

**Important Considerations  
In Evaluating SPC  
Data Management Techniques**

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# Important Considerations In Evaluating SPC Data Management Techniques

## Introduction

During the late 1980's, the personal computer began advancing from infancy into adolescence joining a myriad of computing platforms, development tools and software applications that were proliferating the business landscape. In spite of the promise and excitement ushered in by this extraordinary amount of raw computing power, Information Technology (IT) Departments quickly found themselves inundated with choices. The workplace became preoccupied with concepts such as client/server, downsizing, interoperability, connectivity, open systems, re-engineering, GUIs, and legacy support. Unfortunately, many of the choices were highly incompatible or required extensive IT resources (both manpower and budgetary) to make the technologies work together. To complicate the situation, sometimes individual choices were being made by the end-users themselves. The hunger for business information kept IT overwhelmed with internal application development projects, report requests and technical support challenges. Information could just not be delivered fast enough. The situation would eventually evolve into a time of frustration and disillusionment among users, vendors and IT professionals.

By the early 1990s, Corporate Management began to recognize the importance of information as a strategic resource. It was no longer enough for IT to merely satisfy the organization's processing requirements; information resources had to be harnessed for the business to gain control, manage the impact of rapid technology change and gain a competitive edge. IT thus assumed a new leadership role with responsibility for deploying technological components into a viable networked business environment. Standardization and integration became their guiding principles.

Today, the trend is toward *data warehousing* for storing and sharing corporate information across the enterprise. This approach typically involves a single *relational database management system* (DBMS) as the engine for accessing information contained in the data warehouse. Oracle<sup>®</sup>, Access<sup>®</sup>, SQL Server<sup>®</sup>, Sybase<sup>®</sup> and Informix<sup>®</sup> are just a few of the popular DBMSs chosen for this responsibility. Any third-party software applications implemented within the organization must contain a relational database engine that is compatible with the corporate standard DBMS.

There are obvious advantages to standardization and integration: the single vendor relationship for one, unified IT infrastructures and compatibility across corporate functions (and physical locations) for another. However, since their inception, the relational database management systems that rely on SQL (Structured Query Language) for accessing the data, have failed to live up to the hype with regard to performance. For a truly productive manufacturing setting, there are numerous other drawbacks to the data

warehousing paradigm. Fortunately, there is a more workable solution which is the purpose of this document.

## Presenting Data in Multidimensions

Within any given enterprise there is a distinct collection of business systems that perform various functions such as Customer Relationship Management, Procurement, Accounting, Human Resources, Supply Chain Management, etc. In many of these applications, a standard IT-defined view of the data is practical.

There also exists a number of Engineering types of applications such as CAD/CAM, Process Execution and Control, Industrial Automation and Statistical Process Control (SPC) that require a production-based environment with blazing-fast system performance. Relational database management systems simply cannot deliver the real-time response required by Engineering applications. The tangible business value that these applications contribute to the enterprise with their speed and low maintenance requirements far outweighs the benefits derived from a data warehouse strategy.

A pioneer in the development of real-time SPC software, Zontec recognized the shortcomings of data-warehoused SPC applications many years ago, and has avoided that strategy in all three generations of its software product line. It has instead focused on the best solution for the requirements of the quality management applications rather than being forced into a computing architecture that does not efficiently serve the enterprise. Ironically, in 1998 during the development of Synergy 2000™, Zontec's 32-bit flagship SPC technology, serious consideration *was* given to a database-centric software design. To deliver this type of product, however, would have compromised the company's core values and prevented it from delivering true real-time capabilities.

A more flexible alternative is the multidimensional database approach. Presenting data in multidimensions organizes the information in such a way that allows Operators, Quality Engineers and Managers to "slice and dice" data and to view it from an infinite number of perspectives. For example:

- The ability to query on up to 12 unique sample identifiers, two user notation fields, time and/or date (or any combination of these parameters)
- Instant charting from query results
- Automatic Pareto analysis on corrective actions and operator notations
- Experimentation with varying sample sizes
- Pre-formatted Process Information Reports, monthly, daily and weekly management summary reports as well as reject reports
- Merging of characteristic files
- Temporary withholding of samples from control limit calculations
- The ability to depict multiple control limit calculations on a chart
- A historical view of all samples on a single control chart or any range of data desired by the user

SQL databases, by contrast, don't easily lend themselves to this ad-hoc type of data analysis. Information is highly structured into a simple rows and columns format. With multidimensional databases, users can perform very fast queries on the data file because the data has been consolidated in a format that commonly conforms to the SPC user's data requirements. In effect, users benefit from a specialized *data store* or *data mart* offering quick information displays that are geared to immediate response when process variation occurs on fast-paced manufacturing lines. It extends the very

*"The mandates to grow revenues and get more efficient have shifted the pendulum back from homogeneous, single-vendor environments to one driven by the value offered from best-of-breed solutions. In 2000 and beyond, we will see a proliferation of these types of applications that find creative ways to automate and improve specific processes."*

—Rod Johnson  
AMR Research Inc.

