

---

## Conclusion

---

This paper has outlined the potential of multiagent framework for decision support. From an abstract point of view, the concept of an agent has been used as modularization principle for the DSSs' software and knowledge. The results of such modularization are specialized domains. The presented framework is flexible and easily scalable, because domains are independence.

---

## Bibliography

---

- [Brehmer, 1991] Brehmer, B.: Time scales, distributed decision making and modern information technology. In (Rasmussen, J.; Brehmer, B.; Leplat, J. Eds): Distributed decision making: Cognitive models of cooperative work. Wiley, New York, 1991.
- [Choi, 1999] Choi, Y.S.; Yoo, S.I.: Multi-Agent Learning Approach to WWW Information Retrieval Using Neural Network. Intelligent User Interfaces, 1999; pp. 23-30.
- [Cuena, 1999] Cuena, J.; Ossowski S.: Distributed Models for Decision Support. In (Weiss, G. Ed): Multiagent Systems: A Modern Approach to Distributed Artificial Intelligence. MIT Press, London, 1999.

---

## Authors' Information

---

Vira Lyubchenko - Odessa National Polytechnic University, Shevchenko av., 1, Odessa 65044, Ukraine; e-mail: [vira.lyubchenko@gmail.com](mailto:vira.lyubchenko@gmail.com)

# CONNECTION OF NETWORK SENSORS TO DISTRIBUTED INFORMATION MEASUREMENT AND CONTROL SYSTEM FOR EDUCATION AND RESEARCH

Sergey Kiprushkin, Sergey Kurskov, Eugene Sukharev

*Abstract:* The development of the distributed information measurement and control system for optical spectral research of particle beam and plasma objects and the execution of laboratory works on Physics and Engineering Department of Petrozavodsk State University are described. At the hardware level the system is represented by a complex of the automated workplaces joined into computer network. The key element of the system is the communication server, which supports the multi-user mode and distributes resources among clients, monitors the system and provides secure access. Other system components are formed by equipment servers (CAMAC and GPIB servers, a server for the access to microcontrollers MCS-196 and others) and the client programs that carry out data acquisition, accumulation and processing and management of the course of the experiment as well. In this work the designed by the authors network interface is discussed. The interface provides the connection of measuring and executive devices to the distributed information measurement and control system via Ethernet. This interface allows controlling of experimental parameters by use of digital devices, monitoring of experiment parameters by polling of analog and digital sensors. The device firmware is written in assembler language and includes libraries for Ethernet-, IP-, TCP- u UDP-packets forming.

*Keywords:* distributed information measurement and control system, network sensors, Ethernet Interface, client-server technology, distance education.

*ACM Classification Keywords:* H.3.4 Systems and Software: Distributed systems

---

## Introduction

---

Up-to-date systems of experiment automation are recently built on modules of software-controlled devices or digital measurement hardware, connected to interface bus. In all cases, hardware is connected to computer with interface device.

Integration of distributed system with remote sensors is more efficient, when the network interface used. It can be built on network chip and microcontroller. By using Ethernet interface, it is possible to connect different digital and analog devices, and the connection with servers will be based on TCP/IP networks.

The goal of this work is to develop a network interface for connecting remote sensors and execution units to distributed information measurement and control system for physical experiments.

### The Distributed Information Measurement and Control System

The distributed information measurement system (Figure 1) is based on client/server technology and works in the nets on the basis of TCP/IP protocol stack [Gavrilov et al, 2003] – [Kiprushkin et al, 2005].

The system provides the remote access to information and hardware resources of automation equipped working places. The access to physical equipment is provided by the equipment servers (CAMAC server, GPIB server, the server of access to the MCS-196 microcontrollers and others). The communication server integrates the whole distributed systems. Its functions are: communication with user, system monitoring, security, and proper distribution of resources in multiuser mode.

The experiment process is determined and conducted by client software running on a client computer. It is necessary to emphasize, that the managing experiment software are operated not on the remote computer (as when using Web technologies) [Barrie et al, 1996], [Зимин и др., 2002], but on the user one, connected to the system via global network.

The communication server, the equipment servers, and the client software are implemented as Java applications. The data exchange between them is based on TCP stream sockets provided by java.net package, which is included into Java API standard package. The methods of using the input-output ports for the access to the interface controllers are written in C programming language.

