SUPERVISION AND TELECONTROL OF A RADIO BROADCASTING SYSTEM VIA INTERNET

Joan Aranda
Automatic Control and Computer Engineering Department
Universitat Politècnica de Catalunya (UPC)
Pau Gargallo,5. 08028 Barcelona

Eduard Sanz
Head of Telecontrol Systems Department
Difusió Digital S.T.S.A-Tradia

Key words: Telecontrol, Remote Supervision, Internet, SCADA, Radio broadcasting.

Abstract: In this paper a recent application is showed that uses Internet as a supervision tool and remote control of a network of radio-TV relay stations to offer a better service to future clients. The relay stations network occupies a region of about 30.000 km^2. The operator of this telecommunications network counts with a SCADA system which permits to the operator monitoring and control of the whole network. With the presented application users of the network can access to real time information about relevant aspects of the emission or change some parameters at anytime and from anywhere thanks to internet. The aspects of access security and safe communications have been taken care specially.

1 INTRODUCTION

Telecontrol and remote supervision of industrial applications have been growing up everywhere. They are especially important on distributed systems when they extend on a vast territory.

In this paper we show a particular implementation on a radio broadcasting system, and its relay stations network. The network extends for a region of about 30.000 km^2 most of them occupied by mountains with difficult road access to the relay stations on winter.

The operator of this telecommunications network (the operator, from now on) needs a telecontrol and supervision system of its radio broadcasting system, including infrastructures and equipment, to be offered as a new service to its clients. The central application of this system counts on a SCADA in real time with a continuous polling against a communications front-end. This SCADA concentrates the communications with different remote relay stations (fig 1).

The operator considered the viability to carry out the implementation of a software application that allows resolving the limitations of security of its SCADA system and that makes possible the access of a third party to supervising and remote control of infrastructures property of the operator.

The addition of new functionalities that will be attractive for this type of users, as radio stations or TV channels, tries to be an added value for the future clients. They will appreciate these functionalities at the time of making the decision to contract certain services of housing with the operator.

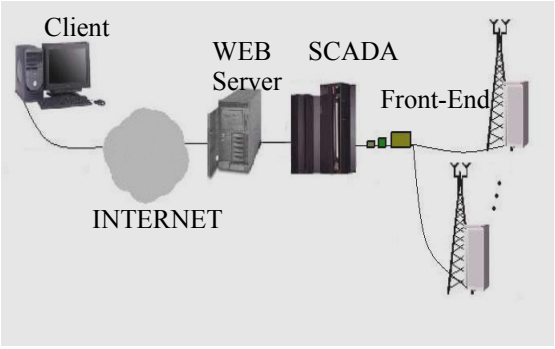

Figure 1: General system architecture

Aranda J. and Sanz E. (2004).
SUPERVISION AND TELECONTROL OF A RADIO BROADCASTING SYSTEM VIA INTERNET.
In *Proceedings of the First International Conference on Informatics in Control, Automation and Robotics*, pages 375-378
DOI: 10.5220/0001143303750378

2 OBJECTIVES

Our basic objective consists of analyzing the users' requirements and designing an open telecontrol system, using the existing infrastructure of remote stations of telecontrol and the SCADA system, property of the operator.

Initially, this service will be offered to the operator clients, through a reduced bandwidth communication channel (commuted telephone network, for example).

We considered that the necessary functionalities to make the product attractive to the client are the following ones:

1. Monitoring of Telecontrol customized data at client level (1 client - N signals).
2. The visualization of digital states of channels connected to the system in "real time" (depending solely of the bandwidth available).
3. The visualization of analogical measures in "real time".
4. Visualization of a listing with the last events generated by the channels that belong to a certain client.
5. Possibility of including connections to other static pages, or send a mail to the contact person (webmaster).
6. Safe connection. The connection with the client must be established through a safe connection, with some type of certificate and encoding in the case of control commands.
7. Execution of commands. Some actions will be allowed to the client on certain channels, with the necessary warning interface and user agreement of the type of action that will be executed. A log file of the commands sent by all the users will be generated.
8. Movement between synoptic screens. The administrator will be allowed to connect several pages of clients, giving the possibility of moving from one page to another just clicking over some icon within the visualization area. A registration of visits will be generated.
9. Storage of analogical measures. Analogical values will be registered in time intervals defined by the client and up to a maximum number of values defined by the administrator. The necessary interface for the selection of these parameters will be designed.
10. Conversion functions and thresholds of analogical measures. A simple conversion function (proportional and offset) will be implemented for the presentation of the analogical values. In addition, maximum and minimum values for a specific measurement will be provided, so that, once surpassed those thresholds, the corresponding alarm will be triggered.
11. Evolution Graph of analogical measures. A graph with the values of the obtained analogical measures of the periodic interrogation of point 9 will be created dynamically.
12. Filtering of events. The user will be allowed to filter the events by the obtained values.
13. Reports screen. A page for internal use will be created to enable fast generation of reports with the filtering of events described previously.
14. Automatic warning by email of certain events. A necessary time of delay in the transitions from 1 to 0 and vice versa will be defined in order to don't disturb the client. A sent messages Log File will be generated.
15. Automatic warning by SMS to GSM mobile telephones. The telephone number will be chosen by the user and a maximum number of messages will be sent. Log with the sent messages will be generated.
16. Slow video show. A page will be implemented where slow video will be visualized (images JPEG, GIF...). The sample time will be selected by the user in relation with the bandwidth available.

The most important processes must leave files of log, giving the possibility of tracking possible malfunctions. Also the operator wants to give this service of supervision and remote integral control to an undetermined number of clients. Under this premise, the system must be easily scaleable.

3 SYSTEM DESIGN AND SPECIFICATIONS

The proposed system shows incalculable value for the clients of the operator, so it guarantees a continuous test service anytime at anywhere. Thus, the works of maintenance and tracking of failures or incidences will be much more effective with a system of the raised characteristics. The determination of the origin of a problem will be considerably faster and it will returns in a superior quality service.

In order to understand usual problems we will show up some examples. A typical client of the operator could be a FM radio station. A technician in charge of emitters and relay stations of this radio station could need to know the nominal power exit and other important parameters of the relay station under which he/she is making field measures. Another example: most of relay stations do not have permanent personnel the twenty-four hours/day that

can monitor (from the studies) the continuity of the transmission. Thus, the possibility of connection with a personal PC from the particular address of the guard person would allow avoiding unnecessary displacements.

For that reason the final solution is not bound to a specific platform or communication channel. The application will allow the remote connection using the telephone lines, or even the connection by means of a data line of a GSM movable telephone.

Given the uncertainty in the final number of concurrent users, the use of an existing network like Internet is valued very positively, in front of the implementation of a specific remote access system for the clients of this service.

3.1 The corporative control system

The hardware architecture of the control center is formed by two servers HP9000, a disc Array and two terminal servers of 16 ports each one, which connect with the front-end of communications, as well as two graphical consoles with 21"monitors. The servers form a cluster MC/Service Guard, connected by network and with the sufficient redundancy so that an error in one of the components does not interrupt in a significant form the service. It counts on redundancy of LAN interfaces, mirror discs and duplicity of ventilation and power supplies, and also redundancy of CPUs in the main server. The terminal servers connect with the front-end of communications through a passive commutation which is controlled by one of the high availability processes of the MC/Service Guard system.

The data management is made with an Oracle relational database, for the historic and configuration data, a real time data base that stores the values and states of the system, an alarms data base that manages the different events based on its critical issue, and the operator answers to these events.

The system allows the supervision and telecontrol of up to 254 remote stations on a same communications line by using Gestel protocol. The connection of these becomes through the corporative network of cross-connect nodes, using V-24 interfaces and point-multipoint structures. At the moment there are 10 remote lines operatives and could be up to 16 with the existing hardware.

In its present configuration, the system reports states, alarms and is able to execute commands in a total of 92 remote locations, on a total of 780 equipments. The control carried out on these equipments implies the configuration of 7400 digital inputs, 1700 digital outputs and 500 analogical measures. This information is captured by the remote stations through input/output cards or via RS-232.

The system also allows the communication with other servers through UDP and TCP/IP, using the standard SNMP (Simple Network Management Protocol).

