Big Data Analysis Improves Efficiency of Manufacturing

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Abstract

In manufacturing and design, the trend of the last several years has been towards Big Data. And Big Data, which includes generation, collection, storage, analysis and query of significantly larger amounts of data, presents new challenges for manufacturers. Firstly, the data being generated must be relevant, it must be the correct data, and it must be useful data. And secondly, the data must be handled properly and efficiently in ways that benefit manufacturers, and must not be allowed to become just something else that bogs us down. Already, many companies collect data for tracking purposes, but few do so for the purposes of improving production and/or processes. And even those who do, do so at great and unnecessary expense with full time analysts who identify patterns and relationships in the data that has been generated. In the ideal scenario, a "perfectly" manufactured assembly, or *ideal* part, and its associated data, is used as a standard to identify and gage patterns in the subsequent data, thereby greatly improving both efficiency and quality.

Introduction to Big Data

"Big Data" is a buzzword that catches people's attention, but behind this exciting phenomenon, there is a simple explanation. In the "old days," most companies selected databases based on their storage capacity; storing and computing large amounts of data came at a premium, both in terms of space and capital. Most companies stored only their most critical data, but today, with storage capacity being much less of a concern, companies can store less traditional, but potentially very valuable data, as well.

Big data techniques are making more and more inroads into manufacturing and are typically comprised of sensing, gauging and/or monitoring data. When this generated data is analyzed against the ideal product data, companies can get a more thorough and insightful understanding of what is actually occurring in their processes and with their final products, which in turn, can be used to improve efficiency, productivity, and quality.

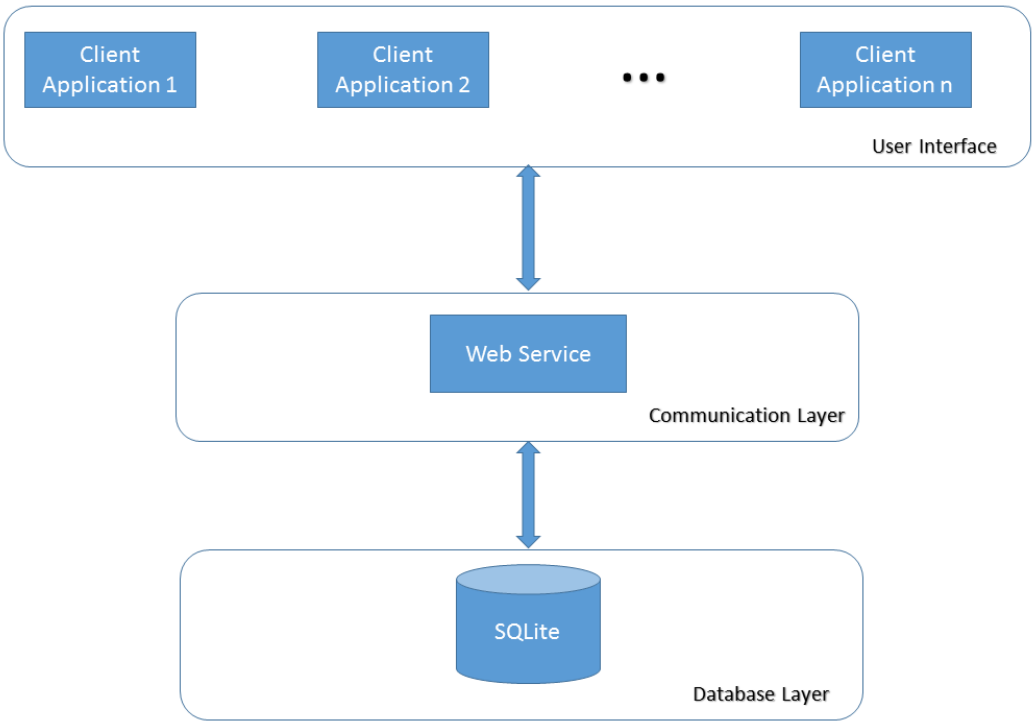
Furthermore, in order to get real business value from your big data, that data must be analyzed appropriately. Promess provides the software that can help you analyze your data efficiently, accurately, and in ways that result in real and measurable gains both for you and for your customers.

