LABORATORY 17

Laboratory of Information Transmission Networks

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The leading researchers of the laboratory include:

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DIRECTIONS OF ACTIVITY

Basic directions of the laboratory activity are development of theoretical foundation for analysis and synthesis of distributed information transmission networks, and practical implementation of large-scale projects concerning with distributed computer and communication networks.

The theoretical researches are carried in the following directions:

- Development of theoretical foundation for design of infocommunication networks including both terrestrial fiber-optic and copper channels, and wireless radio and infrared communication lines.
- Extension of stochastic network (G-network) theory for estimating integral characteristics of infocommunication networks which channels are affected by breakdowns and noise-induced distortions.
- Development of analysis and synthesis methods for wireless local area and regional networks controlled by IEEE 802.11x and IEEE 802.16 protocols.
- Development of methods and algorithms for topology synthesis and optimal routing in telecommunication networks.

MAIN RESULTS

In 2003, the Laboratory continued the fundamental researches related to extreme graph theory, queuing networks theory, and reliability theory. Moreover, the field experiments with various physical media (fiber-optical, radio, satellite communications), operational environments and various network architectures were carried on simultaneously.

The theoretical researches are carried in the following directions:

- Development of theoretical foundation for design of infocommunication networks including both terrestrial fiber-optic and copper channels, and wireless radio and infrared communication lines. Basing on new results of extreme graph theory, the generic problem of minimal-cost network topology design has been formulated and first solved with constraints imposed on connectivity probability (reliability) and packet delivery time.
- Extension of product-form stochastic network theory (G-network theory) for estimating integral characteristics of infocommunication networks which channels are affected by breakdowns and noise-induced distortions. Stochastic models have been developed and studied for choosing optimal parameters of IEEE 802.11x and IEEE 802.16 protocols intended for broadband regional telecommunication networks. Ob-

tained results have been adopted to develop series of high-rate (up to 100 Mbps) and efficient radio equipment that will operate in 2,3-6.1 GHz frequency bands and surpass similar foreign and domestically produced equipment in provided QoS indices.

- The problem of choosing optimal-cost architecture has been formulated and solved for broadband wireless regional telecommunication networks, including optimal allocation of base stations and assigning LANs of subscribers to them, with constraints imposed on electromagnetic compatibility. Developed methods and algorithms have been implemented in the software complex for wireless regional telecommunication network design.

Theoretical results in the area of distributed network analysis and design have been used as a basis for development of large-scale telecommunication network projects. Specifically, the scientific study results have been adopted in the following projects:

- Topological extension of the Radionet cellular radio-modem network to provide an access to Internet for Moscow institutions of science, culture, and education.
- Development of the base station project for the wireless radio-modem network with using tethered aerostat balloons, including:
  - Development of the effective system to control the aerial complex, using azimuth and vertical stabilization.
  - Development of the mooring equipment for new type of aerostat balloon.
  - Development of board-to-ground wireless information transmission systems and software complex to control remotely the base station operation from ground terminal.
  - Electromagnetic compatibility estimation for wireless regional networks using tethered aerostat balloons.
- Development of protocols for interaction between wireless 802.11 networks and cellular GPRS networks, what has ensured an opportunity to deploy wireless corporate networks almost in any region of Russian Federation and to extend the geography of access to Internet for state and commercial subscribers.
- Development and extension of telecommunication networks of Russian Ministry of Transport, Presidium of RAS, and Russian Road Agency.
- Development of the automated docflow system for large managerial institutions.

GRANTS FROM:

- **Purpose Programme of RAS:** "Informatization of Scientific Institutions and Presidium of RAS".
- **Ministry of Industry, Science and Technologies of RF (State contract No. 37.053.11.0063):** "Methods for Design of Computer Networks".
- **The NATO Advanced Study Institute:** "Strategic Management of Marine Ecosystems" (**EST.ASI.979247).**

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