Technology vs. Political Conflict – How Networks Penetrate the Iron Curtain

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Abstract. In July 1977, the International Institute for Applied Systems Analysis (IIASA) near Vienna organized an experimental data transmission line. This paper investigates this experimental data transmission line focusing on three aspects: first of all IIASA was an important location for Eastern and Western scientists for working with each other, secondly the team of computer specialists creating the network was remarkable, and finally the concept of combining computer technology with science cooperation and information transfer was very advanced in the 1970s.

Keywords. Data transmission line, network, Cold War, computer specialists, scientists, science cooperation, computer technology, information transfer

1.   Introduction—Experimental Data Transmission Line in 1977

In July 1977, the International Institute for Applied Systems Analysis (IIASA) near Vienna organized an experimental data transmission line:[1]

During three weeks, scientists from Austria, Poland, USSR and the US were enabled to communicate electronically through the Iron Curtain.[2] This fact was a remarkable event in the history of computer networks. In particular, the roots of the motivation are interesting: Which were primarily based not on technology but on politics. Gennadij M. Dobrov,[3] a Soviet science researcher and philosopher of science, considered science as an international and cooperative process. Therefore he argued that it is necessary to establish teams of scientists from different countries who would then cooperate in their research of vital problems of mankind in spite of

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[1]   This article is the revised paper held on the International Conference of IFIP working group 9.7, International Communities of Invention and Innovation, New York, May 25-29, 2016. For more details see the extended German paper: Frank Dittmann, Technik versus Konflikt. Datennetze durchdringen den Eisernen Vorhang, in: Osteuropa 59, 2009, no. 10, pp. 101-119.

[2]   G. M. Dobrov et al., Information Networks for International Team Research, in: International Forum on Information and Documentation 3, 1978, No. 3, pp. 3-13

[3]   In Memoriam (Gennady M. Dobrov), in: Options March 1989, p. 18.

political and ideological differences. However, this endeavour was obviously difficult during the Cold War and that's why the idea arose to solve all the problems by communicating via computer technology. In 1977 the three-week data transmission line proved that the general concept worked. This paper investigates this experimental data transmission line focusing on three aspects: First of all IIASA was an important location for Eastern and Western scientists for working with each other. Secondly the team of computer specialists creating the network was remarkable. Finally the concept of combining computer technology with science cooperation and information transfer was very advanced in the 1970s.
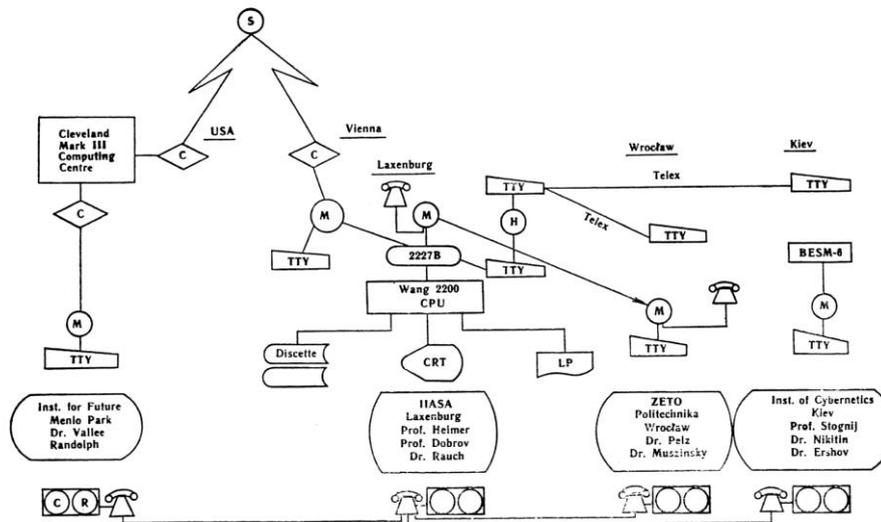

Fig. 1. Experimental data transmission between Austria, Poland, USSR, and U.S. in July 1977. Source: In: International Forum on Information and Documentation 3, 1978, No. 3, p. 10

