

THE REMOTE MONITORING AND CONTROLLING VIA THE GSM NETWORK GPRS DATA TRANSFER

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ABSTRACT

The aim of this work was to design and apply a remote access by means of a mobile phone running the Java based application routine. That Java mobile phone routine communicates with the controlled and monitored system through the GPRS data transfer by means of the internet TCP/IP protocol. The data are transferred in XML format.

Keywords: remote monitoring and controlling, GPRS data transfer, XML data structures

1. INTRODUCTION

There are not many professional systems for the remote monitoring and controlling of simple devices via GSM GPRS data services in Czech Republic. The mobile monitoring and controlling system for very simple systems embodying slow trends has been designed and is still in a development phase. The slow response of GSM GPRS processes is not the limiting factor in the application area then. Some similar applications for mobile phones destined for free of charge SMS sending via the GSM operator gates were the inspiration for this work.

2. THE GSM-GPRS NETWORK STRUCTURE

The GPRS Core Network shown here is simplified to just have the SGSN (connected to the BSS by the Gb interface) and the GGSN. The two are connected together by a private IP network called the GPRS backbone shown as the Gn Reference Point.

2.1. GPRS

Unlike the CSD and HSCSD technologies, the GPRS is based on different principle. GPRS is based on the packet switching what is similar to LAN technologies. The GPRS technology creates something like a new network with packet switching overlaying the current one. In other words, the GPRS makes use of the network transfer capacity exclusively in case data sending or reception is needed. The transfer capacity is not permanently reserved like at CSD or HSCSD technology and the usage of the network is not blocked for another users. Thanks to the GPRS technology, more participants can use data transfer services than it is possible at the circuit switching of CSD and HSCSD.

2.2. EDGE

The EDGE (Enhanced Data rates for GSM Evolution) technology represents the last effort to increase the transfer rate of the existing GSM networks structure. The EDGE technology preserves the current frequency ranges and channels but it uses the different way of modulation. The original two-stage modulation used for radio signal transmission has been replaced by a more efficient 8-stage modulation. Due to that, it could reach theoretically the transfer rate up to 384 kb/s using 8 slots.