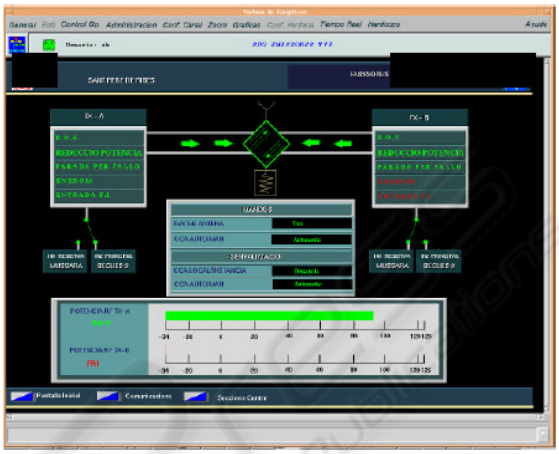

Figure 2: SCADA Interface: Synoptic screen for real time operation on a television relay station.

3.2 Implementation

The proposed solution consists of the following elements (figure 3):

1. Data base SQL Server 7.0: with information about the clients, channels, parameters, etc. The historical data are stored in the Oracle data base of the server where the SCADA runs.
2. Data base ORACLE: Holds the historical information of alarms and the configuration parameters of the digital output signals.
3. The web server: Acts as application interface. The client uses it to extract information from the remote relay stations and to set up the required services on its channels. The system administrator has the corresponding Webpage interface.
4. ActiveX Components: They supply essential utilities for the assembly of the application.
5. NT Services: the system has three own services in execution: tracking of digital channels, tracking of analog channels and the registration of the captured information.

The communication settles down through the following sequence of operations (fig.4):

1. The Web server receives requests from the clients, unloading static and dynamic images that are kept in the client PC.

2. The client makes the request of the telecontrol information of the contracted services.
3. The server requests the information in real time through protocol SNMP to the corporative telecontrol system.
4. The server offers the information to the client and it refreshes the representation in the local machine. The operation takes place at the frequency fixed by the system administrator.
5. In addition to the real time information, the client can ask for historical information that the Web server acquires from the corporative control system data base.

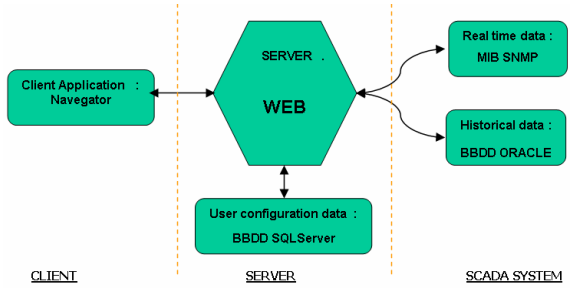

Figure 3: Application data structure

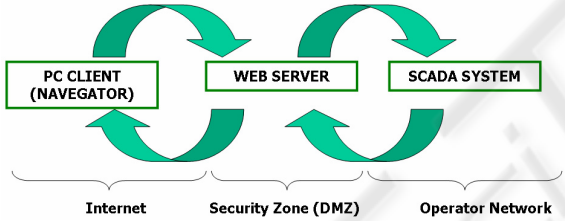

Figure 4: System operation.

4 RESULTS

A friendly and functional interface has been designed that allows the clients continuous monitoring and remote control over the relay stations network (figure 5).

It solves functional limitations of the SCADA system as the massive management of alarms. This kind of services and the automatic generation of reports for the internal use of the own operator have made of the developed application a profitable investment, only for the own management of the network quality.

In addition they have been introduced new broadcasting service functionalities that will call the attention of the potential clients. This will derive in the benefit of new services to contract, as they can be the transmission of slow video, the inclusion of images to its own Web, monitoring cameras, transit (through Digital Audio Broadcasting, for example), beauty cams to show the weather conditions in different places, etc. (figure 6).

A complete interface has been created to allow the client changing some parameters without depending on the availability of the system administrator to carry out some service modifications. For instance, the time between captures of analogical values (sample rate) or the email address where the user will receive the notification of the events that he/she previously has programmed.

Figure 5: Relay stations network of the operator

Figure 6: Real time video from a concentrator

REFERENCES

Orfali R., Harkey D. (1998) “Client/Server Programming with Java and CORBA” Second Edition. John Wiley & Sons, Inc., New York.

Stallings, William, (1994) “SNMP, SNMPv2, and CMIP: The practical Guide to Network-Management Standards”, Addison-Wesley Publishing Company.

www.verising.com; Implementing Web Site Client Authentification Using Digital Ids.

www.Microsoft.com; ASP Technology Overview. Implementing a Secure Site with ASP