2. The Location – the International Institute for Applied Systems Analysis (IIASA)

October 1972 after six year preparation time the IIASA was founded in London.[4] In 1966, U.S. President Lyndon B. Johnson had already developed the idea that

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[4] See: Howard Raiffa, In the beginning, ... The early years of IIASA, as recalled by its first director, in: Options Special Issue: Annual Report 1992, March 1993, p. 6-10; Roger E. Levien, Introduction to IIASA: Applying Systems Analysis in an International Setting, in: Behavioral Science 24-3/1979, p. 155-168, Howard Raiffa, Rand, IIASA, and the Conduct of Systems Analysis, in: Agatha Hughes, Thomas P. Hughes (ed.), Systems, Experts, and Computers. Cambridge/Mass., London 2000, pp. 433-461, Alan McDonald, Scientific Cooperation as a Bridge Across the Cold War Divide: The Case of the International Institute for Applied Systems Analysis (IIASA). IIASA Research Report RR-99-6, 1999, Giuliana Gemelli: Building Bridges in Science and Societies during the cold War: The Origins of the

scientists from the Soviet Union and the U.S. should work together on vital problems of mankind like energy supply, environmental protection, food production, healthcare and the like. The founding Nations explicitly excluded militarily relevant topics such as nuclear-power and space-exploration. Johnson's intended to build bridges in order to reduce East-West tensions. He meant to increase human contacts, in this case, between scientists.

On the American side McGeorge Bundy was authorized to negotiate with the Soviet side. Bundy was Professor in Harvard and between 1961 and 1966 security adviser of President Kennedy and President Johnson. Then he headed the Ford Foundation.[5] He contacted in the USSR the deputy chairman of the State Committee for Science and Technology Džermen Michajlovič Gvišiani. Gvišiani had worked since 1955 in GKNT and founded in 1969 an Institute for complex management problems at the Academy of Sciences of the USSR. In addition, he held a number of different positions in international cooperation.[6] Not least Gvišiani's wife was the daughter of Soviet Premier Alexei Kosygin.

Both sides agreed the cooperation should be limited not only to the superpowers. Thus the Soviet Union insisted to include the GDR -- a demand that has always led to opposition in the West before the official recognition of the socialist German state. The problem was circumvented in which the established institution received the status of a Non-Governmental Organisation (NGO). As a result, however, the financing was more difficult because governments could not make direct grants to such institutions.

Political and military crises overshadowed the six years of the negotiating process. Some examples are the Vietnam War and the intervention of Red Army troops in Czechoslovakia in 1968 to crush down the so called Prague Spring. Furthermore the negotiators of the IIASA needed to circumvent the "German problem" which meant that the FRG government would not accept activities which could be regarded as recognition of East Germany. On top of all these difficulties, at the beginning of the 1970s the British Government did expel hundreds of Soviet diplomats for spying. Nevertheless, in 1972 IIASA got started with an American director and a Soviet institute's council chairman.

International Institute for Applied Systems Analysis (IIASA), in: G. Gemelli (ed.): American Foundations and Large-Scale Research: Construction and Transfer of Knowledge. Bologna 2001, pp. 159-198.

[5] Who's who in American politics 1967-1968. New Providence 1967, In Memoriam McGeorge Bundy, in: Options Fall/Winter 1995, p. 19.

[6] Borys Lewytzkyj (ed.), Who's who in the Soviet Union. A biographical encyclopedia of 5000 leading personalities in the Soviet Union. Munich 1984, p. 56; In Memoriam Jermen Mikhailovich Gvishiani, in: Options Summer 2003, p. 25.

Bulgaria	National Centre for Cybernetics and Computer Technique
Canada	Committee for the International Institute for Applied Systems Analysis
Czechoslovakia	Committee for the International Institute for Applied Systems Analysis
France	French Association for the Development of System Analyses
FRG	The Max Planck Society for the Advancement of Sciences
GDR	Academy of Sciences
Italy	Nation Research Council
Japan	Japan Committee for the International Institute for Applied Systems Analysis
Poland	Polish Academy of Sciences
U.K.	Royal Society of London
USA	National Academy of Sciences
USSR	Academy of Sciences

Fig. 2. Founder organization of IIASA.