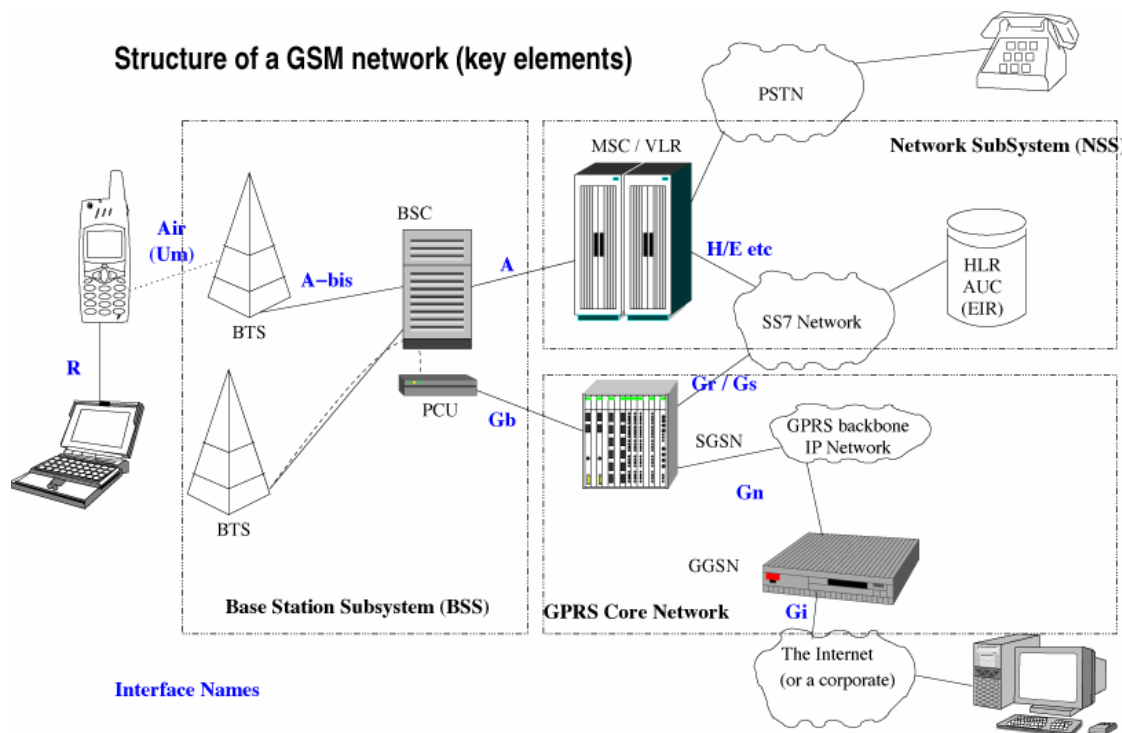


Figure 1. The GSM-GPRS network structure

3. THE JAVA LANGUAGE TECHNOLOGY

The Java language is the most popular programming language nowadays. It is either used for Internet applications programming and for the programming of different hardware and software platforms applications.

3.1. Java 2 Micro Edition

This edition is called J2ME (Java 2 Micro Edition) or Java ME. J2ME and it represents the comprehensive collection of technologies and specifications that makes it possible to create and run Java applications on different devices and with limited resources. The resources are meant as processor performance and the accessible memory capacity. The devices fitting in that group are for instance pagers, mobile phones, set-top boxes and even car navigation devices.

3.1.1. Configuration CLDC Java 2 Micro Edition

That configuration is much less demanding in comparison to CDC and its goal is to create a lowest applicable common base fro J2ME devices. That configuration is well spread in the mobile phones area nowadays. The majority of mobile phones are supporting that configuration and only an unremarkable minority supports the CDC configuration. Analogous to CDC configuration, the CLDC configuration is passing the development phase and there is an up-to-date version CLDC 1.1 currently.

4. THE PRACTICAL IMPLEMENTATION

We need the necessary tools for Java application programming aimed at computers or mobiles. The development is more comfortable and quicker then. We need the JDK (Java Development Kit) installed as a base for Java programming. The JDK package contains the necessary tools for Java program development as was mentioned earlier. We manage only with runtime environment JRE (Java Runtime Environment) packages in case we need only run Java applications. Those packages are to be downloaded from Sun Microsystem website. We need also a suitable development environment installed, so called IDE. There were two development environments suitable for our purposes, namely Eclipse and NetBeans. Both environments are supporting the standard application programming and there is an accessible support for both for development in J2ME. The internet

download of both environments is free of charge what was also remarkable for us. We have chosen NetBeans after pondering advantages and disadvantages eventually. The main reason for our decision was the Mobility Pack existence. The Mobility Pack is a Net Beans supplement J2ME programming support. Furthermore, we had to add various devices emulators like mobile phones from different manufacturers.

4.1. The communication test program for PC

There was a PC test program created that sends the monitored and controlled systems simulated data to the mobile phone via internet and receives new data for them from the handy. This test-program is a standard Java application for a desktop PC. That program uses a simple graphic interface for displaying the program run information. The program was created in the NetBeans environment which has the graphic interface support inbuilt like many other modern development tools.