Statement of Problem

Identifying the most critical and useful data from increasingly large data pools has become a huge problem. As the amount of collected data has increased overall, the collection of unessential data has increased at an even higher rate. Thus, identifying the correct attributes of the ideal assembly, finding and analyzing the appropriate data, and having the ability to find and analyze patterns and relationships that are present, has become increasingly cumbersome with “big data.” But it is precisely this aspect of big data that most directly has the capacity to improve both efficiency and quality across manufacturing industries.

Database Architecture

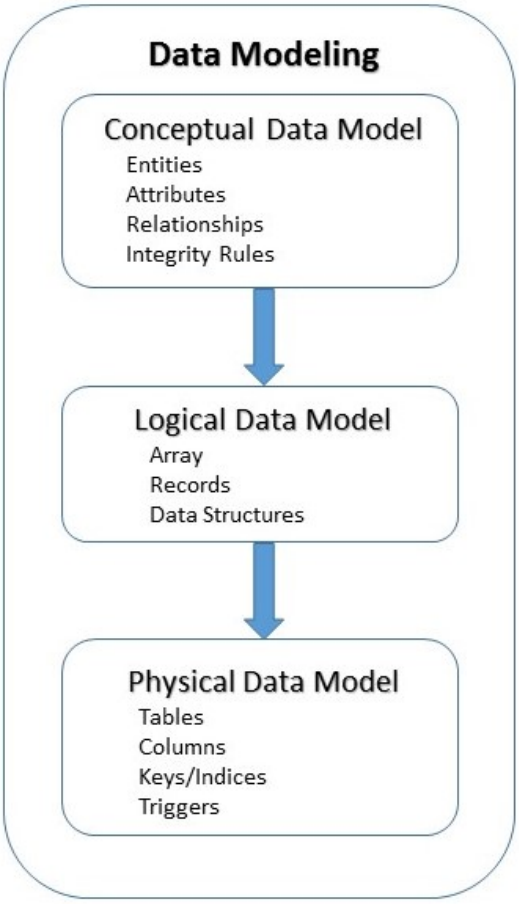
Database architecture is comprised of a model that governs the interaction between the user and database, determines the type of data that is collected and where that data will be stored, as well as the application of that data in the future. To reduce the complexity of the architecture of the data, software architects have come up with the three-tier database architecture. A three-tier architecture is comprised of a user interface, communication, the database layer, and of course, the communication between them. All of these are maintained as independent modules on separate platforms and the communication between the user interface and the database is executed via a web service.



Different client applications store and/or interact with data in the SQLite database via the web service. And since each customer application has its own particular set of

challenges and demands, selecting the correct database is a critical task while modeling the database architecture for any particular organization. One must first assess several things, including: the maximum size of data; the type of database management system that is required; and the flexibility of the database and database engine that will be required to support the application.

SQLite is a relational database management system that works cross-platform. The SQLite database engine does this by using a dynamically linked library, instead of just a stand-alone process, with which the application program communicates in a client-server database management system. Because the need for such a system, and the speed, flexibility, and ease-of-use it provides for our customers, was there, Promess has made it possible for the SQLite database to be used.



Data Acquisition and Filtering

Big data can be created from sources such as fully electric servo-driven assembly presses, or monitoring systems that measure force, torque, flow, and/or pressure. For example, consider a **servo electric press** assembling, monitoring and gauging, a production run of bearing assemblies, which has the potential to produce several gigabytes worth of raw data per day. Much of this data is not critical and can be filtered out. Furthermore, the data collected may be stored in multiple formats: mathematical or analytical functions used in plotting graphs such as for finding minimum, maximum or average; relative or fixed upper and lower limits for analysis may be stored in formats such as XML or as a JSON string, while data points may be stored in other formats to increase speed and performance. As a result, the data collected may not be stored in a format that renders it ready for analysis. Even when data is in an appropriate format for analysis, or has been converted to such a format, the challenge of filtering critical data from among all of the raw data that has been generated, remains. The filtered data must be able to cover a broad spectrum of circumstances, and it must maintain the integrity of the raw data, even after it has been reduced.