Since the mid-1970s IIASA worked on an experimental computer network called IIASANET which connected the Research Institute for Applied Computer Technology in Budapest, the Institute for Cybernetics in Bratislava, the Moscow Institute for Control Technology, the Institute for Cybernetics in Kiev and the University of Technology Vienna. Via the European Informatics Network (EIN) the institutions had access to other computer networks, in particular to the ARPANET.[7]
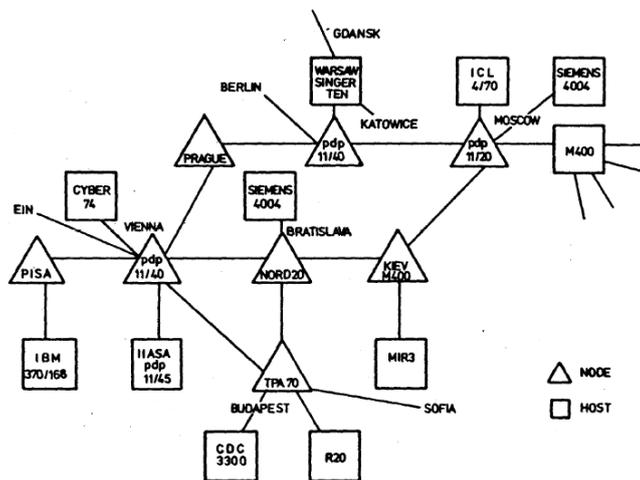

Fig. 3a. IIASANET 1976 and 1983

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[7] A. Butrimenko, Computer Networking, in: IIASA Conference '76, 10-13 May, 1976. Vol. 2, pp. 201-214.
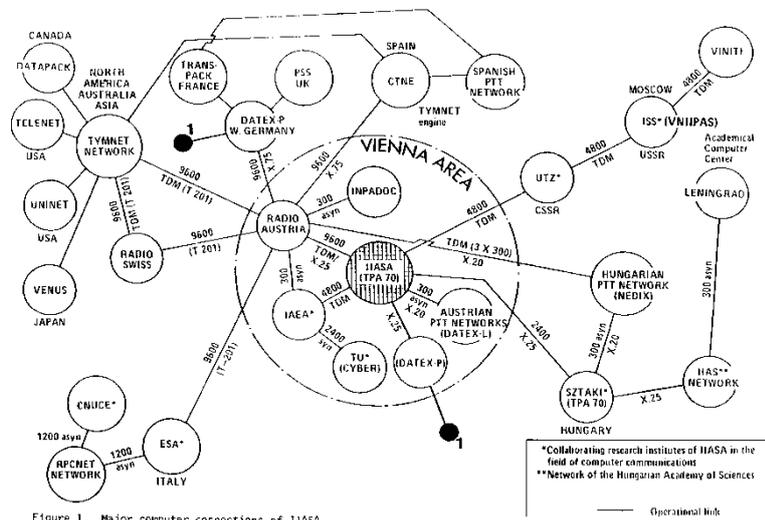
Figure 1. Major computer connections of IIASA.

Fig. 3b. IIASANET 1976 and 1983 Source: (left) A. Butrimenko, A., Computer Networking, in: IIASA Conference '76, 10-13 May, 1976, Vol. 2, pp. 201-214; p. 210 and (right) I. Sebestyén, Experimental and operational East-West Computer Connections. The telecommunication hardware and software, data communication services, and relevant administrative procedures. Final Report. Laxenburg, IIASA, 1983; pp.130-133.

The motivation of this effort is remarkable because it was based not primarily on technology but mostly on politics: As mentioned above though IIASA international teams of scientists from different blocks were meant to collaborate with each other, however, during the Cold War it was difficult to bring scientist together, because of bureaucratic restraints in organizing journeys across the Iron Curtain, safety hurdles, or shortages of foreign currencies in Eastern countries. The idea arose to avoid these problems by using data transmissions: computer networks were supposed to support scientific work among scientists of the two different blocks.

