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ON CERTAIN ASPECTS OF TELEINFORMATION NETWORKS: COMPUTER NETWOR--ETC(U)
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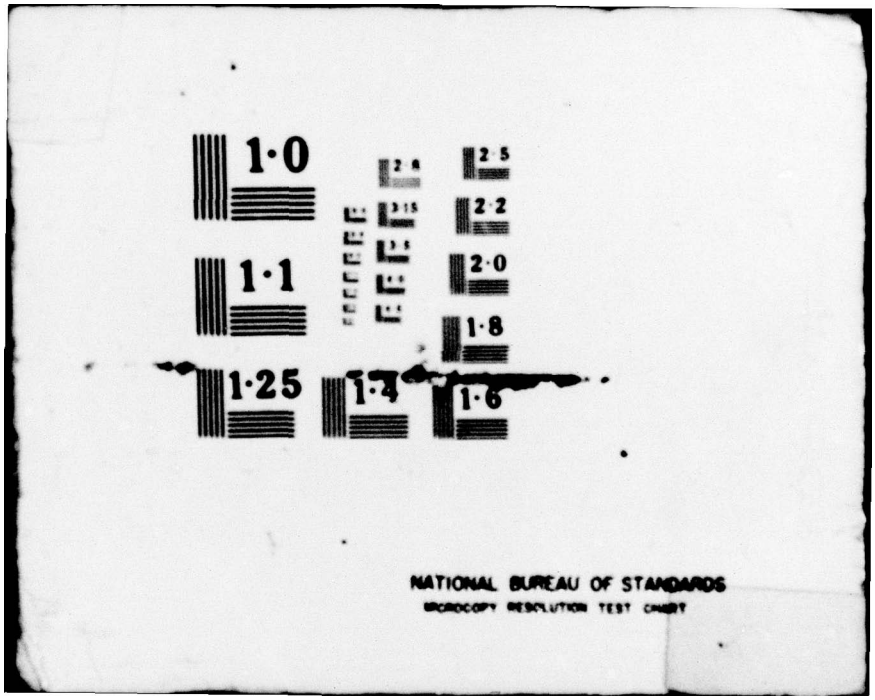
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FOREIGN TECHNOLOGY DIVISION

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By

Janusz W. Sowinski

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ON CERTAIN ASPECTS OF TELEINFORMATION NETWORKS; COMPUTER NETWORKS

by Janusz W. Sowinski

Functional analysis of teleinformation networks

The idea of a teleinformation network is understood as a collection of remote end systems, telecommunication processors and other telecommunication equipment, along with data processing computers, which all function together via a telecommunication line within the framework of one system.

From the point of view of the network, a functional analysis made within the boundaries of a telecommunication network leads to the deduction that every point or node can be qualified as belonging to one of the following groups;

1) information source
2) switching node
3) information outlet

Information sources or places on the network through which information is inputed for the first time are comprised of the following;

- terminals
- processors for converting information also called information processors
- telecommunication processors

Switching nodes are those network points in which information transmitted from the source changes form and/or content or also undergoes an exclusive transmission delay after which it is directed to outlets. Switching nodes include;

- front-end processors
- multiplexors
- concentrators

-equipment controlling groups of terminals
-commutators

Information outlets are those network points to which information is supplied. Outlets can be transitory (intermediate) from which information will be transmitted to another appointed location, or final through which information leaves the network and is outputed in an appropriate form through output equipment. Outlets include;
-terminals
-information processing units
-concentrators.

A front-end processor can introduce into the network information emerging as a result of processes occurring in it. It can accept information transmitted to it from the network and can perform the switching node function for information flowing between the information processor and its surrounding network.

Similarly, the concentrator can fulfill the function of a source, outlet and switching node for information except that in this particular instance it would be connected to a front-end processor and not an information processing unit.

A multiplexor is exclusively a piece of switching equipment so called because it cannot generate information nor can it be a location for its eventual output. It simply switches information flowing between a group of end equipment and a front-end processor.

From the cursory description of teleinformation networks presented above results an obvious conclusion; that their practical realization became possible only after solving many software problems equally at the level of operating systems as well as user programs e.g. data transmission, routing, node administration etc. Particularly interesting are software

problems at the level of procedural control, data transmission, programming problems, aspects of routing algorithms, administration of nodes and networks etc.

The development of computer networks(causes, goals and classification

Generally the sizeable development of information systems and specifically teleinformation systems has led in past years to the emergence of a large numer of independent computing systems used to advatage by individual services in agriculture, trade, education etc. Frequently, within the framework of a single institution or organization, have been found systems of great equipment and software heterogeneity distinguished by significant but specific resources such as outmoded equipment, various data banks, specialized programming languages for various applications, numerous programs etc. Individual resources accessible through the framework of one system, with respect to the variety mentioned above, have become inaccessible to other users of neighboring systems needing them. Developing systems and software for the use of all systems cannot ordinarily be hoped for if only from a strictly economic point of view.

