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ТЕОРЕТИЧЕН АПАРАТ ЗА АНАЛИЗ И СИНТЕЗ НА СИСТЕМА ЗА КОМУНИКАЦИОНЕН ПРОТОКОЛ СЪС СПЕЦИАЛЕН НАБОР УСЛУГИ

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THEORETICAL APPARATUS FOR ANALYSIS AND SYNTHESIS OF SYSTEM COMMUNICATION PROTOCOL WITH A SPECIAL SET OF SERVICES

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Abstract: *Information about a project of total theoretical apparatus for analysis and synthesis of the protocols for the control of selected system structures of communication system are described in the paper. The methods of analysis are oriented to essential proprieties of all referent model layers interfaces (capacity in both directions, elasticity for the whole set of services, code transparency, reliability, etc.) The methods of synthesis are oriented to the selection of optimality criteria, creation of hypothesis about protocol algorithm, hypotheses testing and to optimization of suitable protocol structures. After the elaboration of theoretical apparatus the solution moves to system application phase. In this step the theoretical apparatus is used for the implementation of typical solutions into the existing systems, for the elaboration of the recommendations for new standards creation and for the elaboration of the procedures for non-standard protocol creation.*

A lot of experience is laid in the introduced protocols. The consequence of individual stages is respected but expert approach without exact theoretical apparatus is preserved.

Key words: *communication protocol*

Introduction

The goal of the article is information about a project of total theoretical apparatus for analysis and synthesis of the protocols for the control of selected system structures of communication system. The methods of analysis are oriented to essential proprieties of all referent model layers interfaces (capacity in both directions, elasticity for the whole set of services, code transparency, reliability, etc.) The methods of synthesis are oriented to the selection of optimality criteria, creation of hypothesis about protocol algorithm, hypotheses

testing and to optimization of suitable protocol structures. After the elaboration of theoretical apparatus the solution moves to system application phase. In this step the theoretical apparatus is used for the implementation of typical solutions into the existing systems, for the elaboration of the recommendations for new standards creation and for the elaboration of the procedures for non-standard protocol creation. Essential referent models which cover most of the provided services were gradually created for the communication systems. Protocols between individual layers are standardized for the layer model. Algorithm and format of the protocols was created gradually by iteration procedure on the base of experience. When the sep/ice set is extended, the existing protocols may not be suitable for the new services. The project's goal is the elaboration of theoretical apparatus for the analysis of existing protocols and for the synthesis of supplement protocols especially of application and transport protocols. Goal of protocol optimization by fixed system function is followed by the analysis. The synthesis means creation of protocol structure to the fixed structural function. For usual system function it is enough if the protocol fulfils this function. For special functions, for example by safety services, the protocol has to have necessary measure of redundancy. The basic role of the synthesis is the determination of necessary measure and composition of this redundancy.

The apparatus for the tasks of protocol analysis and synthesis is based on system theory with looking on the type of system control task. Necessary parts of information theory have to be respected because information is manipulated in every protocol. Circuit theory gives the tools for application of the synthesis tasks solution in the concrete communication systems and for optimization of the existing protocols. The conclusions are formulated into the recommendations in the area of standards and in the area of routine activity with the protocols for fixed range of the system functions.

Every communication system is a service subsystem by processes control by the system which has destination behavior. Then the communication system itself is a controlled system which besides its technology part (acquisition, transmission, safe-keeping and processing of information) contains its control part. It has to work according to the control procedure which consists of the control algorithm and language for realization of this algorithm. The language has its meaningful and formal point. The control of communication system can to narrow to control of network in the first approach. The control procedure and the protocols as its realization is subordinated to network technology. From this point of view we have the monofunctional (telephone, data,…) or polyfunctional networks which integrate the whole service set. The extensive private networks, which have to overcome passing from functionally divided to integrated, have a special position.

The protocols in the communication system were elaborated and gradually standardized for the individual reference models. Most of the standards are oriented to layer reference model OS I (open system interconnection). Open system interconnection covers almost the whole set of telematic services. Separate proprietary solutions of function and protocols dominant in the private networks applications and in the industrial applications. The standard protocol ISO MMS (Manufacturing Message Protocol) is gradually becoming preferred and it is made for communication between the nodes of private network for industrial use. Protocol MMS is implemented over different protocol folders.

