

Success of a Self-Built SCADA System- Walking Away from the Traditional Approach

Colorado Springs Utilities Gas Department recently replaced an aging, proprietary SCADA system. The system had served them well for a dozen years but was no longer being improved by the vendor. In addition a Year 2000 fix was required to keep the system running into the next century. The proprietary nature of the system also made sharing of data difficult.

CSU began the replacement project using the same processes as had always been used. These included, hiring outside services to develop request for quotation, submitting RFQ to vendors, evaluating proposals, visiting vendors, choosing a system and finalizing a contract. Before the selection process ended, CSU had found a SCADA replacement process that produced a 70% budget reduction and created an environment of teamwork and a level of system expertise that could not have been achieved any other way.

PROJECT HISTORY

In late 1996 CSU Gas received notice that their SCADA system would not be Y2K compliant without a software fix. The vendor had not yet developed the fix but was planning on splitting the cost of the fix between interested customers. This lead CSU to analyze their needs and determine if a new system could be justified.

The CSU system had been in use since 1987 and was a candidate for replacement for several reasons.

First, the proprietary system did not easily share data with other software. The database was not ODBC compliant and no networking protocols were supported. This made the system a stand-alone island of information.

The amount of historical data that the system could retain was small. The system could retain three days of minute data, three months of hour data and three years of daily data. Without the ability to network to another system any data that needed to be kept beyond the specified limits had to be printed and then stored and accessed in hard form.

The system did not support Remote Terminal Units available in 1998. Due to a transition from leased line to radio communications, a replacement of external RTU devices and communication interfaces was going to be necessary before 2000.

The cumulative effect of these factors led department management to approve system replacement with project completion planned for fall of 1999.

Once the project was approved the process of replacement began in the same manner as had always been used to replace systems of this magnitude and importance.

A project engineer was assigned to the project from the System Control section of the Gas Department. The first responsibility of this engineer was to form the project team from members of the System Control group. The project team consisted of five Gas Controllers, the Gas Control Supervisor, the System Control Supervisor, an Engineering Technician and 2 Electronics Specialists.

The team then prepared a Request for Quotation to be issued to consultants interested in preparing a detailed project specification. This project specification would then be packaged as a RFQ to be issued to SCADA system vendors. The process for issuing the first RFQ took about 4 months from inception until proposals were received.

Five consultants responded to the RFQ for preparation of the second RFQ. The bids ranged from a low of \$20,000 to a high of over \$150,000. The three remaining bids were in the \$40,000 range. The low bidder had an advantage because this company had built CSU's existing system. Therefore, less expense was required to learn the basic system needs. The high bidder believed in an extremely detailed analysis of system needs that required large numbers of specialized personnel to accomplish.

The low bid was chosen because the team believed that the chosen company could provide a specification that would meet the needs of CSU. This company had written similar specifications for multiple projects in the preceding year. Also, the team's preliminary analysis of needs and available systems did not uncover any non-standard needs that would require a more specialized specification.

The consultant made a fact finding visit to Colorado Springs during the summer of 1997. This visit included meetings with system users, an overview of existing functions and a road map of future improvements. From this the basic structure of the RFQ was built. Throughout the fall the RFQ was fine-tuned and by December it was ready for issue to interested SCADA vendors.

The RFQ was issued in December of 1997 and was due back to CSU Gas by late March of 1998. A pre-proposal meeting was held for interested bidders in February. Approximately ten vendors came to this meeting. The vendors ranged from traditional gas SCADA vendors to system integrators. They were local and national concerns.

The project team had not pre-qualified bidders. This decision was made because the team felt that they needed to address all possible solutions if the interests of CSU were to be best served.

Five proposals were received for the project. The bids ran from \$400,000 to over \$1,000,000 dollars. Two of the bids were from traditional gas SCADA vendors, two were from system integrators and one came from an integrator who had partnered with a traditional SCADA vendor to implement the vendor's software at a lower price than the vendor could have bid.

A decision was made for three team members to make site visits to two of the vendors. The vendors visited were the traditional SCADA vendors. The team had determined that the integrator bids did not provide savings commensurate with risk associated with the integrator approach.

After the site visits, the best vendor was chosen and preparations were made for contract negotiations. A date in November of 1998 was chosen for contract negotiations.

After nearly 2 years of research and \$30,000 invested in outside services and travel **CSU changed their approach and decided to configure a system using off the shelf software and in house expertise.**

The decision grew from an increasing awareness that evolving technology provided an opportunity to save substantial money while also increasing the level of employee involvement.

An understanding that employees were up to the task also drove the decision. Employees understand computer systems and software to a degree that is greater than their documented experience might indicate. These embedded skills along with the ease of configuration of MS Windows based control software made a strong case for building the system in-house.

