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Evaluation efficiency of database management systems

**Summary:** In this article we approved to using quality models from ISO/IEC 9126 standard (today ISO/IEC 25010) for quality evaluation of relational database management systems (DBMS). We defined attributes for characteristic of efficiency and received some values of measurement for the two DBMS. In paper was showed architecture of created software for attributes measurement based on quality models.

**Keywords:** database management systems, quality models, efficiency, productivity

1. Modern state of relational database management systems

Modern DBMS are highly functional and integrated, also distributed, complex and have some level of productivity. Complexity of DBMS is related to realization of business processes in some subject area. Complexity includes methods to describe different processes as data collection, manipulation, reliability saving and representation different kinds of information. After that, important functions of DBMS are strong management and accuracy of technology process, which display some subject area features.

Today we use many types of DBMS, which display different data models and different schemes for saving data. So today, productivity is one of the most important quality characteristics of DBMS. When we design some type of software, which includes database, we must choose most optimal DBMS. Now we do not have effective formal and universal tools for optimal choose of DBMS. In this article, we propose to use recommendations of international standard organization (ISO) in the field of software quality evaluation and we built quality models, which include designed attributes of productiveness for DBMS.

Evolution of searching solution ways in this field, which answer on some questions about integration data structures for saving them on logical and conceptual level leaded to creating new special type of high performance software as database management systems (DBMS).

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2. Analyze modern DBMS

Modern processes for create software need to use big mass of calculated information which have different kinds and different views. That generates some problems with reliable data saving, effectiveness of receiving data from data source and effectiveness of migration data between more two others software. During the time, mass of an information only increase and we must search solution ways for effectiveness data saving and data processing. As results, we can receive new different data structures, methods and tools, which may use as data storage. Evolution of searching solution ways in this field, which answer on some questions about integration data structures for saving them on logical and conceptual level leaded to creating new special type of high performance software as database management systems (DBMS). In this paper, we considered relational DBMS’s as a main objects of our research.

DBMS include:

* hardware;
* software;
* data;
* procedures – instructions and rules for design and use DB;
* users.

DB users divided on groups:

1. Data administrator. These users carry out functions of data management, DB design and creating some algorithms and procedures for data manipulation etc.

2. DB developers. They create DB and instruction for use it.

3. Applied programmers. These users create and support tools for data access and display data in convenient view for end users.

4. End users.

3. Design quality model of DBMS

Today there are many relational DBMS, which include the same or like functions of these systems. Developers or data administrators have many problems to choose most effective DBMS. Methods and tools, which they can use, are not generally accepted, standardized and each other developers have own vision for priority to choose of DBMS.

Standard ISO 9126 defines three quality models, which represent [1, 2]:

* Quality in use;
* External Quality;
* Internal Quality.

DBMS are special software type. For relational DBMS we built external quality model, which displayed on figure 1.



Figure 1. External quality model for DBMS

Formal record quality in use model for all types of software we taken from [3, 4]:

$Q\_{use}=\left\{H\_{i}^{u},A\_{ij}^{u},C\_{ij}^{u},M\_{ij}^{u}\right\}, i \in N\_{u}, j\in \overbar{1,F\_{i}^{u}}$(1)

where $Q\_{use}$ – quality in use,

$H\_{i}^{u}$ – characteristics of quality model in use,

$A\_{ij}^{u} $– quality attributes;

$C\_{ij}^{u}$ –limitation on the attributes values,

$M\_{ij}^{u}$– quality in use metrics.

For external and internal quality models we taken formal records from [3, 4]

$Q\_{ext}=\left\{H\_{i}^{x},P\_{iK}^{x},A\_{iK}^{x},C\_{iK}^{x},M\_{iK}^{x}\right\}, i \in N\_{x}, j\in \overbar{1,F\_{i}^{x}}$(2)

$Q\_{in}=\left\{H\_{i}^{x},P\_{iK}^{x},A\_{iK}^{y},C\_{iK}^{y},M\_{iK}^{y}\right\}, i \in N\_{x}, j\in \overbar{1,F\_{i}^{y}}$(3)

where $Q\_{ex}$ and $Q\_{in}$– according external and internal quality,

$H\_{i}^{x}$ – characteristics of external and internal quality model,

$P\_{iK}^{x}$ – subchaaracteristics of external and internal quality,

$A\_{iK}^{x} $and $A\_{iK}^{y}$– according external and internal quality attributes,

$C\_{iK}^{x}$ and $C\_{iK}^{y}$ – limitation on the attributes values external and internal quality,

$M\_{iK}^{x}$ and $M\_{iK}^{y}$– according external and internal quality metrics.

We defined attributes of efficiency characteristic of external quality model. On figure 2 displays that attributes.



Figure 2. Detailed external quality model

Some results of evaluation productivity attributes for two DBMS displayed at the tabl. 1 and tabl. 2.

Table 1. Evaluation DBMS on selection

|  |  |  |
| --- | --- | --- |
| Iteration(Number of rows) | Oracle, time of select, ms | MS SQL Server,time of select, ms |
| 1000 | 0,009 | 0,005 |
| 2000 | 0,011 | 0,009 |
| 3000 | 0,008 | 0,008 |
| 4000 | 0,01 | 0,006 |
| 5000 | 0,004 | 0,006 |
| 6000 | 0,007 | 0,005 |
| 7000 | 0,02 | 0,006 |
| 8000 | 0,006 | 0,004 |
| 9000 | 0,007 | 0,009 |
| 10000 | 0,009 | 0,005 |
| Avg | 0,0091 | 0,0063 |

Table 2. Evaluation DBMS on insert

|  |  |  |
| --- | --- | --- |
| Iteration(Number of rows) | Oracle,Time of insert, ms | MS SQL Server, Time of insert, ms |
| 1000 | 0,003 | 0,005 |
| 2000 | 0,006 | 0,003 |
| 3000 | 0,004 | 0,004 |
| 4000 | 0,004 | 0,007 |
| 6000 | 0,002 | 0,008 |
| 7000 | 0,008 | 0,008 |
| 8000 | 0,007 | 0,005 |
| 9000 | 0,008 | 0,003 |
| 10000 | 0,005 | 0,004 |
| Avg | 0,0054 | 0,0051 |

On the figure 3 we show architecture of tool for measurement efficiency (productivity) of DBMS.



Figure 3. Architecture of tool to evaluate efficiency DBMS

CONCLUSION

We proposed method for choice DBMS by the productivity characteristic, which based on standardized quality models of standard ISO/IEC 9126.

In perspective of our research we want to build formal apparatus for optimal choose of DBMS, which will include customer's requirements and will generate some set of optimal solutions.

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