*"Traditional RDBMSs can not adequately handle complex or hybrid data.... The data warehouse is proving to be more complex to manage than originally thought, and it is clear that these solutions do not completely solve users' decision support problems....Users are seeking more powerful, less costly components that efficiently and effectively solve their problems."*

—SPEX, IT Industry Analysts (div. of Meta Group)

usefulness of the data by adding layers of incremental value when it comes to monitoring, reporting, and analysis.

## Is Real Time Being Compromised?

While most SPC application vendors describe their software as “real-time,” all involve some sort of time delay. During data entry or if files are small, the time delay from SPC systems that use relational DBMSs may on the surface appear to be negligible. However, as the SPC file accumulates a larger and larger volume of data, performance becomes slower and slower. This condition can be illustrated simply by generating a chart from a sizeable SPC data file. When the most recent data point is entered, notice how the chart update does not take place in real time.

Only Zontec delivers true, real-time SPC. The moment the user presses the *Enter* key, the SPC calculation takes place, the calculated data is stored on the network server, the chart is instantly updated and the data is available to be shared throughout the enterprise. This technique also guards against accidental data loss if a PC is turned off by mistake or if a network failure occurs.

Another reason relational database implementations are not efficient is because these packages store the raw data without the SPC calculation, and store it independent from the application. Therefore, any time a command is issued, the application must re-calculate the entire data set regardless of how insignificant the command may be. Again, when the file is relatively small—around 50 samples, for instance—performance will be acceptable. When the file grows to thousands of samples, performance degradation will occur. For a true indication of system response, evaluations between software packages should always be made with files containing extremely large file sizes.

Another performance-related issue for SPC applications built with a database engine surrounds the locking and releasing of records when accessed by multiple users simultaneously. Whenever concurrent users issue a database command at the same time, one and only one user is allowed access to the record; all others are shut out which also affects the speed of the system. Ideally, multiple users should be able to enter data, chart, report, monitor the process, perform analyses and accept high speed data from peripheral devices such as CMMs (Coordinate Measurement Machines) or PLCs (Programmable Logic Controllers) at the same time without causing a negative effect on the work of other users.

## IT Maintenance Issues

Perhaps the single most powerful argument against data warehousing of SPC data revolves around the administrative effort involved in managing the database function on a daily basis. The SPC function should be simple to manage and maintain and flexible enough to change with minimal effort by members of the Quality Team. In general, SPC data warehouses require heavy IT involvement in all aspects of the application—so much involvement that a Database Administrator (DBA) must be hired or assigned full-time responsibility for the system. Each part or process must have its own database definition, and typical Quality Assurance personnel will not be familiar enough with database concepts for handling the day-to-day requirements of the system. Similarly, IT staff members are not SPC experts able to apply the appropriate computations to the raw data stored on the database whenever reports are required. Considering the potential number of internal and customer-requested reports, the IT effort could be staggering. Also of concern should be the maintenance and downtime issue for making routine

*...The reality of data warehousing is much more risky and difficult than the promise.... Companies that build a single vast collection of data find these multi-terabyte databases are expensive, difficult to build and maintain, and can quickly overwhelm a company's network and technology infrastructure.*  
—Christopher Koch  
CIO Magazine

### **What Should Companies Look For in an SPC Application?**

1. *Ease of use, ease of maintenance*
2. *Easy data accessibility*
3. *Fast graphics and charting*
4. *Real-time data input*
5. *Support for multiple concurrent users*
6. *Fast and flexible reporting*
7. *Instant charts from query results*
8. *Easy to add, remove, modify process characteristics without Data Base Administrator*
9. *Program functions based on the users' SPC tasks (Operator, Engineer, Manager Levels)*
10. *Ability to interface with multiple databases*
11. *Large data storage capacity: up to 2-billion samples per characteristic*
12. *Analysis using all or partial data file*
13. *Report generation providing daily/weekly/monthly statistics*
14. *Web-enabled reporting*
15. *Plant-wide, company-wide and enterprise-wide monitoring*
16. *Automated real-time data collection from CMMs, PLCs*
17. *Easy to learn—no database expertise required*
18. *No need for a dedicated IT professional*
19. *Built-in data security by user type*
20. *Software that was designed for the application not the data storage requirement*
21. *No annual database license fee*
22. *Low-cost maintenance*
23. *32-bit development platform*
24. *Windows 98/NT/2000 application*
25. *Less than 2MB RAM used*
26. *Data log for user accountability*
27. *Customizable input screens for operators, jobs or processes*
28. *Users trained in less than a day*
29. *Wireless capability*
30. *Web-based application delivery through ASP (Application Service Provider)*
31. *Reports with up to eight charts per page*
32. *Centralized information*
33. *Historical information displayed in charts or spreadsheets*
34. *Copy/paste functions with other Windows applications*
35. *Color-coded process status indicators*
36. *Easy Operator interface*
37. *Ability to establish different sample sizes within a part/process file*
38. *Ability to store attribute and variable data in a single part/process file*

system changes, rebuilding the database, and handling data corruption. Furthermore, it is entirely possible that the entire database could be lost and beyond recovery if corrupted. Formal backup and disaster recovery procedures are, of course, essential IT responsibilities, and necessitate that all users be logged off the system during a restore.

