Database Management & Security:
The Development of DBMSs

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This is the __ in a series of articles on database management and security. In this article, we look at the development of databases – even before the development of relational databases – and how they provided a more secure environment for programming and data management in the 1960s and 1970s.

You'll recall how much trouble unstructured collections of individual files can be; databases are collections of files that include self-referential data. Data about the data are called metadata; they can be read and interpreted by the database management system (DBMS) and thus used to communicate with the application programs accessing the data. (Incidentally, I happen to continue using words with “data” as plurals because of my early years of learning Latin, but almost no one else does anymore. You can be perfectly correct nowadays saying “data is” or “metadata is.”)

The data dictionary contains some (not all) of the metadata and defines attributes of all the fields and records, including logical constraints on the data ranges and relationships among the data. Metadata include names, editing constraints such as allowable ranges, and relationships among records such as the number of records that share a common value (called a key). Because the metadata reside with the data instead of inside the compiled programs, maintaining programs becomes vastly simplified. In the same way, the metadata provided documentation about the database, reducing the errors and inconsistencies that are inherent with manually maintained, replicated copies of system documentation.

Metadata extend integration by providing performance-enhancing indexes for common lookups; databases can even store default formatting such as number of visible decimal places in displaying a field, for output such as displays or paper reports.

A curious phrase “a database is a model of a model” expresses the notion that databases do not have to be what is called isomorphic with reality; that is the structure of the database is an abstraction from reality. Indeed, it is a second-order abstraction in the sense that a database designer represents her view of what she understands from interviewing users. Naturally, the users are expressing their perspective on reality. The implication is that a database design should never be viewed as rigidly fixed for all eternity; it is an instantiation of one interpretation of a view of reality.

Another comment is something that I have been teaching for decades: the availability of the tool determines perceptions of what is possible. One of the most striking experiences I ever had as a consultant occurred in the mid-1980s when I was just striking out on my own. I was helping a clothing factory in Montréal to optimize their databases and the head of IT and I were walking through the offices one day when I stopped dead in my tracks. I pointed to an employee at a desk and asked the VP if we could go speak to him. “Hi,” I said, “whatcha doin’?” Well, said employee, he was calculating subtotals based on a report. You see, it was precisely the sight of someone using a calculator with a computer printout that got my curiosity going. “Have you
done this before?” I asked. “Sure,” he said, “every month for the last three years.” “Did you ever ask anybody to put the subtotals into the report for you?” He stared at the VP and me in astonishment and said, “They can DO that?” And this is why I am telling you this story. It seems that nobody had ever walked around finding out what the employees needed or telling them what was possible.

From a security standpoint, the risk of errors resulting from any manual process should raise hackles; that the manual process was being repeated month after month for years was an appalling potential source of data integrity problems.

The lesson, even for security experts, is that we need to use the time-tested technique of MBWA: management by walking around. There is no substitute for contact with reality. All the reports in the world are just hearsay: go out and see for yourself what’s happening in your working environment.

In the next article, we’ll continue exploring DBMSs and look at how Codd’s relational model provided increasing structure for secure data management.

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This series of articles is based on the narrated lecture “Introduction to Database Management System Administration & Security” <http://www.mekabay.com/courses/academic/norwich/msia/index.htm> prepared for the MSIA program <http://www.graduate.norwich.edu/infoassurance/> at Norwich University <http://www.norwich.edu>. You are welcome to download the lecture files at any time.

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