FEATURES OF APPLICATION META-GRAMMAR FOR THE FORMAL DESCRIPTION OF PROTOCOLS TO TRANSFER DATA IN GRID SYSTEM

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Abstract

The main features of the application of the Meta-grammar theory for formal description of the standard data transmission protocols in Grid Systems are determined. The elements of Meta-grammar specifying the syntactic structure of telematics standard systems protocols used in existing Grid systems are considered.

Keywords: Meta-grammar, syntactic structures, formal grammatical, transmission protocols in Grid Systems.

Introduction

For the purpose of definition of possibilities offered for application in works Meta-grammar (MG) classes for the decision of specific applied problems of creation grid systems, testing the equipment of processing and data transmission in this work features of special classes of the MG used as reference descriptions (specifications) of standard systems of telemetric reports, used in existing grid systems are considered.

In works it is shown, that one of the most perspective directions of the decision of a wide range of problems of data processing in grid systems is application of the structural and combined structurally-statistical, structurally-algebraic methods.

The Basis of the majority of widely known structural methods of processing and their modifications now is application of the formal grammatical specifications which serve as reference descriptions of the basic classes of standard systems of telematic protocols, used in existing grid systems.

The formal grammatical specifications must meet the following basic requirements (Adzhemov S.S, Nikolayev A.V, (2003)).

1. Completeness and without redundancy descriptions of protocol structure .
2. The possibility of using efficient algorithms of synthesis, restoring and modifying grammatical specifications .
3. Ability to use effective methods of syntactical analysis as a procedural component of data processing techniques in Grid systems.

In assessing the feasibility of these requirements respectively, the following parameters are used:

1.Power of language families generated by grammars; degree of completeness of coverage by these languages the whole variety of syntactic structures of specific classes of protocols, visibility, the complexity of specifications, the identity of the structural properties of the object and the formal description.
2. In addition to the above mentioned parameters characterizing the result of synthesis (restoration) of grammars parameters of synthesis procedures and the restoration of structural descriptions (time and complexity of the capacitance), the parameters of sample data (completeness of structural information sequence (Foster. I., C. Kesselman), etc.) are considered.
3. Temporary and capacitive complexity of syntactic algorithms analysis, characteristics of a sample of data (volume, individual "syntactic" features), the recovery at different levels of distortion in the data sequence.

Earlier executed works analysis showed that in most practically important cases, by combining into the system and the use of additional rules of the MG surpass the known grammar formalisms by the first and third groups of parameters and somewhat inferior in some parameters of the second group that due to the need to account more fully a priori information about the processed data class.

At the same time by using a combined approach to the synthesis and recovery of grammatical structures, the procedures of creation a GM and conventional grammar can be attributed to a single class of (Foster. I., C. Kesselman), and in some cases when using the MG procedures for modification of standard descriptions Are significantly simplified (Adzhemov S.S, Nikolaev A.V.,(2003))..

As a whole it creates good preconditions for MG use for the decision of problems of data processing in grid systems (Adzhemov S.S, Nikolaev A.V.,(2003)).

In particular, one of the most important and commonly used families of protocols to transfer documents and data is a family of protocols, created on the basis of the recommendation ITU-T T.70 specifying the order exchange and structure of the protocols of physical, channel, network and transport layer for data transmission. Owing to popularity and sufficient study basic procedures specified in it are often used as a kind of "testing ground" for testing new methods and languages for formal descriptions of protocols documentary exchange . In particular, in the work a method for the specification of considered protocols systems and the corresponding signal designs based on a kind of decomposition-aggregative approach and the application as the language of formal description of regular grammars is proposed (Atakishchev O.I.,(2004)).

At the same time, the application of the proposed approach to the formal description of the protocol is limited to linear and multilevel signal designs without syntactically managed investments and sequencing of the rules in network data, defined by the system of protocols. As shown in known works (Atakishchev O.I.,(2004), 4), for the description of similar systems of protocols and signals corresponding to them it is necessary to use more difficult grammatical designs concerning subclasses Meta-grammar. Even in case of acceptance of some assumptions about "finiteness" of separate alarm sequences, attempt of their description by means of regular grammar there appears a problem of "combinatory growth» of numbers of coordination in this Meta-grammar

With growth of number of levels of a network investment of data that leads to practical impossibility to use similar formal schemes. At the same time the similarity of such structures with languages, considered in , as applied to the analysis of formal Meta-grammar properties allows you to apply for their regular MG with an expanded set of rules Control (Adzhemov S.S, Nikolayev A.V, (2003),).

Here is a general Meta-grammar scheme describing the syntax system of T.70 protocol, for the case where data transfer is carried out in a data packet from one subscriber, and we'll give a brief description of its constituent elements. MG is represented as a formal system:

$\boldsymbol{G_{Gs} = <\{G_1^{(1)}, \{G_{i2}^{(2)}\}, G_1^{(3)}, \{G_{i4}^{(4)}\}, \{G_{i5}^{(5)}\}\} W_{GS}>}$,

Where $G_1^{(1)}$ - Regular grammar that describes the procedure to transfer frames, similar to (Atakishchev O.I.,(2004)), $G_1^{(1)} \in \{G_r\}$ in the notation of (Atakishchev O. I , (2001));

$\{G_{i2}^{(2)}\}$ - The set of grammars that describe the structure of personnel, with a detailed level of service and information fields, similar to(Atakishchev O.I.,(2004)), i2 = 1 (1) 6, S-, V-and I-frames "direct" and" reverse channels and i2 = 1 (1) 3 for unidirectional transmission are described;