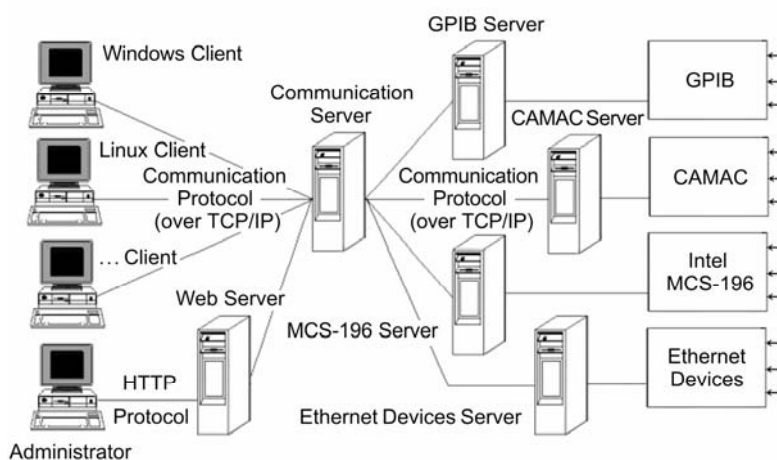


Figure 1. The scheme of the distributed information measurement and control system

### Ethernet Interface

There are many specialized processors (network chips) designed for communication over networks. But it is necessary to create a central command unit, which will communicate with devices and control the network chip. This unit can be built on microcontroller.

Choosing network chip, it is necessary to take into account the physical environment and the required transmission rate of data. For communicating over 10 Mbps network, based on twisted pair, Realtek RTL8019AS processor was selected. This chip is compatible with ISA personal computer interface by timings, data and address signals.

By emulating ISA bus with microcontroller, it is possible to gain proper network chip functioning. Atmel AVR microcontrollers are good choice to implement this idea. They perform each instruction per one clock period, so their performance is 16 MIPS for 16 MHz clock rate. This performance is enough for ISA emulation.

Atmel ATmega8535 was used in the described device. It has 8-channel 10-bit ADC, 8 Kb Flash ROM, 512 b EEPROM, 512 b RAM, pulse-width modulator and analog comparator.

The main logic of the device functioning is described below. When the device is turned on, microcontroller firmware program is initiated. By sending the RESETDRV signal, the network chip is resetting. Then microcontroller configures the network chip. Configuration can be made in accordance to the desired aim of operation: e.g. reading data from measurement device and sending these data to specified network address.

The operation modes are:

- Control of the experiment execution through digital or analog devices (relays, step motors, gas injectors, etc.)
- Control of some parameters by polling analog and digital sensors (pressure, temperature, and optical sensors, atom beam sensor, etc.).
- Notify of parameter value, registering by measurement device.

## Software

It is possible to present information flow as follows.

Analog value is converted into binary code by ADC. This very value must be received "on the other end of wire" for placing into database. The result is put into TCP packet. TCP protocol provides the reliable transmission of the messages between remote application processes. Then the IP datagram is formed from TCP packet (the level of the internetworking) and is sent to the bottom level – a network interface level.

Protocols of this level must provide the integration into global network: TCP/IP network must have a facility of the integration into any other networks, which doesn't depend on internal technology of data communication in these networks. Hence, this level is impossible to define once and for all. An interface facility must be designed for every communication technology. IP-frames to Ethernet encapsulation protocol pertains to such interface facility. Encapsulation of IP-package into Ethernet-frames is described in RFC1042. Then Ethernet-frame is sent via communication media.

The other side receives the frame and performs the re-conversion by correspondent server software. Processing of the frames encapsulation doesn't take much processor time in personal computer. But microcontroller has smaller speed and less memory. That's why it is very important to solve this task by means of optimized algorithm and assembler language.