Standard solution of protocols for OSI model does not cover the functions of communication system which are necessary by control of the critical processes. Existing solutions are concentrated into the workstations. Competent protocols solve necessary level of safety for every application ad hoc. Therefore standard protocols are being amended and adjusted so that an added function or new type of service could be ensured. Also in the reference model OSI are gradually completed the functions of individual layers and after sufficient extension of these functions we come to changes or completion of the standards for introduced protocols. As an example can serve the standard according to the recommendation ITU X.500

A lot of experience is laid in the introduced protocols. The consequence of individual stages is respected but expert approach without exact theoretical apparatus is preserved.

Basic solution of the problem

Basic contribution of project solution is elaboration of total theoretical apparatus which enables unambiguous transition from the protocol primitive to the function and the services. By synthesis this transition is reverse, non unambiguous but optimal. Existing approaches are different because the construction of the protocol is based on the process model of communication system. Perceived quality of process control is mapped into the offered quality. The result of this mapping is a set of functions, which have direct coherence with the achieved quality. The relevant function can be overwritten to the control algorithm by the set of rules and this algorithm can be transmitted to the protocol construction. It is a fact that if there is a tool to transmit Junction to the protocol, there must also be a passage from every relevant function of communication system to the protocol which operates this function.

The theoretical apparatus is used over the communication system model. The model is created so that it maps all attributes of system which are essential for its control. If the existing protocols were suitable for the individual layers functions of reference model, the project solution would go further because it enables the creation of models which satisfy all necessities of system control. We can say that it is the hierarchy

of control functions from business control to the network element control. The solution will be a contribution to all processes which are running in the communication system. The installing of new function and its competent protocol means only the extension and does not mean change of approach by the demand of customer or by transit of system to new technology step or to new service set. If the theoretical apparatus manages basic operation of manipulation with communication system functions, it can be expanded to the function vector by chain rules. This procedure leads to internet work protocols on required internetworking level. The rules for manipulation with the function vectors can be spread from sharp to fuzzy, what gradually leads to expert approach.

Fixed structure of protocol for selected function range is not optimal for extensive networks. Optimal control needs flexible protocol. It can not be compiled by determined approach. The solution supposes usage of genetic algorithm and learning structures for synthesis of flexible protocols. The theoretical apparatus will then become useful by analysis and synthesis tasks of control of all the processes for which the communication system is service subsystem.

The model on which the theoretical apparatus is created and verified is elaborated mostly as numerical. We use the fact that all relevant processes can be described by numerical mathematics tools. This also holds true for control functions of such processes. If this principle is extended to creation of control task, we can successfully use the conclusions of discrete control theory. By managed description (modeling) of processes and their control we can exactly move to the creation of optimal protocols structure. The optimality means that protocol structure is adapted to competent step of process control. The communication system raises its performance and accuracy of executing partial function also on the changing customer's demands. Necessary measure of model independent from hardware and software solution of technology functions, signal processing and from control functions is regarded by communication system modeling.

Use of the theoretical apparatus is important part of the solution when creating new standards for communication system protocols. We can also obtain effective criterion for evaluation of existing standards implementation.

The ways how to reach the goals

The solution, procedure begins by modeling of communication system processes control. The modeling must begin by mapping of relations between the service quality and system performance. This step can best be described by fig. 1.

Complexity of network and volume of services determine the claims on the network control. It is necessary to add the technology level of network elements, which determines the way of executing control procedure. Basic task of network control is to guaranty the

sturdiness against network overload and the failures. The control also has to react to customer demands and dynamically control them.

Customer has a partial access to the software part of network and to simple control of the network interfaces.

It is necessary to create the control structure so that it enables a connection of different network elements to control mechanism and calculate support system across the standard interfaces. It is necessary to use distribution network (data network) as simple as possible for this connection.

The interface protocols are based on the model of open network architecture (ONA). The layer principle is also used by creation of this structure. In fact, the layering is based on the process model. Each layer can be further divided. The functions in this hierarchy are grouped into standard categories. Here is the list of categories:

control of events. These functions control all network layers structure from point of view of alarms identification and their solutions,

control of sources. Functions for layers construction from point of view of the hardware and software equipment of the sources,

control of configuration. Functions for network completion from individual elements with goal of configuration change control, of tendency change by failure, by overload, etc.,