$G_1^{(3)}$ - Regular grammar describing the procedure for substitution of data packets in the field of information personnel by specifying with that purpose permitted sequences of products usage in the grammars $\{G_{i4}^{(4)}\}$ as in (Atakishchev O.I.,(2004));

$\{G_{i4}^{(4)}\}$ - The set of grammars, describing the possible structure of packages, similar to grammars $\{G_{i2}^{(2)}\}$ (i_4=1(1)18 to describe the signal of one station);

$\{G_{i5}^{(5)}\}$ - The set of grammars that describe the syntactic structure of frames and packets with details of how to separate syntactically significant bits and their combinations, similar to (Atakishchev O.I.,(2004)), $\{G_{i5}^{(5)}\} \in \{G_{im}\}$ in the notation of (Atakishchev O. I , (2001));

W_{GS} - MG scheme, the generalized structure W^o_{GS} which specifies the following matrix:

		$G_1^{(1)}$	$\{G_{i2}^{(2)}\}$	$G_1^{(3)}$	$\{G_{i4}^{(4)}\}$	$\{G_{i5}^{(5)}\}$
	$G_1^{(1)}$		{TS(1)}			
$\mathbf{W^o_{GS}}$ =	$\{G_{i2}^{(2)}\}$			{TS(3)}	{TS(1)}	{TS(1)}
	$G_1^{(3)}$				{TP(4)}	
	$\{G_{i4}^{(4)}\}$					{TS(1)}

Rules (TS (1)) define a decomposition of the fields of frames and packages, the rules of TS (3) and TP (4) determine the order of substitution packages in the field "data" information frames, similar to (Atakishchev O.I.,(2004)).

If the communication channel transmitted packets from different subscribers in the regime with the establishment of a virtual connection, the MG takes the following form:

$$G_{Gs}^{*} = <G_1^{(1)}, \{G_{i2}^{(2)}\}, \{G_{i3}^{(3)}\}, \{G_{i4}^{(4)}\}, \{G_{i5}^{(5)}\}, W^{*}_{GS}>.$$

In the MG uses the same elements as in the grammar network GGC, are used only instead of one grammar $G_1^{(3)}$ it contains the N_3 (the number of subscribers included in communications) such grammars, each of which "tracks" the order of attachment of the package from each of the N_3 subscribers. Scheme rules W * gC, in contrast to the WGC, contains (TS (3)) and (TS (4)) rules for each new $G_{i3}^{(3)}$ grammar, and TS (3) rules for grammars $\{G_{i3}^{(3)}\}$ *and* $\{G_{i5}^{(5)*}\} \subseteq \{G_{i5}^{(5)}\}$, describing the decomposition of unique to each subscriber fields packets (logical channel number, etc.).

In this case, a generalized scheme of the rules of W^{*}_{GS} MΓ $G_{KC}{}^{*}$ submit-ted in the form of a matrix:

		$G_1^{(1)}$	$\{G_{i2}^{(2)}\}$	$\{G_1^{(3)}\}$	$\{G_{i4}^{(4)}\}$	$\{G_{i5}^{(5)}\}$
W*$_{GS}$ =	$G_1^{(1)}$		{TS(1)}			
	$\{G_{i2}^{(2)}\}$			{TS(3)}	{TS(1)}	{TS(1)}
	$\{G_1^{(3)}\}$				{TP(4)}	{TS(3)}
	$\{G_{i4}^{(4)}\}$					{TS(1)}

If necessary, N_3 grammar $\{G_{i3}^{(3)}\}$ can be replaced by a two-level network grammar $(G_1^{(3.1)}, G_1^{(3.2)})$, where the grammar $G_1^{(3.2)}$ is identical to $G_1^{(3)}$, Grammar $G_1^{(3.1)}$generates a chain, each element is decomposed into a grammar $G_1^{(3.2)}$ to TS (1) rules and chains set the allowed sequence of alternating packets from different subscribers. Similarly, when using the MG simply (by adding individual grammars and rules of control) other modifications of the protocol under discussion can be created.

In general, the scheme proposed by the MG grammars corresponds to the scheme outlined in the proofs of the theorems presented in (Adzhemov S.S, Nikolaev A.V.,(2003)), and grammatical patterns of networks used for the specification of the protocols of the transport and session levels of telematic communication services (T. 70 / 4 and T.62) .This allows you to use the proposed subclass of regular combined MG or its equivalent subclasses of grammar networks for the standard description of a wide class of protocol systems with similar syntactic structure. Herewith:

- The complexity and awkwardness of the use of standard specifications are significantly reduced by using regular grammars and avoidance of duplication grammars, describing the structure of similar data transmission protocols in Grid systems.
- The network structure of syntactic descriptions increases through usability and easiness of modification when changing individual elements of protocols, systems (protocols).
- Effective methods are used for full and part-time parsing regular MG used as basic procedures of developed methods and algorithms for processing and transmission of data in Grid systems (Foster. I., C. Kesselman).
- It becomes possible in some way affect the characteristics of the processing and transmission in a distortion of data in the communication channel and processing varying parameters MG (sets of rules harmonizing grammars), the depth of decomposition of the structure description .
- Formalization within single MG standard descriptions of non-several classes of protocols and protocol systems allows in some cases, repetition-free synthesis of pipelined-parallel procedures for handling heterogeneous data in Grid systems (Atakishchev O. I , (2001)).

Conclusion

In general, to examine the characteristics of grammar networks in problem solving specification data transmission protocols in Grid systems has shown that the MG meets the basic requirements for reference grammar specifications of this class for existing and future Grid system.

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