3. The Origin – Wide Area Computer Networks for Military Purposes

During the Cold War computers – and in particular network-technology, were regarded as strategically important to the West and East because the advanced one were developed and widely used in the military context. In the U.S. the leading concept was provided by Semi-Automatic Ground Environment System (SAGE) built up between the 1950s and 1963.[8] SAGE was a control system in the U.S. for

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[8] See e.g. K. C. Redmond, Th. M. Smith, from Whirlwind to MITRE. The R&D Story of the SAGE Air Defense Computer. Cambridge/Mass., London 2000. See additionally the special issue of Annals of the History of Computing 5, 1983, No. 4. The great importance of SAGE

detecting, tracking and intercepting Soviet bomber aircraft. It was very important for the development of computing and led to huge advances in online systems and interactive computing, real-time computing, and data transmission via modems.
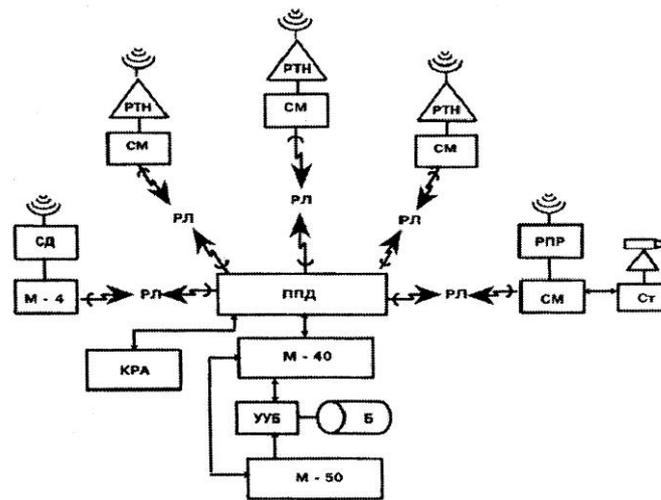

Fig. 4. Computer network of an experimental missile defense system 1955/56. Source: V. S. Burtsev, Distributed Systems: The Origins of Computer Networks in the USSR, in: G. Trogemann et al. (eds), Computing in Russia. Braunschweig 2001, pp. 215-220.

In the Soviet Union computer networks were developed for military purposes as well. Similar to SAGE, in 1953, a group of specialists at the Moscow Institute of Precision Mechanics and Computing Machinery started to create a computer-based missile defence system.[9] This Moscow Institute and its director Sergey Alekseevich Lebedev played an important role in the history of Soviet computing.[10] In 1956 the first experiments started. Radar stations sent information to a computer centre by remote data transmission over roughly 100 to 200 km. There a special computer, called M-40 (see graphics above), selected and digitized the data to plot the trajectories of the flying object and a second computer, called M-50, generated control signals. This equipment made it possible to aim a rocket at the moving ballistic missile target automatically. At the end of the 1950s, the experimental anti-aircraft system was replaced by an improved one. The total length of the computer network now reached several hundred kilometres. In 1969, the system was replaced again by an advanced anti-aircraft system. Data transmission lines were also used for

mentioned the Soviet scientist W. S. Gurow. See Grundlagen der Datenübertragung. Leipzig, 1969; pp. 285, 298 (Russian Edition, Moscow 1964).

[9] V. S. Burtsev, Distributed Systems: The Origins of Computer Networks in the USSR, in: G. Trogemann et al. (eds), Computing in Russia. Braunschweig 2001, pp. 215-220; p. 216.

[10] G. D. Crowe, S. E. Goodman, S. A. Lebedev and the Birth of Soviet Computing, in: IEEE Annals of the History of Computing 16, 1994, No. 1, pp. 4-24.

information transfer from stations automatically observing Soviet space ships and satellites.

Additionally ideas for using this military based technology in the civil sector arose in the 1960s. During that time Viktor M. Glushkov,[11] director of the Institute of Cybernetics of the National Academy of Science of Ukraine, developed the concept of a computer network for a nationwide economics control system called OGAS (All-Union Automated System), therefore he was very important for the IIASA story.