Management set December 1, 1998 as the project kick-off date and gave the employee team until April 1, 1999 to prove that the approach would meet the factory acceptance test portion of the specification developed for the original RFQ. By the end of March, the team had built all of the functions necessary to meet the specification. The employee built system failed to meet only one part of the specification. The automatic fail-over required 5 seconds longer than the specified amount of time.

Over the next three months the team improved their previous design and added workstations to the system and by July 1 the employee built system had replaced the old system for all of Gas Control's critical data collection needs. The total cost of the system, including cost of internal labor was \$125,000.

The system continues to function with improvements continuously added by the employee team.

FUNTIONAL COMPARISON of APPROACHES

Generation of RFQ for Outside Services to Generate RFQ for System

The old approach required an RFP to be generated for outside services to generate an RFQ for the actual system. The time requirement to accomplish this starts at 4 months and requires that engineering staff spend many hours performing administrative functions.

Since no outside services are used this step is not necessary under the new approach.

Generation of Specification and RFQ for System

Under the old approach the vendor hired in step one would generate a specification which would be submitted to vendors for bidding. This step required a minimum of 5 months. This included review of the RFQ by the legal staff of CSU to insure that no liability issues would arise from the bid process. Once the RFQ is issued it is very inflexible. Addenda require a good deal of effort to implement and may be costly both in time and additional system cost.

The new approach does not require a formal specification. This does not mean that the approach is unstructured. In place of the structured Specification the project team builds a Requirements list. This list can then be prioritized to build a basic frame for the project. One of the main advantages to this is that it is flexible.

Analysis of Proposals

The traditional approach required that competing proposals be analyzed to determine conformance to the requirements of the RFQ. This is another time intensive administrative task. Because of the high value of the contract care must be taken to document each step in the analysis process lest there be any dispute concerning the final decision.

The new approach to SCADA replacement uses this time to examine and rate basic off the shelf packages for suitability as replacement software. This is hands on analysis using demo versions of the software. All of the off the shelf vendors provide demo versions of their software. The demo's are either I/O or time limited but usually contain all of the functional elements of the purchased version. The provision of functional demonstration systems is rare among the traditional vendors.

Vendor Site Visits

The traditional SCADA vendor installs fewer than 100 systems per year. This small customer base generally requires an out of state visit to at least one site. If the decision is between multiple vendors the team may make more than one trip. Again time and money are burnt on tasks which do not contribute to the quality of the system.

The new SCADA vendors sell thousands of licenses a year. Their customer base is geographically and functionally diverse. This provides the opportunity to visit systems locally and to examine functionality issues from differing perspectives. The intense competition in this field also drives innovation above that found in traditional systems.

Negotiation and Contract Finalization

The traditional approach requires negotiation and contract work. The contracts can be the most complex part of the process. Again legal advice is necessary. Often times outside services are used to aid in negotiation.

With the new approach the system can be configured and built with minimal expense. The system can then be expanded to a final configuration with little risk.

System Installation and Testing

The traditional system is configured at a remote site. The system is assembled at this site and tested. This test requires the attendance of CSU and outside services staff. The system is then disassembled, sent to CSU's control room and reassembled. A second site test, requiring vendor personnel attendance, is then conducted before the system is considered finished.

With a self built system all configuration and testing is done on site. Competing ideas can be tested simultaneously and the best configuration determined. Users make all decisions concerning the configuration of the system. Parallel testing can be set up so that no gap exists between old data and new. For a company with 24-hour shifts, slow overnight and off-season shifts are used to build the system. Employee morale benefits from this. In addition labor that would be O&M becomes capital labor which can be depreciated.

Support Costs

Ongoing support for the traditional system CSU choose cost \$23,000 per year. The total software cost for the off-the-shelf system was \$27,000. Support fee's for this system cost \$3,000 per year.

BUDGET COMPARISON

For Colorado Springs Utilities the traditional approach would have cost \$350,000 in hardware, software and engineering. Outside services added another \$40,000 in cost. Travel by CSU employee's added another \$15,000 to the project. CSU estimated project administration cost at \$35,000. The total cost, assuming no unforeseen cost adders would have been \$440,000.

The system as built cost \$27,000 in vendor software, \$3,000 in additional software, \$20,000 in hardware and \$75,000 in internal labor for a total system cost of \$125,000. In addition the hardware used was better hardware then the vendor had proposed.

70% cost reduction is in itself reason for this approach to be seriously considered by any organization replacing a control system. CSU found an additional benefit in increased employee participation, which lead to an increase in technical expertise and elevated morale and a greater team environment. This benefit exceeded the cost savings.

CONCLUSION

Companies that use large amounts of outside services to replace aging system should begin exploring the possibility of using internal labor and expertise to do the job. For a small investment, evaluations of software can be made and the groundwork can be laid to make a quick and seamless replacement possible.