The optimum SPC system should be practically self-supporting. In such a system, installation, setup and configuration can be accomplished by a Network Administrator in as little as half an hour—not hours or days. Once the program is installed, IT support is held to a minimum.

Quality Managers or Quality Engineers assume responsibility for creating the SPC data files, modifying them or making changes “on the fly.” The system will be so easy to use that all types of users, whether Operator, Engineer or Manager, can generate queries and create reports without IT intervention whatsoever.

### **Versioning Support**

The enhancements and additional functionality that come from new software releases brings much excitement and anticipation to data-driven companies. It can also be a company's worst nightmare if application developers and DBMS vendors are not totally in sync: Will the existing SPC application remain intact if a software update is issued to the DBMS? Or is the SPC software developer lagging behind in its support for the newest DBMS release? What is the impact to the SPC application if a company switches DBMS vendors entirely . . . or merges with a company using another DBMS? Compatibility between versions of programs is an important issue when complementary technologies are in for change.

Many SPC vendors store their data within a relational database which may or may not be the same as the corporate standard. They use ODBC (Open Database Connectivity), a Microsoft standard application programming interface for accessing data contained within SQL databases, to achieve corporate compatibility between the two database formats. Several versions of ODBC are currently available which adds yet another level of complexity to the IT infrastructure. If and when compatibility is achieved, ODBC becomes one

more maintenance issue thrown into the IT mix along with additional memory requirements.

## The Bottom Line

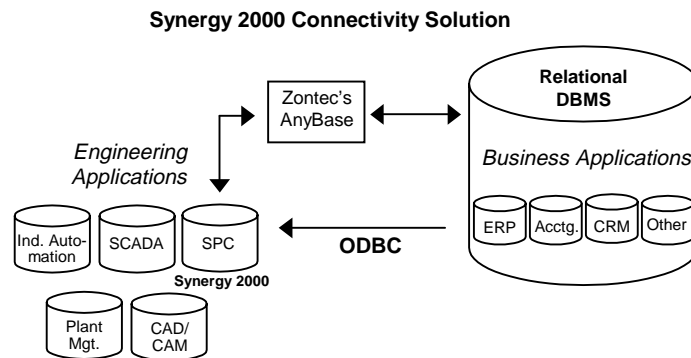
*"The average ROI of an enterprisewide warehouse is 321 percent, compared with 532 percent ROI from a smaller, task-specific data mart."*  
— Jennifer Bresnahan  
CIO Magazine

Financially, the data warehouse approach to SPC is an extremely costly investment. In addition to the cost of the SPC software itself, the DBMS software requires an annual license renewal fee which must be included in the budget. Any projections for SPC cost-savings are soon offset by the total price of the system—especially when IT salaries and administrative costs are tallied. Software packages with a one-time cost are a much wiser use of corporate dollars.

## Conclusion

In spite of its strong view that SPC is not a good relational database software application, Zontec has for years encouraged the sharing of quality management information across enterprise networks. However, its overall solution draws on a solid *interface* . . . not rigid *standardization* and ineffective *integration* of applications and DBMSs. To achieve this goal, Zontec has developed a creative and efficient data warehousing solution for engineering types of applications.

Unlike other vendors, Zontec stores its data within the SPC application itself. If it is necessary to perform SPC on data already stored in a corporate DBMS, Zontec uses ODBC to import that data directly into Synergy 2000. No additional layers of technology are involved. ODBC is a standard feature in Synergy 2000.



For bi-directional communication, an optional Synergy 2000 software module called AnyBase has been designed to communicate transparently with the corporate database as if the data were native to the Synergy 2000 application. With AnyBase, SPC users gain access to and from more than 125 DBMSs. AnyBase offers users the best of all possible worlds: access to DBMS and real-time performance required for mission-critical engineering applications.

In conclusion, nearly 20 years in the quality management industry have given Zontec a unique insight into the production orientation of highly successful manufacturers. It has observed the tremendous lack of speed and power of database-driven SPC systems, and their ultimate failure to sustain engineering requirements. Where relational database SPC implementations are inflexible and soon hit the limits of performance and functionality, Zontec's Synergy 2000 is a dynamic design, exciting to users, and a best-of-breed tool for continuous process improvement.

### **Drawbacks of an SPC Data Warehouse**

1. *Inflexibility of data format*
2. *Performance issues*
3. *Not true real time*
4. *Impossible for multiple concurrent users to access same file*
5. *High maintenance; requires dedicated IT professional*
6. *Potential versioning issues between DBMS and application*
7. *Costly annual DBMS license renewal fee*

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