4.   The Team – High-Ranking Scientists from East and West

Considering IIASA computer network activities one can find several computer scientists who are viewed as crucial for the history of the wide-area network and the internet in general, like the US American internet pioneer Vint Cerf, the U.K. pioneers of computer network technology Peter T. Kirstein, Donald W. Davies und D. L. A. Barber and last but not least Louis Pouzin from France.[12] From the Soviet side scientists should be mentioned such as the Ukrainian Gennady Michailovič Dobrov, the IIASA project manager for computer science Alexander Vasilevič Butrimenko and the important computer specialist Viktor Michailovič Glushkov from Kiev. All these scientists participated in several conferences on computer networks at IIASA in Laxenburg. It can be assumed that these scientists discussed ideas and facts of their field of expertise. This paper is not the place to outline the activities of all of these individuals but to focus on the concept of computer networks in general.

5.   The Idea—Computer Centres Interconnected via Data Transmission Lines

The idea of wide spread computer networks was established in the Soviet Union in the 1960s. Glushkov developed the concept of a computerized all-union planning and management system, which he called OGAS.[13] He participated at least twice at the mentioned IIASA conferences.[14]

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[11] V. S. Mikhalevich, Academician Viktor Mikhailovich Glushkov, in: Cybernetics and System Analysis 29, 1993, No. 3, pp. 303-306.

[12] Proceedings of a IIASA Conference on Computer Communications Networks. October 21-25, 1974.

[13] William J. Conyngham, Technology and Decision Making. Some Aspects of Development of OGAS, in: Slavic Review 39, 1980, No. 3, pp. 426-444.

[14] V. M. Glushkov, Computer Networks: Comments on a IIASA Research Activity, in: IIASA Conference '76, 10-13 May, 1976. Vol. 2, pp. 235-237; Proceedings of a IIASA Conference on Computer Communications Networks. October 21-25, 1974, S. VII.
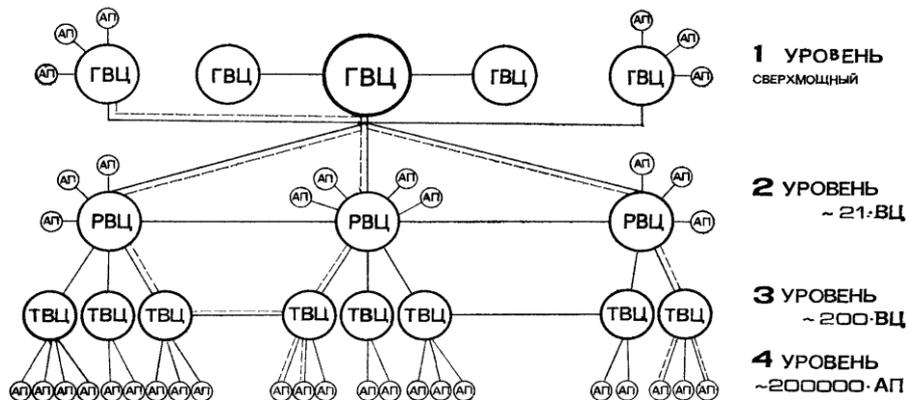
Fig. 5. OGAS structure. Layers: 1 - All-union, 2 – Republic, 3 – Territory, 4 – Company. Source: D. G. Zhimerin, Obscegosudarstvennaja avtomatizirovannaja sistema upravlenija (OGAS), Moscow 1975, p. 42