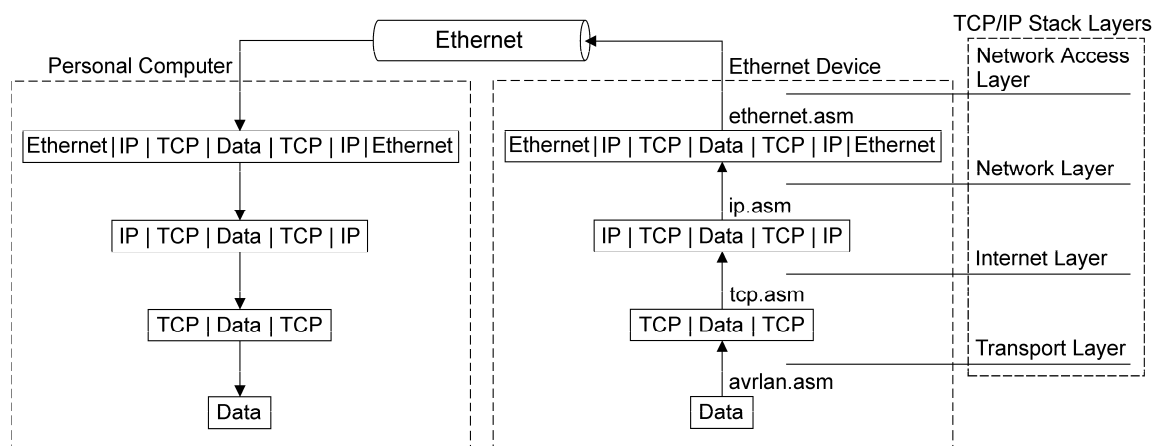


Figure 2. Set of the program modules and sequence of the transmission of the frame, received from remote device by PC

Set of the program modules and the sequence of the transmission of the frame, received from remote device by personal computer, are shown on Figure 2.

It is possible to use complete 3rd-party libraries and functions for TCP/IP implementation, because the software requires standard interactions only. These libraries are presented in all up-to-date programming environments (Java, .NET, Visual C++, Delphi, LabVIEW, etc.).

There is a question that needs to be answered by a developer of software: what level of TCP/IP stack must be implemented. This choice depends on software, used in personal computer, dataflow and processing speed of microcontroller, as well as requirements of reliability of information delivery.

The more preferred way is to use the lowest possible level of TCP/IP stack, sending data in Ethernet-, or IP-frames.

E.g. measured values of remote temperature sensor can be packed into Ethernet frames directly if qualification of the developer is sufficient to use the Ethernet level. But if the LabVIEW used, then you need to use all modules for package framing (from ethernet.asm to tcp.asm) on microcontroller side. Using the Java language for writing client applications also superimposes the restriction: when TCP-socket is used, you need to use the tcp.asm library in microcontroller. If you use UDP (unreliable delivery protocol) you must encapsulate messages with udp.asm library. This library works at transport level of TCP/IP stack that obliges to use as well as all underlayed protocols. Firmware, designed for the described device, is written on assembler language and includes Ethernet-, IP-, TCP- and UDP-package libraries.

The described device can be used in other networks, based on other protocols, but in this case it is necessary to develop the libraries for generation of correspondent frames.

Internet does not give any warranty for time of package delivery. This reason limits the use of the device in system that imposes hard time restrictions of information delivery. This feature can be eliminated by using a special network, used for undertaking the physical experiment only.

---

## Conclusion

Ethernet interface device and corresponding software were developed and created. It implements access to remote sensor and digital device of the laboratory complex, used for scientific experiments in the field of optical spectroscopy and distant education on Physics and Engineering Department of Petrozavodsk State University.

This interface helps to increase the variety of devices, which can be connected to distributed information measurement and control system without using the computer and software-operated module electronics, as well as different instrument interface like GPIB.

---

## Acknowledgments

We would like to express our gratitude to the laboratories' Head I. P. Shibaev for support of this work as well as students A. V. Mandychyev and E. A. Vasilieva.

The research described in this publication was made possible in part by Award No. RUX0-000013-PZ-06 of the U.S. Civilian Research & Development Foundation (CRDF) and of the Ministry of Education and Science of Russian Federation.

