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One example of the use of a database in the modern world is the use of a “rewards program” by a retail businesses like Kohls<sup>®</sup> or Macys<sup>®</sup>. In order for these businesses to run successful rewards programs, they must store various types of information about their mass quantity of customers. For example, a customer may be issued a rewards card upon the inception of their subscription, and that card may be associated with a respective ID number. That ID number, then, becomes a characteristic of that customer. The ID number is in fact data, along with other attributes of that particular ID number like first name, last name, age, zip-code, etc. It can further become information when there is a meaningful correspondence between characteristics, such as a given ID number corresponding to a particular and unique first name, last name, age and zip-code, which then represents the profile of a *customer*. When this happens, these elements can be further interpreted and organized and can therefore represent information instead of simply data, which is considered less meaningful.

This organization of data can have significant implications and can provide tremendous value to businesses. For example, once the characteristics of first name, last name, age, and zip-code can correspond to a specific ID number, one can query the database to determine all the customers with the same zip-code, or all the customers within a given age range. This can then assist the business in it’s marketing efforts by allowing them to gain a better understanding of their market and the types of consumers that shop at their stores. It would simply not be possible to keep track of this information without a database in the modern business world because of the vast majority of consumers and complexity of information today.

Data is in fact meaningless without proper organization and characterization. The “structure” of the data refers to the way data is organized, such as the use of data in objects and arrays in a programming language. An “operation” on the data can also be described as an action performed on the data, such as a query to retrieve information. In addition, there could be certain constraints on a given set of data in the form of a range (e.g.  $1 < x < 10$ ). Here, there are certain limitations of what “x” can and cannot be. The symbol “x” is limited to being greater than one, as well as less than 10. This is one way data (the “x”) can be used in the expression of information ( $1 < x < 10$ ). Further, the above are all ways data can be manipulated in the form of information.

The hierarchical data model, made by IBM, was an improvement from the previous flat file system of data modeling where a “root node” is established and a wave different elements branch off of that root node. Then, a new wave of elements can branch off of the first wave of elements, and so on and so forth much like a “family tree”. There were a few issues associated with this. First, it was possible for

certain elements to repeat, which is inefficient and unfavorable since conciseness is preferred to make things simpler and more efficient. Also, it was difficult to establish a relationship horizontally between elements in the “family tree”, as one would have to navigate from the root node in order to navigate to a different branch. Once the network model was established, the issue of repeating ceased which was an improvement in itself. Despite this, there was still the same issue of navigation as existed with the hierarchical model.

I think the principle of XML is something that is very helpful. The fact that coding can be written in a way to mimic and suggest the same actions being performed in plain English is something that can be of tremendous help to those less familiar with computer science. The biggest issue that stands out to me that may arise if this notion was used as a model for data storage is the fact that there is so much data to be stored, organized, and accessed. Nonetheless, if this is something to be achieved and adopted by many, I think it would better help many everyday people use and understand databases.