THE TECHNIQUE FOR DESIGNING OF EFFECTIVE LOGICAL DATABASE STRUCTURES FOR TECHNICAL DIAGNOSTICS SYSTEMS

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Abstract— The article contains an analysis of the efficiency of information processing during technical diagnostics of complex objects computer systems (CS), which is largely determined by the structure of the database system of technical diagnostics. Local databases are functionally complete elements and logical and physical structures to support specific types of databases and operating systems must be designed for them. The logical structure of the local database is based on their synthesis, the efficiency of which is determined by the system-wide criterion for the optimal functioning of the database. In this case the optimal structure of local logical database is designed for the synthesis of the results of the logical structure of the database, the selection of the type and design of the structure of the network directory. Designing is carried out by means of the normalization of the graph of the logical structure of a separate node CS formed as a result of the synthesis of optimal logical database structure and determining in the column disconnected and poorly connected sub graphs which the basis of the logical structure of a local database supported by the DBMS. To confirm the effectiveness of the proposed method the modeling query to the database using the existing and proposed structures of the database is simulated. As a result, the total processing time of requests for the proposed database structure has decreased on average by 15%.

Index Terms— Information Transfer Protocol, Redundancy, System Remote control System, the Communication Channel, Controlled Point.

I. INTRODUCTION

Effective systems of technical diagnostics, performance information exchanges largely determines the optimal construction of their constituent structures of local databases. This paper proposes a formal approach, which allows you to design effective database structure for use in technical diagnostics.

Proposed article approach is based on solving the problem of normalization of the logical structure of the graph, each node of a computer system; determination disconnected and weakly connected components (sub graphs) of the graph of the logical structure of each node, the design of local databases, supported by specific database management system. The simulation showed that the overall query processing time for the proposed structure of the database has decreased on average by 15% compared with the traditional approach to their design.

The efficiency of information processing during technical diagnostics of complex objects computer systems (CS) is largely determined by the structure of the database system of technical diagnosis. Local databases are functionally complete elements and logical and physical structure to support specific types of database management system (DBMS) and operating systems must be designed for them**.** Under optimal logical structure of the local database we mean a variety of types of records placed in the node CS and connected system of address pointers, providing optimum efficiency at the specified criteria, which meet the requirements of users when processing the information.

Designing of optimal logical structures for local databases is based on their synthesis, the efficiency of which is determined by the system-wide criterion for the optimal functioning of the database. In this case optimum local database of logical structure is designed on the basis of the synthesis of the logical structure of the database, selecting the type and structure design of a network directory. Designing is carried out by normalizing the graph of the logical structure of a separate node CS formed as a result of the synthesis of optimal logical database structure and determining DBMS in the column disconnected and poorly connected sub graphs on the basis of the logical structure of a local database supported by specific database management system (DBMS).

According to the known characteristics of optimal logical structure of the database and the network directory the informative statement of the problem is as follows:

H = { h_t }- a plurality of types of records; $\psi^{3n} = \| \psi_{tr}^{3n} \|$ II- Matrix placement record types of nodes CS; $A^{3n} = \| a_{t1t2}^{3n} \|$ - adjacency matrix of semantic types of records; $B^{3n} = \| b_{t1t2}^{3n} \|$ -Matrix types of relationships between the logical records; $N^{3n} = \| n_{ti}^{3n} \|$ - the composition of the matrix record types- You must determine the number of local databases located on each node of the CS and their

logical structure ensuring optimal functioning of the database (in the sense of efficiency criterion optimal logical structure of the database) and satisfying the structural and systemic constraints imposed by specific database management system (DBMS) and operating systems.

To determine the optimum number of local units in the database satisfying it is necessary to solve the problems of the CS of normalization of the graph of the logical structure, r-th node CS determining unbound and weakly connected components (sub graphs) Count of logical structure of the r-th node; designing of local databases supported by specific database management systems (DBMS).

The count of the logical structure of the r-th node is defined as the CS plurality of types of records placed on the r-th node CS, which are interconnected by a plurality of logical connections. On the basis of the information recorded in the online catalog we which characterizes the distribution of the types of records the nodes CS and is formalized in the form of a matrix $\psi^{\text{зп}} = \| \psi_{tr}^{\text{зп}} \|$ We define a subset of the types of records $H_r \subset H$ located on the r-th node of the CS: $\psi^{\text{зп}} = \| \psi_{tr}^{\text{зп}} \|$ On the set of H_r using the information about the relationship between the types of records, we define a matrix $A_r^{\text{зп}} = \| a_{t1t2}^{\text{зп}} \|$ illustrating the relationship between the types of logical records located on the r-th node CS. The matrix $A_r^{\text{зп}}$ is a matrix of semantic adjacency of many types of records and is the starting point for the design of procedures for the logical structures of local database. The matrix $A_r^{\text{зп}}$ is a matrix of semantic adjacency of many types of records and is the starting point for the design of procedures for the logical structures of local database. The set H_r and the matrix $A_r^{\text{зп}}$ determine the logical structure of the graph r-th node CS $G_r^{\text{зп}} = (H_r, R_r^{\text{зп}})$. To determine the sub graphs of the logical structure of the r-th node CS the following problem is solved. Let $H^{(1)}{}_r = \{h_{pr}^1\}$ - many types of entries of the first level of the hierarchy graph $G_r^{\text{зп}}$. The set $H^{(1)}{}_r$ is a minimal set of vertices of $G_r^{\text{зп}}$ from which all the vertices are reachable, i.e it is the base of the graph $G_r^{\text{зп}}$. Let $F(H^{(1)}{}_r)$ - be reachability set base $H^{(1)}{}_r$,then $F(H^{(1)}{}_r) = H_r$ and $\forall H_r^* \subset H_r F(H^*{}_r \neq H_r)$. We define the set of attainability for each type of record sets $H^{(1)}{}_r = \{h_{pr}^1\}$;

