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# VISA DRIVERS IN DISTRIBUTED MEASUREMENT SYSTEMS

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*Abstract: Application of software drivers, based on VISA architecture, in Java application and applets is considered. Next, an example of the system, that uses a communication based on sockets for remote controlling HP859x Spectrum Analyser, also via Internet, is presented.*

*Keywords: distributed measuring system, Java, VISA driver*

## 1 INTRODUCTION

Last years appear as a period of fast development of network technologies, that can be used for remote access to advanced metrological services, such as specialised processing procedures, remote access to unique measuring instruments, measuring systems and research laboratories. Using distributed networks enables one to simultaneous applying above elements by many users independently from their place of stay. In the paper a general concept of network sharing measuring instruments connected to PC computers is presented. Main deal of the described work is to ensure remote controlling for HP 8590 spectrum analyser, via distributed network, in particular: designing program interfaces and dialogue interfaces for virtual distributed measurement system. A possibility of using VISA software drivers [2],[10] for designing measuring systems, that is controlled via Internet, is analysed. One of the most important problem was ensuring co-operation of the drivers with applets or applications.

## 2 THE NEW CONCEPT

There is many methods to ensure the user remote access to instruments from terminal that is connected to LAN/WAN network. All these methods are based on architecture Client-Server using standard network protocols (for example: TCP, IPX, UDP). Most of the solutions [3],[4],[5],[6] are based on integrated environments as LabView, LabWindows or HPVEE, that have built-in procedures that ensure an access to network transmission protocols. There is a possibility to use WWW mechanism that enables one to remote control a measuring system from WWW page using standard Internet browsers (as: Netscape Navigator, Internet Explorer).

Such an access to available services is very easy for users, so we decided to apply Java architecture [9] in the project and we have taken an assumption, that remotely controlled application will be accessible as an applet via WWW server.

The problem of appropriate driver architecture in distributed measuring systems was analysed. Variety of measurement instrumentation and communication interfaces requires some different drivers to used instruments in measuring systems. It is necessary to know suitable communication functions for each of interfaces (often very different). In this paper an application of novel and flexible IO interface VISA type in distributed measurement systems was considered. This type of software interface enables one to design single driver, that can control an instrument via various communication interfaces. Data flow diagram is presented in Figure 1.

## 3 IMPLEMENTATION

The following assumptions for developed system were taken into account:

- the specialised TCP/IP server takes a function of an mediator between measurement application (applet) and instrument driver library,
- this server (further called GPIB/HP859x server) is extended version of GPIB server presented in [1],
- the VISA type HP859X instrument driver is used,
- the Java class for communication between an applet and mentioned server is developed,
- the special protocol is created for mentioned above communication,
- the simple WWW server makes that an applet together with class is available from WWW page.

Designed software was divided into four functional modules:

- data source interface,
- data source server,
- client interface,
- WWW server.

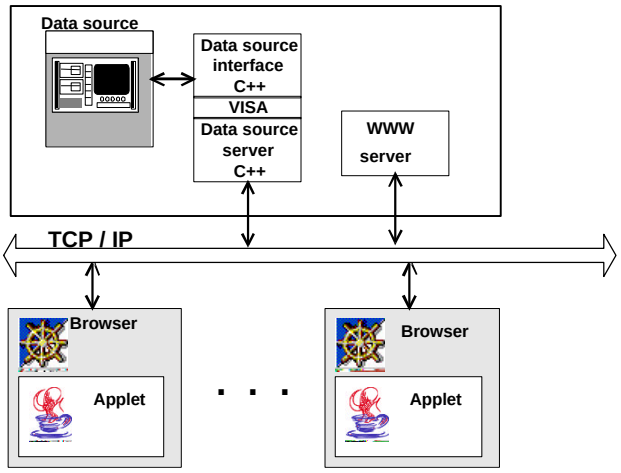


**Figure 1.** Data flow diagram in Virtual Laboratory.

Measurement instruments with interfaces. (e.g.: IEEE 488.2, RS-232C, VXI) are treated as a data source. Data source interface consists of:

- IEEE 488 interface bus,
- IEEE 488 controller board,
- driver for controller card (in computer's memory),
- VISA library ("visa.lib") together with LabWindows/CVI environment (runtime),
- VISA type instrument driver for HP 8590, compiled to static library ("hp859x.lib").

All mentioned above parts can be seen in Figure 2.

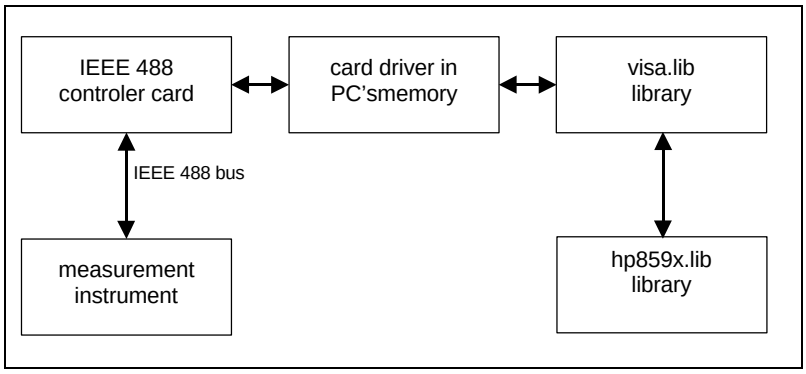


**Figure 2.** Block diagram of data source interface.

Although we use an IEEE 488 interface, there is no GPIB library in data source interface. Here we use VISA library (Virtual Instruments Software Architecture), which allows us to control instruments via variety of hardware interfaces, such as IEEE 488, almost all serial interfaces, even the VXI.

