Proceedings of the 5th WSEAS Int. Conf. on APPLIED INFORMATICS and COMMUNICATIONS, Malta, September 15-17, 2005 (pp39-41)

Paging Forwarding from POCSAG to TETRA

IGOR OZIMEK, ANDREJ HROVAT
Department of Communication Systems
Jozef Stefan Institute
Jamova 39, 1000 Ljubljana
SLOVENIA
http://www.ijs.si

Abstract: Paging systems have traditionally been used to contact people, especially emergency service personnel like fire-fighters, emergency medical service personnel, etc. Messaging capabilities of newly introduced modern professional digital communication systems like TETRA can replace paging services. However, during a transition period both systems must operate in parallel, which requires a solution for automatic message forwarding between the two systems. In this paper, a system is described that selectively forwards messages from a paging system to a TETRA system.

Key-Words: Paging, TETRA, SDS Messaging, Message Forwarding

1 Introduction

Paging systems are wireless communication systems used to contact people, especially emergency service personnel like fire-fighters, emergency medical service personnel, etc. Before the era of widespread wireless communications and cellular phones, paging systems were an important means of communication, and are still widely in use. Besides contacting people, paging systems are also used to remotely switch on/of various devices, e.g. public sound alarms.

With the introduction and employment of new professional digital communication systems like TETRA, the role of paging systems has become less important since they can also be used for the functions traditionally performed by paging systems. However, due to a large number of existing users of paging systems and gradual employment of new communication systems there is a need to run both systems concurrently during a transition period, hence the need for a solution to automatically forward messages between the two systems.

In this article, paging systems and the digital communication system TETRA are briefly described, following by presentation of a system we developed to forward messages from a POCSAG paging system to a TETRA communication system.

2 Paging Systems

A basic paging system [1] consists of a paging terminal with one or more radio transmitters depending on the required area coverage, and a number of pagers (Fig. 1).

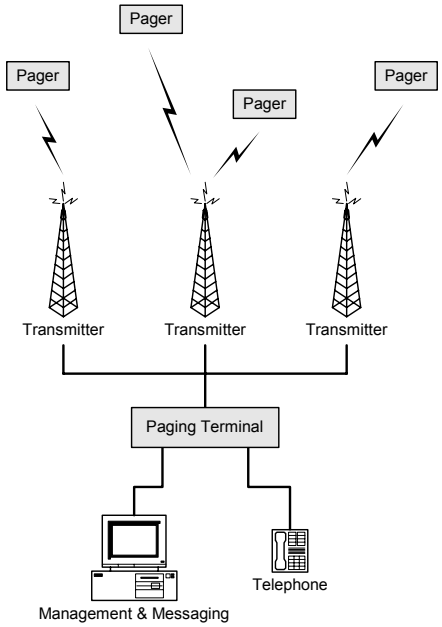

Fig. 1: A basic paging system

A pager is a small receiver that one carries around most of the time and is constantly switched on. A typical example is a stand-by member of a fire brigade or emergency medical staff, who is alarmed by the paging system to report on duty in case of emergency.

Paging systems stem from the analog era and were traditionally one-way only systems, i.e. a user had no way to answer the call. A particular pager was addressed and triggered by a sequence of tones and produced a sound signal informing a person about an emergency situation. Voice messaging was also possible, with voice following after the addressing tone sequence.

With the development of digital communication technology, a number of digital paging systems were developed. Some of these digital formats are proprietary solutions while other are publicly available standards. Messages consist of an address part and a data part. They can either trigger a sound signal (as in the case of analog pagers), or carry a numeric or textual message to be displayed on a pager equipped with a display. With a suitable paging receiver, paging messages can also be used to switch on and off different remote equipment like public sound alarms.

First generation digital paging systems offered a low data rate transmission in the range of a few hundred bit/s. Such systems are Motorola's Golay (300/600 bit/s), NEC's NEC-D3 (200 bit/s) and European POCSAG format (Post Office Code Standardization Advisory Group, ITU Recommendation M.584, originally 512 bit/s). POCSAG is an open, publicly available format which is still in wide use. To cope with the rising communication capacity requirements, additional higher data speeds (1200 and 2400 bit/s) were defined. Possible VHF/UHF radio frequency bands and other operational characteristics of paging equipment are defined in ITU Recommendation M.539.

Another approach to paging was to use an existing broadcasting infrastructure, namely commercial FM radio stations, with a subcarrier for transmission of paging messages. Such systems are the Swedish MBS format and RDS (Radio Data Systems) - the latter has much wider scope and was originally developed for other services but also supports paging. Both systems' operating speeds are 1187.5 bit/s.

With the large number of long textual messages sent in a paging system, the low data rates of the first generation digital paging systems became a bottleneck. Hence, the second generation provides higher data rates. Two main representatives are Motorola'a FLEX protocol with data rates of 1600, 3200 and 6400 bit/s, and European ERMES (European Radio Message System) with 6250 bit/s.

The need for return information resulted in two-way paging protocols. Two important members are, ReFLEX and InFLEXion, both based on the one-way FLEX protocol.

3 TETRA

TETRA [2] is a professional wireless voice and data communication system, similar to GSM but with distinct features (group calls, call priorities, direct mobile-to-mobile communications without a base station, etc.) required by professional users (police, fire brigades, etc.). TETRA standards are available from ETSI (European Telecommunications Standards Institute). Besides voice communication, TETRA provides three different data transmission modes:

- Circuit Mode. A fixed data communication channel is established between two points. Data rate with basic low-level error protection coding and single slot operation achieves 4,8 kbit/s.
- SDS (Short Data Service). This is a special service, similar to SMS in GSM, suitable for low data rate packet transmission.
- Packet Data. This is a fully featured packet data communication suitable for IP (Internet Protocol) traffic. The single channel net bit rate is 4,8 kb/s.