$$F(h_{pr}^1) = \{h_{pr}^{(1)}\} \cup \Gamma^1(h_{pr}^{(1)}) \cup \Gamma^2(h_{pr}^{(1)}) \cup ... \cup \Gamma^n(h_{pr}^{(1)})$$

Where $n \leq I_0 - 1$

The analysis of the intersections of two sets of attainability reveals incoherent components (sub graphs) in the column of the logical structure of the r-th node CS. Two sub graph G_{p1} and G_{p2}, graph $G_r^{\text{зп}}$ such as $h_{p1r}^{(1)} \in H_r^{(1)}$ and $h_{p2r}^{(1)} \in H_r^{(1)}$ where $h_{p1r}^{(1)}$ and $h_{p2r}^{(1)}$ - root node of graphs G_{p1} and G_{p1} .They are not connected, if $F(h_{pr}^1) \cap F(h_{p2r}^{(1)}) = 0$.

Many types of records and the relationships between them forming a disconnected sub graph of the logical structure of the r-th node CS entered into a variety used in designing of the logical structure of a local database.

To isolate the unconnected components of the graph following procedure is used:

1. It defines a set of record types of the first level of the hierarchy $H_{ri}^{(1)} = \{h_{pri}^{(1)}\}$ for the i-th connected component of $G_r^{\text{зп}}$.
2. It determines attainable set for each type of record $H_{pri}^{(1)} \in \{h_{ri}^{(1)}\}$

$$F(h_{pri}^1) = \{h_{pri}^{(1)}\} \cup \Gamma^1(h_{pri}^{(1)}) \cup \Gamma^2(h_{pri}^{(1)}) \cup ... \cup \Gamma^n(h_{pri}^{(1)})$$

3. It defines a set of $M^{(p)} = \{m_j^{(p)}\}$ paired intersection of the set of attainability $m_j^{(p)} = F(h_{p1ri}^1) \cap F\{h_{p2ri}^{(1)}\}$
4. The analysis the elements of set $M^{(p)}$. If the set of paired intersections consists of the empty subsets, then go to step 7, otherwise - to step 5.
5. Select a minimum $m^{\min}$ subset $M^{(p)}$, $card(m^{\min}) = \min[card(m_j^{(p)})]$ the elements which make up the set of vertices of allocated sub graph $G_r^{\text{зп}}$.
6. From the set of vertices $G_r^{\text{зп}}$ remove the top of the selected sub graph and communication leading to its root node. Go to step 2.
7. Incoherent components (sub graphs) of the graph obtained by the removal of tops and bonds are added to the set of allocate sub graphs. End of procedure.

There is a need for strongly connected components of handwriting structure of r-th node, i.e. the allocation of logical structures of local sub graphs database is

determined by limitations on the amount of the information stored in the nodes of CS the efficiency requirements for backup and restore the database.

Let the graph G_r^* be unconnected components whose vertices are the root node selected sub graphs and arcs are the connection between them, there is a graph of core or backbone of the logical structure of the graph r-go unit. In order to determine the possibility of cutting of spanning graph to determine the degree of connectivity of its vertices. As the assessment of the coherence peaks of a spanning graph is applied by the cumulative frequency graph arcs spanning queries and adjustments of users.

The decision on the removal of communications and education connected sub graph regarded as the logical structure of the local database is taken by the designer on the basis of information on the composition (types of records) allocated sub graphs and the degree of connectivity vertex spanning graph taking into account peculiarities of the technology and operating experience of local databases of particular node CS.

On the basis of information on the types of records and their relationship defining dedicated sub-boxes the logical structure of the local database is designed. The features and limitations of specific database management system (DBMS) are taken in to account.

CONCLUSION

To confirm the effectiveness of the proposed method query the database using the existing and proposed structures of the database has been simulated, the results of which are shown in the figure. As can be seen from the figure, the total time of processing the request for the proposed database structure is $t_{БД}$ has been decreased by an average of 15%.

Thus, the proposed method makes it possible to design an effective database structure for use in technical diagnostics and reduce the query processing time compared to the conventional one.

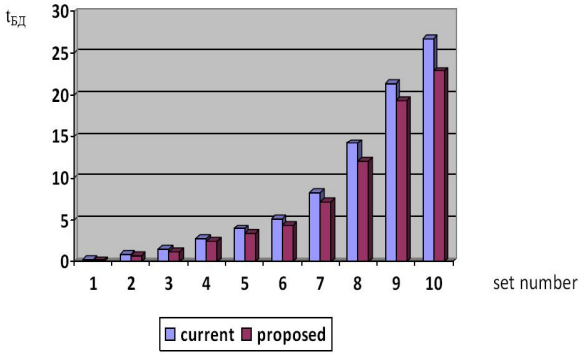


Fig. The effectiveness of a technique of designing the database structure

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