Data source server (called as server), created in Visual C++ 5.0, is based on data transmission via sockets (TCP/IP protocol) [8], [9] and includes an interpreter of commands, that are coming on appropriate communication port. It takes a function of an mediator between measurement application (applet) and instrument driver library [10].

The communication between particular elements of the system is shown in Figure 3.

Created data source server, Java class and idea of communication between them are very similar to solution described in [1]. The main differences are as follows:

- the libraries visa.lib, cvirt.lib and compiled instrument driver are linked to the server,
- the new functions for controlling spectrum analyser are added to the interpreter,
- the hp859x.class consists of methods which matches proper functions in instrument driver.

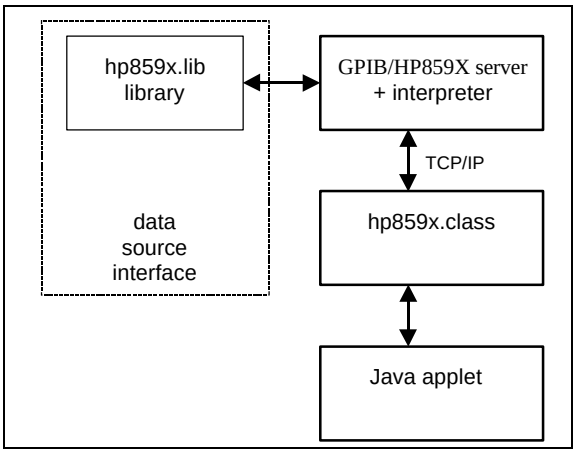


**Figure 3.** Communication between Java applet and data source interface using VISA architecture.

For example the two fragments of initialisation function source code are shown below.

```
switch(fun)
. . .
case 81:
   podziel_na_pola();
. . .
if (blad==0)
  {
   sprintf(str,"hp859x_init
            GPIB%i::%i,1,1,&instrSession)",atoi(Pola[0]),atoi(Pola[1]));
      LogToFile(str);
      sprintf(resourceName,"GPIB%i::%i",atoi(Pola[0]),atoi(Pola[1]));
   uir_err = hp859x_init (resourceName, 1, 1, &instrSession);
   if (uir_err != 0)
    {
     hp859x_errorMessage(VI_NULL,uir_err,errorMessage);
     sprintf(str,"99(%s)", errorMessage);
        }
    else sprintf(str,"81()");
  }
 break;
```

**Example 1.** Function (from server side) for analyser initialisation

```
public int hp859x_init(int boardID, int addr)
{
      out.println("81("+boardID+";"+addr+")");
      try {
               str = in.readLine();
               if (str.startsWith("81"))
                        System.out.println("OK " + str);
               else
                        System.out.println("Err "+ str);
         } catch (IOException e) {
                System.err.println("Couldn't get I/O for the connection.");
                return -1;
         }
return 0;
}
```

**Example 2.** Method (in hp859x.class) for analyser initialisation

To build a client interface (Java application or applet) specialised class was created, that contains methods corresponding to functions of instrument driver. This class can be treated as instrument driver in Java.

Communication between Java applets (or application) and server is carried out using protocol specially designed for this purpose. This protocol was created to limit transmitted data amount, to limit a possibility of faults appearance when a measuring system is working, and to easy detection and interpretation of errors.

Simple WWW server was created in Java to make available (HTTP protocol) client applet with created class.

## 4 EXAMPLES

Presented concept was a starting point for building the measurement applications. The applications, accessible using standard browsers, were built as the applets. A system that consists of HP 8590 spectrum analyser connected with PC computers via NI IEEE 488.2 [7] interface board was applied to create an example of measurement application. A virtual panel of HP8590 spectrum analyser was designed. It enables one sending appropriate measurement parameters and measuring a frequency spectrum. The applet uses a HP.class method that is dedicated for HP859x spectrum analysers. The graphical user interface (GUI), the Java applet, is built using event driven based programming technique. The elements of GUI are as follows:

- buttons “Connect“ and “Quit“ responsible for performing and stopping connection to server,
- set of dialog boxes for elementary parameters of spectrum measurement,
- button “Go“ performing the measurement,
- graphic display for measured spectrum visualisation.

## 5 CONCLUSIONS

The presented system has some, not trivial advantages comparing to solution described in [1]. Application of VISA driver architecture enables one to design system’s software independent from hardware interface being used. VISA functions let us to use not only IEEE 488 interface, but also serial interfaces and VXI interface. Another feature is an accessibility of VISA drivers for most of measurement instruments. Developed data source server becomes the specialised tool, dedicated to particular instrument or group of instruments. Of course there is still possibility to use low level, interface functions, for controlling these instrument’s features, which were no implemented in server. The use of interface functions was strictly described in [1]. Presented example confirms usefulness of proposed concept.

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