but instead of signal spreading, it exploits power difference for signal separation. That is, a strongest signal is detected first, then eliminated it from original signal by applying SIC (Sequential Interference Cancelation) , thus the second stronger signal is detected in the next stage. By an initial performance evaluation, more than 30% improvement in overall cell throughput was observed.

Hidetoshi Kayama received the B.E., M.E. and Ph.D. degrees from Kyoto University in 1987, 1989 and 2004, respectively. He has been with NTT Radio Systems Laboratories since 1989, working on research of packet radio access protocols for cellular and wireless LAN. Since 1998, he was with NTT DoCoMo, Inc., where he engaged in the development of PHS cell station and research of MAC protocol for 4G mobile communication systems. Since 2004, he was a director of Lab in DOCOMO Beijing Communications Laboratories Co., Ltd. in China. From 2010 to 2012, he leaded a national research project of cognitive radio technologies which was organized by MIA, Japan. Now he is the President and CEO of DOCOMO Beijing Labs. He received the Scholarship Encouragement Award in 1995 from IEICE, Best Paper Award of ICT2002, APCC2008, APCC2012, and ICCTA2009 respectively.