Data Modeling, Querying and Analysis

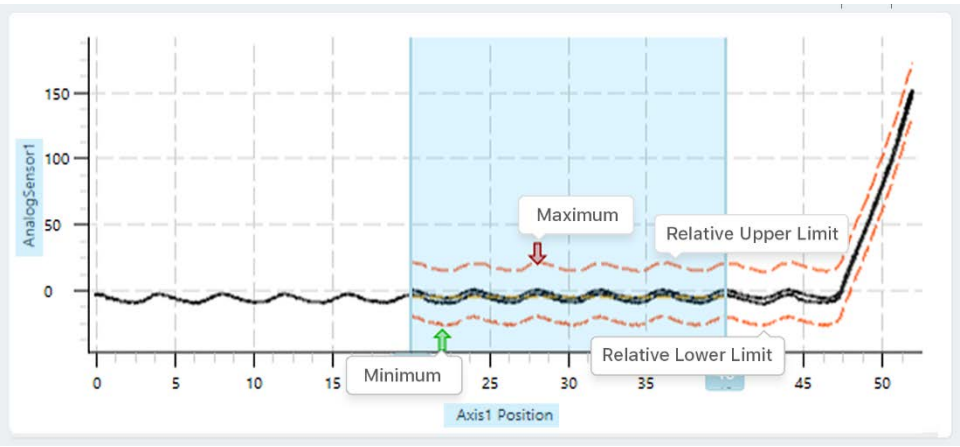
Data Mining is a computational process of finding patterns by discovering trends already present in the data in novel ways such that it becomes useful. This helps to reduce production costs and increases both production and quality. Big Data is sometimes “noisy” and often unreliable, but can be more valuable than smaller data sets because

Big Data makes it possible to identify patterns and correlations. Also, in the event that some of your data turns out to be missing, for whatever reason, then the patterns which have been discovered through the analysis of previous Big Data can be used to help predict and to compensate for the missing data.

In manufacturing industries, monitoring artifacts such as Curve math, X & Y crossing, Dy/Dx functions, Live expressions, and Gauging minimum, maximum and average over the steps and macros are some of the widely used software data analysis functions. Force and position data for each assembly are analyzed and stored for quality assurance purposes. All the data can be collected and plotted in the user interactive graphs.

During data modelling, software engineers have to take into account the frequent queries that may be made by users of the data that is going to be used the most. This helps in guiding which changes should be made in the database, such that the most relevant and frequently used queries are effectively optimized. The speed and performance of the queries are also dependent upon the appropriate database modeling having been used.

Effective Big Data querying is enabling the interactive data analysis with the real-time answers. For example, effective querying may be set up to create a system that stores data in the database and then plots a live graph of force vs position by querying the database. This, in turn, provides instant analysis of that data against pass/fail criteria, to determine whether or not the part was assembled successfully and within tolerance. Querying Big Data must be optimized so that the results available to users is available practically instantaneously. The querying and viewing of the data must also be able to be executed inexpensively and reliably.



Promess makes quality manufacturing and analysis easy by providing software that allows you to query and view your data without compromising speed and performance. Promess helps you in processing and making sense of your data by plotting graphs with various options to cover the various checks required in manufacturing industries.

Effectively managing and processing your Big Data also means having the ability to export your data in different formats and to ensure that your results are secure and reliable.

Conclusion

As Big Data and application technologies evolve and become more established in manufacturing, more sophisticated qualitative analysis will allow industries to grow, to be more productive, and ultimately, to be able to achieve better success in the marketplace, both for themselves and for their customers. The system software collects data and uses it to produce an operational signature of the process, which, in turn is used to directly improve the quality of the product itself.

Undoubtedly, dealing with Big Data is complicated. How effectively you will be able to rise to the challenges that Big Data presents, and how effectively you can use that Big Data to your advantage, while still maintain the highest standards on your production line, will determine whether or not you are among those who succeed and thrive down the road. Big Data may be complicated, but Promess can help make it far less complicated, for you.