Extended Abstract submitted to

ITG Workshop "IP Netzplanung, Netzmanagement und Optimierung,,

July 20-21, 2000, Würzburg, Germany

Topics: IP-based Applications over GPRS
Radio Network Dimensioning

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Title: **Radio Network Dimensioning for GPRS Networks to support Mobile Internet Applications**

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Radio Network Dimensioning for GPRS Networks to support Mobile Internet Applications

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ABSTRACT

In the framework of the evolution of the *Global System for Mobile Communication* (GSM) towards *third-generation* (3G) mobile communication systems known as *Universal Mobile Telecommunication System* (UMTS) new standards are presently integrated into the existing mobile radio networks. The driving force for this development is the predicted user demand for mobile data services that will offer IP-based mobile Multimedia applications and mobile Internet access.

After *High Speed Circuit Switched Data* (HSCSD) has been introduced in some countries, the *General Packet Radio Service* (GPRS) will be available end of 2000 in Europe and many countries worldwide. With these new services mobile Multimedia applications with net bit rates of up to 117 kbit/s will be offered and established on the market. To realise mobile real-time applications as the next step the ETSI is presently developing the *Enhanced Data Rates for GSM Evolution* (EDGE) standard, which offers a net bit rate of up to 384 kbit/s by means of modified modulation, coding and medium access schemes. The packet-oriented part is the *Enhanced General Packet Radio Service* (EGPRS).

The objective of several research projects in this context is to determine the need of radio capacity for the introduction of the General Packet Radio Service into the GSM. The output of simulative and analytical examinations shall deliver results directly usable for radio network dimensioning and capacity planning as known from Erlang-B-Tables and -Formulas to dimension circuit-switched networks.

The simulation model is the ComNets GPRS simulator named GPRSim, which recreates the GPRS network with its system components and protocols, radio channel attributes and applications.

In this contribution the radio network capacity needed for the General Packet Radio Service (GPRS) in coexistence with conventional circuit-switched voice services and the admissible quality of service for mobile Internet users is presented. Since the GPRS is to be integrated into the GSM infrastructure, a number of physical channels have to be made available to GPRS used as fixed and on-demand Packet Data Channels (PDCHs). A simulation environment for a GPRS network and its traffic sources based on Internet traffic models and on a Poisson process for the coexisting circuit-switched applications are introduced. Simulation results comprise performance measures for the quality of service from the user's point of view, the system throughput per cell and the channel utilization for a range of load situations in order to fix the needed radio capacity regarding cell configurations with 1 to 5 transceivers (TRX) and up to 8 on-demand PDCHs.