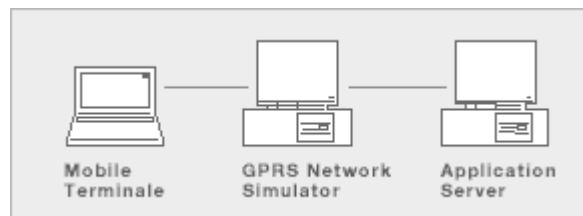


1. GATE EMULATION

GATE (GPRS Application Test Environment) is an application test tool developed by Ericsson. The aim of GATE is to provide the application developer with means to test and verify the functionality of an application, in a very realistic simulated GPRS environment, prior to launching the application commercially.

GATE lets the application developer define GPRS characteristics during testing. This can be performed both manually and automatically. The automatic setting of characteristics provides means for performing repetitive tests.

GATE is placed between the fixed network (a lab network or for remote testing the Internet) and the mobile stations running mobile applications. When using GATE the terminals either communicate with an application server on the fixed side of GATE or another terminal.



Regardless of the destination all traffic goes through GATE. GATE simulates the functionality of a GPRS network as seen from the mobile station. The mobile stations connected to GATE receive an IP connection over which they can run IP based applications. To connect a device to GATE all that is required is that it supports the IP protocol. No extra software is required on the device. Applications running on the device are configured and run as they normally would be run in a fixed environment. However, the connection that they have to the outside world will be provided by GATE. Applications will therefore experience GPRS communication characteristics.

A base station communicates on several different frequencies with the mobile stations within its cell. Each frequency can handle eight timeslots and each timeslot has the capacity of 14,4 kbit/s. Since a mobile station can handle 8 timeslots in both directions, the best case scenario gives us a 115 kbit/s duplex connection with the mobile station. However, on average the bandwidth will be lower since mobile stations are competing with each other for common radio resources. They are also competing with voice traffic, since data and voice are transmitted in the same frequency band. Noise and interference due to terrain, ground speed and base station density also affect bandwidth rates. Another limit is the fact that the first generation of mobile stations will probably not be able to send and receive on more than a few timeslots.

All the factors mentioned above can be set in GATE. More specifically these factors are

1. Number of simulated packet switched users
2. Number of simulated circuit switched users
3. Number of timeslots dedicated to packet switched traffic
4. C/I value for the mobile station
5. Uplink and downlink capacity of the mobile station

Given these values a bandwidth is calculated for the mobile station. This bandwidth limit is then enforced for all applications on that mobilestation, until the GPRS factors change.

2. GATE TEST SCENARIOS

Scenarios are a scripting mechanism available during testing with GATE. A scenario is simply a way of expressing a sequence of simulation parameters. The purpose of a scenario is to automate the setting of a sequence of parameters so that sequence can be reproduced at any time.

To further increase the flexibility of scenarios they are broken down into situations. A situation in GATE can be seen as a narrow description of either real world GPRS characteristics or of a technical test case. The set of defined situations can be seen as a repository of building blocks used and reused to define scenarios. Say that the perceived characteristics of GPRS while travelling down a highway at 50 km/h is defined and translated into a GATE situation. This building block can be put together with others into a scenario that captures the perceived GPRS characteristics while moving from city to city. It could also be used in a scenario that describes travelling between a city and an airport.

The number and types of scenarios, necessary to test an application, depends on the types of environments that the application targets. The theoretical combination and permutations of GATE test factors is nearly endless. Therefore, a compromise between necessary test-attention and maximum test-security must be found.

3. THE GATE SYSTEMS DEMONSTRATION

For the demonstration a GPRS Slide Show application was chosen. This application demonstrates synchronised images and audio streaming at around 20 kbit/s. The RealSlideShow 6.0 was used to generate SMIL (Synchronized Multimedia Integration Language) files for each presentation. Image streams are encoded in JPEG format sized 320x240 pixels at a bitrate of around 12-15 kbit/s depending on the nature and quality of pictures. Audio streams are encoded in AMR (Adaptive Multirate) audio format at ~5 kbit/s using a software library from Audio Visual Technology, Ericsson Research. The media data are sent via UDP while the control setup data are sent via TCP. Some elementary traffic control and packet retransmission methods are also implemented in this application to cope with unreliable network connection.

The scenario that was developed for the systems has the purpose to show the impact of changing radio conditions on the behaviour of this application. The GATE factors are modified in such a way that the effective bandwidth is on the one hand partly sufficient for the demands of the application and on the other hand partly not. This means, that the number of background GPRS and circuit switched users is modified during the run of the scenario and the C/I value for the mobile station is modified. The uplink and downlink capacity of the mobile station is on the other hand constant (1 + 4 timeslots), taking into consideration, that the GPRS-terminals of the first generation will not support more than 4 parallel timeslots. Thus, the effective bandwidth in this scenario is pending between 0 and 57,6 kbit/s. Taking into consideration that the application has a demand of ~ 20 kbit/s, it is obvious that the demands of the application are not fulfilled during the whole run of the scenario.

During the demonstration you can see how the traffic control and packet retransmission methods implemented in this application are able to handle properly the changing radio conditions. Enjoy!