TETRA defines a standard interface, PEI (Peripheral Equipment Interface), for connecting a peripheral data device (e.g. personal computer) to a TETRA mobile station. It uses standard asynchronous serial line EIA232 with default baudrate 9600, and classical AT command interface.

TETRA SDS messages can be used to replace paging messages provided by a dedicated paging system.

4 Message Forwarding System

While modern digital communications radio systems can replace existing paging systems, both will have to coexist for a considerable period of time due to the large number of pagers in use and limited coverage of the initial TETRA installations. This caused a need for automatic message forwarding from an existing paging system (in our case a POCSAG system) to a new TETRA system until the TETRA takes over the paging functionality completely.

A message forwarding system could interface directly to the paging system on one side and TETRA equipment on the other, intercepting messages in the paging system and forwarding them to TETRA, as illustrated in Fig. 2.

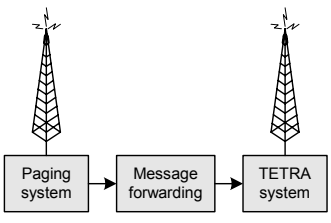

Fig. 2: Message forwarding with direct vendor-specific interfaces to both systems

This approach would pose problems with vendor-specific interfacing to both systems. A simpler and cleaner approach is to design an independent message-forwarding system that uses a special pager (receiver) to receive all transmitted paging messages, and selectively forwards them to TETRA recipients by sending SDS messages from a TETRA mobile station. This approach is illustrated in Fig. 3.

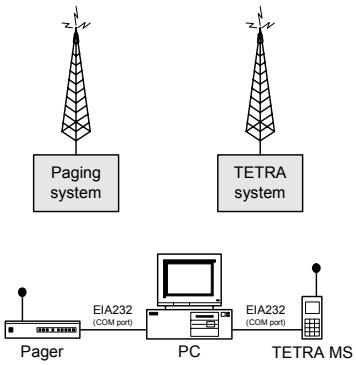

Fig. 3: An independent message-forwarding system

The system consists of a pager, a TETRA mobile station and a computer. Most standard pagers are miniature devices made to produce audible alarms and display messages on the screen. Pagers exist with serial line output, however they usually only receive messages sent to their specific address(es). For the message forwarding system in Fig. 3, a special version of pager is needed that receives all transmitted paging messages and outputs them (together with addresses) via a standard interface, typically a serial line, to a computer.

As for the TETRA mobile stations, most of them have a built-in serial line interface according to TETRA standards and can readily be connected to a computer.

The computer in our case is a PC running MS Windows OS. Since the processing overhead is quite low due to the low bit rate of the paging system, it does not need to be specifically devoted to paging message forwarding but can also be used for other applications.

The message forwarding application was written in Visual Basic. Its main functions are:

- Receiving and logging all paging messages.
- Forwarding (and logging) messages sent to those paging addresses that map to corresponding TETRA addresses.
- Managing address mapping from the paging address space to the TETRA address space.

The application's user interface is shown in Fig. 4 and 5. The main window (Fig. 4) displays received and forwarded messages. A second window (Fig. 5) is used to manage address mapping, i.e. to add or remove address mapping entries to/from the corresponding database. Only those paging messages with addresses found in this database are forwarded to the corresponding TETRA addresses.

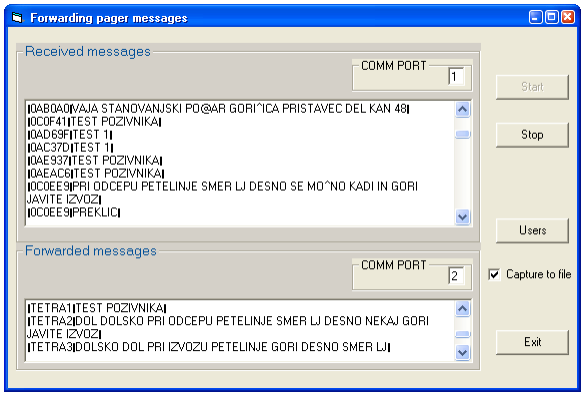

Fig. 4: Main application window - receiving, forwarding and logging of messages

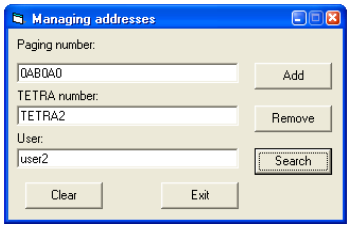

Fig. 5: Address management - mapping paging addresses to TETRA addresses

5 Conclusion

We present a message forwarding system that selectively forwards messages from a classical paging system (POCSAG) to the new digital communication system TETRA. POCSAG is currently widely used in Slovenia for alarming in emergency cases (contacting emergency service personnel e.g. fire brigades and medical emergency teams, activating public sound alarms, etc). This message forwarding system will be used during the transition period with both systems operating in parallel, until the paging functionality is completely taken over by the TETRA system and existing pager users equipped with TETRA stations.

References:

[1] L. Harte, *Introduction to Paging Systems*, Althos Publishing, 2004

[2] J. Dunlop, D. Girma, J. Irvine, *Digital mobile communications and the TETRA system*, John Wiley & Sons, 1999