The tendency towards making the mentioned resources available to users of various systems (centers) has consequently led to the research of methods of connecting various computers and the development of the concept of computer networks.

The computer network constitutes a collection of information systems located in a certain geographical area connected by a transmission network with the goal of enabling all network users with the advantage of the resources of individual sysytems. The computer network, therefore, is a particular case of a teleinformation network. Construction of the first of this type of

network began at the end of the sixties and this rapid development principally enabled the evolution of a large number of information systems (centers), the growth of dependability of transmission systems as well as the reduction of the cost of their expoitation.

The basic goal motivating the construction of computer networks is the allocation (sharing) of computing resources understood as the allocation of computing processor power as well as its hardware resources, the allocation of software resources and the collection of data. These objectives can be more particularly classified as follows;

1)load allocation, that is a distribution of computing power demand such that every working unit in the network is equally utilized.

2)program sharing, that is enabling data transmission from every network node to the computer in which is found the given program.

3)data sharing, enabling transmission of programs to computers in which are stored large data banks

4)dynamic access to files, enabling an operating program on a particular access to files existing at other computing centers as if they were local

5)functional reliability and accessibility understood as increased reliability of processing and protection from the consequences of the break-down of a computer or an element of the transmission system.

6)reducing transmission costs to the individual user along with a high factor of utilization of telecommunication lines by a large number of users.

7)cooperation between user; a way of creating research or design groups which, through access to common programs, data or other type of resources work more efficiently without duplicating efforts.

Individual solutions of computer networks differ in purpose, operating pronciples, spatial structure(topology), equipment utilization and software. Thus classification of computer networks also refers to their many parameters. Namely, the following are noted;

1) in regards to purpose; specialized and universal networks
2) in regards to operating principles; remote job entry, charged networks, conversational networks as well as resource allocating networks
3) in regards to compatibility of computer systems operating on a given network; homogeeous and heterogeneous networks
4) in regards to spatial structure; centralized and decentralized networks

The computer network classification described above embodies to a great extent the complexity and difficulty of solving equipment and software problems. It becomes necessary for a network center to elaborate appropriate programs enabling mutual transfer of users' jobs among particular systems of processing information (processing computers) as well as between them and network computers. In a situation where as a rule each computer has its own individual operational system such a job is very difficult to solve. User needs constitute a further demand so that creating a network or connecting existing user computers to an existing network leads to as few changes in software of the existing and thus far unexploited situation. Extensive modifications od complicated operating systems could lead to great disturbances in the work of computing centers.

During the design and development ~~to~~ of software for telecommunication computers connected to a network, many heterogeneous solutions are applied that depend as much on the type of network, its composition, organization and means of operation as for the the characteristics of the information computer itself.

To illustrate the problems, described below is one of the simplest concepts applied during network construction. It depends on the fact that since every network computer treats every other computer in the network as its terminal , or as a group. In such a case, the software of an operating network in a job processing mode will be relatively simple not demanding great changes in the operating system of the network computers. Software, having received a job for execution originating from another computer (on-line) will be treat it as a job originating fron a terminal and will place it in line for jobs awaiting execution. At the appropriate time, the job will be processed and the results transmitted to that on-line computer or to another according to a received address according to principles acceptable to its own terminal.

Software becomes more comlicated in a network operating in a conversational mode. In this instance, it must assure connection to every user requiring communication with one of the network computers for the duration of a seance (accomplishing the job communicated). In this type of network, the users entry to the given local system with a job for a remotely located system causes a generating of processes (program activation) related to the execution of this job or creating links between these processes (programs). The user, via this connection, can in the course of execution control his job in the remote computer as if he was a local user of that computer. On the other hand, the remote computer will treat the generated programs as being local. The connection created will exist through the entire duration of the user's seance enabling him to transmit particular commands and data to the computer and receive responses.

The above distinctly illustrates that the problem of proper and reliable exchange of information between certain software elements (programs, operational systems, processes) constitutes

one of the most important network problems. Software elements located in various computers must conduct a dialogue and exchange data, controlling and other information between themselves. This dialogue must take place according to certain rules specifying the format and type of the exchanged information (of those communicating) their time sequences, procedures in particular situations etc. , in other words, a certain compilation of rules and procedures of conduct called telecommunication protocol. The type of accepted protocol influences ina real way the functional (user) parameters as well as the characteristics of network expoitation. The details of establishing protocol and its functions in a network center (multicomputer) ordinarily requires a great deal of attention at the stage of network design.

Other software problems for a computer network not discussed here include the structure of transmitted data, control and administration of networks, creation of languages to control networks, safeguarding information etc.

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