The OGAS system consists of a lot of computer centers which are connected electronically and had different layers.[15] Companies use regional computer centers (marked with No. 4). On the next layer above are computer centers of the Soviet republics (marked with No. 3) and the next layer are computer centers of Soviet central planning institutions (marked with No. 2). On the very top is the central Soviet government (marked with No. 1). A digital communication network connects all these centers hierarchically. The objective of the system was to answer questions like the following: Which company produces a certain product in the region and offers free capacity? The answer should be given in about 20 minutes, which stood for real time back then! Evidently, the Soviet political leadership appreciated an instrument which promised total access from the All-union planning institutions down to all companies and organizations hoping for a significant improvement of the central planning system. Glushkov supported such euphoria with the very ambitious idea of a fully automated process for monitoring, planning, and managing. He pronounced: "There is the opportunity of a non-stop planning process which is closely connected with the process of managing. Again, this process of managing allows a process of a continuous and uninterrupted correction of planning specifications."[16] On the one hand Glushkov estimated costs of about 20 billion Rubles for realizing the system during 15 years, but on the other hand he forecasted advantages of 100 billion Rubles. It is evident from the current viewpoint that Glushkov totally underestimated the complexities of the Soviet economic system. Therefore his ambitious system was never realized, because of technical problems, political barriers, and lack of money.

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[15] V. M. Glushkov, Macroeconomic models and principles of OGAS, Moscow 1975 (in Russian), Dmitrij G. Zhimerin, All-union automated system of planning (OGAS), Moscow 1975 (in Russian).

[16] Viktor M. Gluschkow, Dialogsystem in der Planung, in: Rechentechnik / Datenverarbeitung 11, 1974, No. 2, pp. 5-6, p. 6.

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However, such utopian ideas came up not only in the Soviet Union. Around the same time in the U.S. J. C. R. Licklider,[17] who is regarded today as a visionary of the information society developed the idea of Thinking Centers combining functions of classic libraries with the advantages of electronic information processing.[18] Licklider estimated that between 1970 and 1975 such centers would come into existence. Licklider envisioned that computers would help to solve complex problems in a flexible way in which human beings determine aims, hypothesis and criteria whereas computers do the routine work. Interestingly enough Glushkov's and Licklider's visions are very similar: Whereas Licklider emphasized knowledge management in a more general way to overcome the so-called information overflow, which was widely discussed during that time, Glushkov focused on information processing of economically important data.

Licklider stressed the advantages of using computers in team-working processes in particular to communicate over a long distance. This he called "on-line interactive communities". Exactly this idea became the starting point in a report about the mentioned experimental data transmission by Dobrov ten years later (1977).

6. Summary—International Contacts Across the Iron Curtain Never Stops

Although, during the Cold War scientific cooperation between East and West needed to overcome a lot of hurdles, scientific contacts never ceased. In particular, international conferences offered Eastern computer scientists the opportunity to meet their Western colleagues. Since 1977 about every four years an International Congress on Computer networks organized by IFIP took place in Budapest. Besides these conferences in the Hungarian capital other international conferences took place in Eastern countries, for example, conferences in Karlovy Vary (Czechoslovakia) or symposiums organized by the Centre for Computer Technology of the East German Academy of Sciences. In general the USSR and other COMECON countries worked very actively as members in international organizations such as in the International Federation of Automatic Control (IFAC) or the International Federation for Information Processing (IFIP). Additionally, the CCITT (French abbreviation of the International Committee for Telephone and Telegraph Systems) played a key role in East-Western cooperation on network technology. Traditionally, most of the national PTTs are CCITT members. Although the CCITT standards were only

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[17] Chigusa I. Kita, J. C. R. Licklider's Vision for the IPTO, in: IEEE Annals of the History of Computing July-Sept. 2003, pp. 62-77.

[18] J. C. R. Licklider, Man-Computer Symbiosis, in: IRE Transactions on Human Factors in Elektronics HEF-1, March 1960, pp. 4-11; J. C. R. Licklider, The Computer as a Communication Device, in: Science and Technology April 1968. Both articals appeard as reprint in: R. W. Taylor (ed.), In memoriam: J.C.R. Licklider: 1915-1990. Palo Alto/Ca. 1990.

recommendations most of the members adopted them into national law: only in this way was communication guaranteed without a reference to the different producers.

The development of ideas in science and technology is a process of international cooperation, not limited to East or West. The concept of wide-area networks is a result of a world-wide discussion, as mentioned in this paper. Whereas Licklider emphasized knowledge management in a more general way to overcome the so-called information overflow, Glushkov OGAS focused on information processing of economically important data. In both cases development of wide-area networks was not driven by the technocratic idea to bring computer technology to its limits but by the hope of more effective information management.