---

## Bibliography

- [Gavrilov et al, 2003] S.E. Gavrilov, S.A. Kiprushkin, S.Yu. Kurskov. Distributed information system with remote access to physical equipment. In: Proceedings of the International Conference on Computer, Communication and Control Technologies: CCCT '03 and The 9th International Conference on Information Systems Analysis and Synthesis: ISAS'03. Orlando, 2003.
- [Kiprushkin et al, 2004] S.A. Kiprushkin, N.A. Korolev, S.Yu. Kurskov. Data security in the distributed information measurement system. In: Proceedings of the 8th World Multi-Conference on Systemics, Cybernetics and Informatics: SCI 2004. Orlando, 2004, Vol. 1, pp. 13-16.
- [Kiprushkin et al, 2005] S.A. Kiprushkin, S.Yu. Kurskov, N.G. Nosovich Administration of distributed information measurement system. In: Proceedings of the 9th World Multi-Conference on Systemics, Cybernetics and Informatics: WMSCI 2005. Orlando, 2005.
- [Kiprushkin et al, 2005] S.A. Kiprushkin, N.A. Korolev, S.Yu. Kurskov. Sharing of Instrument Resources on the Basis of Distributed Information Measurement System. In: Proceedings of the Second IASTED International Multi-Conference on Automation, Control, and Information Technology - Automation, Control, and Applications: ACIT-ACA 2005. Novosibirsk, ACTA Press, 2005, pp. 170-175.
- [Kiprushkin et al, 2005] S. Kiprushkin, N. Korolev, S. Kurskov, N. Nosovich. Distributed Information Measurement System for Support of Research and Education in Optical Spectroscopy. In: Proceedings of the Third International Conference "Information Research, Applications and Education": i.TECH 2005. Sofia: FOI-COMMERCE, 2005, pp. 171-179.

---

[Barrie et al, 1996] J.M. Barrie, D.E. Presti. The World Wide Web as Instructional Tool. Science, 1996, V. 274.

[Зимин и др., 2002] А.М. Зимин, В.А. Аверченко, С.Ю. Лабзов и др. Лабораторный практикум по спектральной диагностике плазмы с удаленным доступом через Интернет. Информационные технологии. 2002, N 3, pp. 37-42.

---

### Authors' Information

---

Sergey Kiprushkin – e-mail: [skipr@dfе3300.karelia.ru](mailto:skipr@dfе3300.karelia.ru)

Sergey Kurskov – e-mail: [kurskov@psu.karelia.ru](mailto:kurskov@psu.karelia.ru)

Eugene Sukharev – e-mail: [eugene-mobile@yandex.ru](mailto:eugene-mobile@yandex.ru)

Petrozavodsk State University, Lenin St., 33, Petrozavodsk – 185910, Russia

## PROCEDURE OF FORMALIZATION OF THE INDICES OF BANKS' STABLE FUNCTIONING IN COMPARATIVE ESTIMATES OF THEIR DEVELOPMENT

Alexander Kuzemin, Vyacheslav Lyashenko

*Abstract: The advisability of analyzing the banks liquidity and profitability as the key factor when building the comparative estimate of their functioning is considered. The procedure of formal description of the bank stable functioning indices is substantiated. Fuzzy interpretation of the bank management efficiency estimation is offered. The possibility to formalize the bank functioning estimates on the basis of the corresponding fuzzy set levels hierarchy is analyzed. The comparative estimate of different bank systems functioning is given.*

*Keywords: bank system, liquidity profitability, fuzzy numbers, ownership function management.*

---

### Introduction

---

Analysis of the financial flows of both a banking system as a whole, and separate banks specifically, is one of the key components for building of the adequate economical security system for any subject of management acting in the market economy. The reason is that it is precisely due to banks and their activity that movement and redistribution of cash and financial resources are realized. Because of this, a consideration of the problems of functioning and development of the banking system are constantly the focus of attention. This fact makes the given direction the currently central one.

The comparison estimate of different banking systems deserves particular attention. On the whole, this is favorable not only to revealing acceptable approaches to solution of different problems but the possibility of the forestalling estimates in the decision-making referring to the corresponding development of the banking system. At the same time, actually emerging difficulties in different stages of development or transformation of social-economic systems, first and foremost, call for an appropriate support of the banks stable activity basic condition which, in the general case, is expressed through establishment of the acceptable relation of liquidity and profitability. In other words, liquidity and profitability should be considered as the main components of the unified system for estimation of the financial stability and reliability of the whole bank management system. Thus, an adequate description of the liquidity and profitability interrelation is one of the key sub-problems demanding a solution.

---

### Substantiation of the Object of the Research

---

The foundation for the chosen direction of researches is based as a rule on the statistical derivations or models, whose origin being in the approaches of the theory of games. But in both cases the mathematical basis of researches forms generally the probabilistic methods of data analysis. The works of E. Berglof, G. Roland, G.J. Mailath, L.J. Mester, T. Hellmann, K. C. Murdock, J.E. Stiglitz [1, 2, 3] can exemplify such a consideration of the bank activity. Nevertheless, the main problem emerging when building an adequate system of an economic