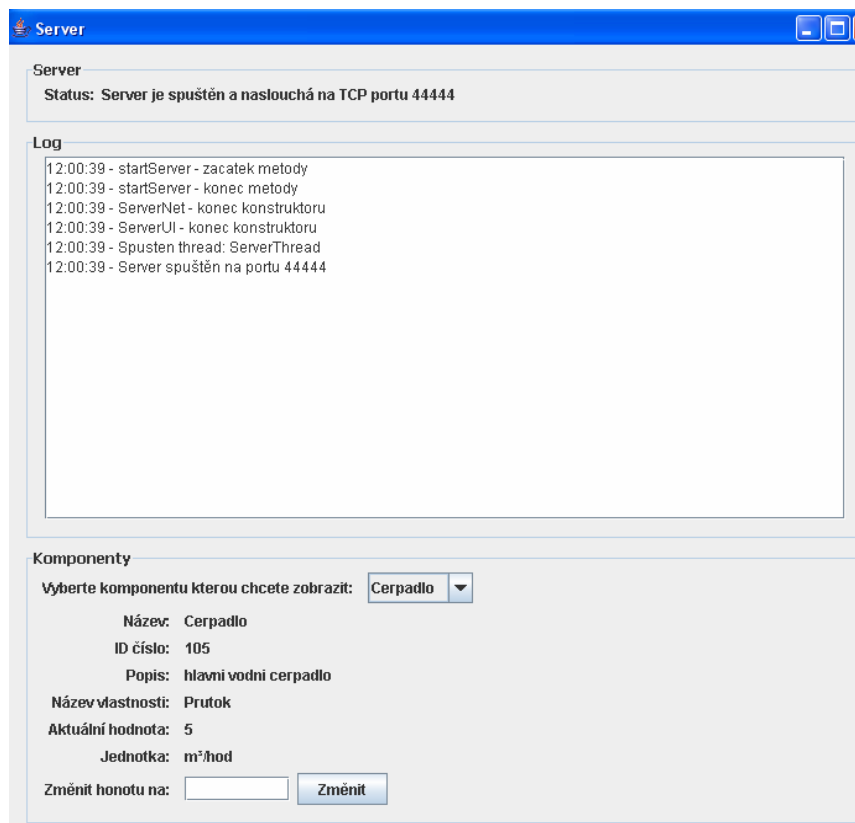


Figure 2. The testing program of communicate for the PC

You can see the graphic output from that program in Fig.2. The program graphic output is divided in three parts. There is only an information message on top informing on the fact that the server watching the incoming connection is running and the relevant port number. The state information on program activities is displayed in the middle area. That information was helpful during the program development and debugging. The main area is in the bottom. There are all simulated systems displayed and it is even possible to change set values there. The PC test program expects the simple format commands from the mobile client. Those commands are similar to the XML format and PC returns the XML file containing demanded data to the mobile client.

4.2. The mobile phone program

The goal of the Java program for the mobile phone was to communicate with a remote monitoring and controlling system via Internet. It makes possible to monitor such system and change its parameters remote. According to the mobile phone mobility, we could monitor and control the respective system from anywhere. The program was created in the NetBeans development environment where the

Mobility Pack and Nokia mobile phone emulator installed. Thanks to the Mobility Pack, it is possible to create applications for mobile phones the similar way the standard programs are created. The mobile phone Nokia 6230i was employed for the communication testing and debugging. That mobile phone transfer data either in GPRS and EDGE structures in the Class 10 (4+1, 3+2 slots downstream/upstream) in both cases. The main menu appears after starting the mobile phone program. See Fig.3.

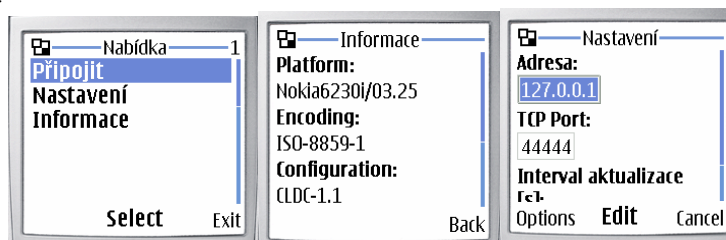


Figure 3. The Main menu, the menu Information displays and the menu Set-Data

As you can see from the first screen, there is a menu consisting from three items and also the possibility to stop application. The menu Information displays the information on equipment the program is running on. In the menu labeled Set-Data it is possible to set address and the server port for the client connection. After the menu Connect has been chosen, the mobile phone connects to the server according to the Set-Data. It receives the data from the server and displays the list of simulated systems to be monitored and controlled with parameter changes.

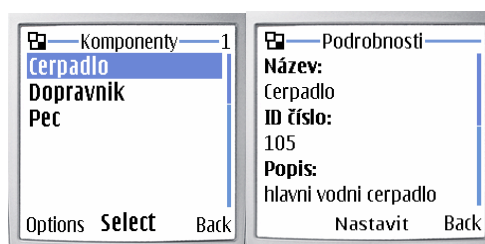


Figure 4. The list of simulated systems, that are monitored and controlled and the further screen is displaying the information on the system

After you choose one of displayed items, you get to the further screen displaying the information on the system selected and you can set the new parameter value to be sent to the server.

5. CONCLUSION

The communication between PC and mobile phone has been either tested with the Nokia 6230i emulator and with the real mobile phone Nokia 6230i. The system described above is fully functional. We would like to test the communication system parameters in nonstandard network situations like short mobile network drop-outs. The short signal drop-outs because of short distance signal fluctuations (the handy in a moving car) are concerned. The short drop-out because of radio channel full slots occupation by other network users needs to be taken into account as well.

6. ACKNOWLEDGEMENTS

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7. REFERENCES

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