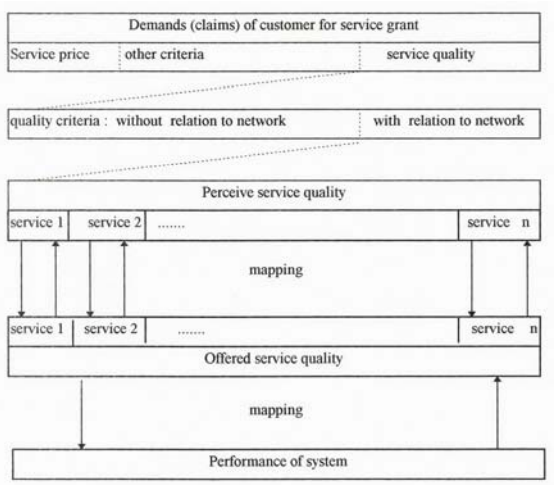


Figure1. Mapping of relations between the service quality and system performance

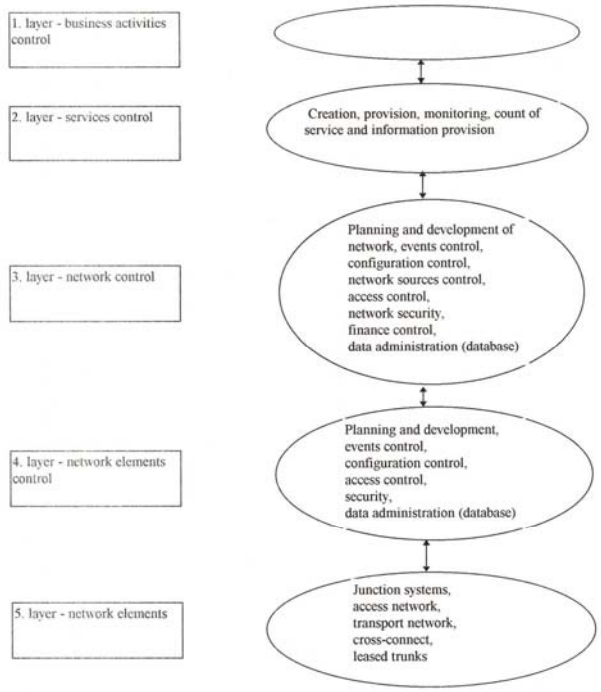
control of finance. Functions for location and control of investment and non-investment budgets, control of actives, book-keeping, etc.,

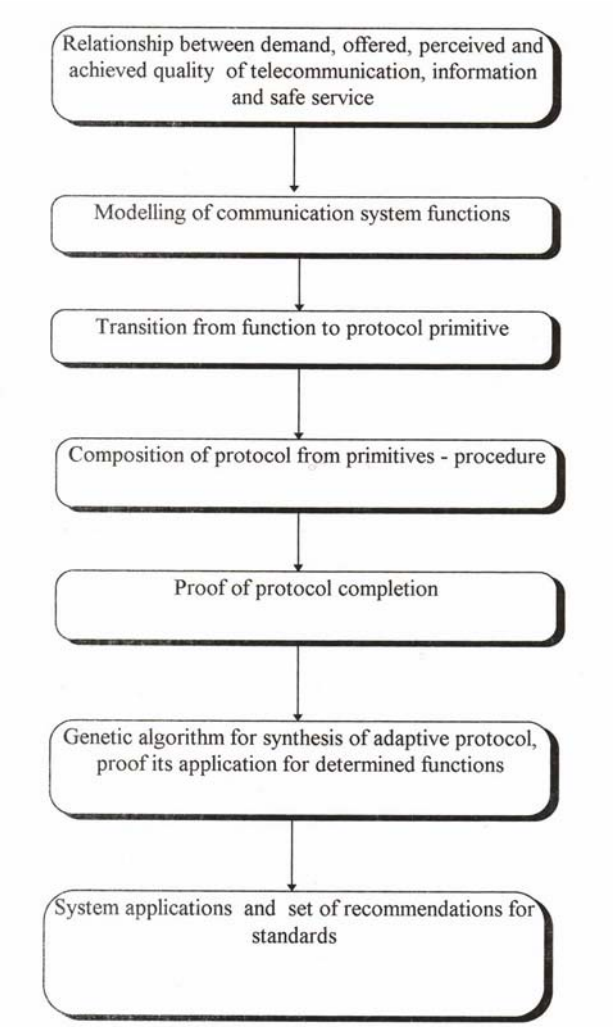
control of access and security. Functions which give way to network for individual levels of staff authorization,

planning and development of network. Functions of network planning for determined volume and set of services

These functions are tied together with defined basic system processes. These functions influence the performance of different control tasks. For example the function of event control can detect network failure which arises after testing and diagnostic of equipment belonging to the competence of network sources control function. The configuration control function can cause temporary over direction (across competent maintenance workers) by help of access control activities. Performance control and data administration give information about service quality. It is realized by the function of finance control if the service is paid.

The categories and their arrangement can be depicted by following diagram:





Conclusion

The procedure from processes definition and functions to protocol analysis and synthesis as part of communication system control:

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