

SCADA System Upgrades – Managing Expectations

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So, you're going to upgrade your SCADA System. Why is it always so difficult, so time consuming, and so expensive? I believe most of the frustration felt by those responsible for upgrading a SCADA System can be traced back to their unrealistic expectations going into the upgrade. The process of upgrading PC software products, although far from perfect and still a source of problems and aggravation, has raised our expectations about how much work upgrading software ought to be.

To compound the problem further, SCADA Systems are being upgraded more frequently as business needs change. The days of ten to fifteen years between upgrade or replacement are long gone. SCADA System users are now typically upgrading their systems every three to seven years. Rather than occurring once or twice in a career, dealing with SCADA System upgrades is a regular problem.

Think for a minute about just how different SCADA System Software is from PC Software. When was the last time you wrote a specification for a PC spreadsheet or PC word processor program? Just as the specification and selection of a SCADA System is radically different than choosing a shrink-wrapped PC software product, so is the process of upgrading each. Did you require custom features from the software vendor? Although the degree of customization in SCADA Systems has continued to decline as a percentage of the total amount of software delivered, it continues to be significant. Most SCADA System specifications now focus on the custom items and assume a reasonable level of basic SCADA functionality. Each of these custom items adds another issue to deal with when upgrading the system. Did you require a performance test? A SCADA System with serious performance problems can approach uselessness. This is rarely the case with PC Software products. Even if the PC Software runs too slowly for a particular user, upgrading the hardware is easy and cheap enough that the pain is tolerable. Major hardware upgrades in a SCADA System are not easy or cheap, so it is much more important to get a System that has adequate hardware capabilities up front. Since performance is often a major driver in the next upgrade, the performance test should be used to ensure the system has adequate capacity for expected growth for a reasonable period. Did you require an acceptance test prior to using the software? Acceptance testing is a critical component of purchasing a new, or upgrading an existing, SCADA System to ensure all areas of the specification have been met. Acceptance testing is rare in shrink-wrapped PC software products. Did you prepare detailed cut-over procedures to ensure minimal downtime? Winning dispatcher confidence and minimizing downtime are critical in moving to an upgraded SCADA System. The option of de-installing the upgrade if it doesn't work well is not really an option so more planning is required to ensure an orderly transition.

It is just not reasonable to expect a SCADA System Software upgrade to be comparable to upgrading off-the-shelf software. The cost of developing any software, and particularly a SCADA System, is very high. SCADA System software must be very high performance to run on reasonably priced computers and also very reliable to maintain the required availability. Due to the low volume of SCADA Systems sold each year, there is a real limit to how much product development will occur. We once estimated what it would take for a particular SCADA vendor to make the initial installation of the baseline product on a new system about as easy as installing shrink-wrapped PC software. To implement the improvement would have increased the price of each SCADA System by an average of about \$100,000. The project was not approved because few users would be willing to pay the extra amount for an easier installation. Making the process of upgrading a SCADA System that much easier is even more complex and difficult than making the initial installation easier. Thus, the resulting price increase would be even greater. SCADA vendors realize that their customers must focus on the functions and capabilities needed to accomplish their business goals and will not spend a lot extra for things that are not essential.

SCADA System Software vs. PC Software		
	SCADA System Software	Software PC
Volume Sales	Very Low	Very High
Cost	Very High	Very Low
Per Unit Cost as % of Sales	High	Low
Performance	High And Consistent	Not Much Of an Issue
“Product” Condition	Not Really a “Product”	Very Standard Product
Reliability	Very High – 24x365	Moderate
Degree Of Customization	Considerable	None

As you can see, these two types of software are radically different. It is critical that you educate all involved parties regarding just how different the process of upgrading SCADA System Software is in order to keep their expectations reasonable. The success or failure of your upgrade will be judged primarily on how well you meet your internal customers’ expectations. By managing these expectations at every stage of the upgrade process, your chance of success rises dramatically.

STEPS FOR UPGRADING A SCADA SYSTEM

1. Identify the need for a upgrade.
 - a. Performance no longer adequate.
As the system grows, point counts, number of users, and increased application programs take their toll on the system performance. Capacity planning and growth projections can help prevent this from happening too frequently.

- b. No room for additional data points.
SCADA System Software limitations or RAM and disk limitations can put a ceiling on the size of the database. Your users will get very impatient if they can't add the points they think they need.
 - c. Too expensive or not possible to export data to external users.
As most of you well know by now, many existing SCADA Systems are rather poor at making data available to the rest of the business. Business users continue to find new uses for SCADA data and are demanding links to access this data in a convenient manner. Upgrading the SCADA System is often the best way of providing the required data transfer capability.
 - d. Implement higher level applications to add extra value.
SCADA System users are being called upon to run the utility better and better with smaller staffs. This often leads to increased automation and higher level applications. The higher level applications require good access to the SCADA data and plenty of computer power to produce results.
 - e. Hardware unreliable and/or too expensive to maintain.
As the SCADA System hardware ages, its reliability declines and maintenance costs increase. The reduced hardware maintenance costs can provide extra funding to finance the upgrade.
 - f. Software no longer supported.
At some point the vendors of the Operating System and SCADA System Software will cease support for the System, either by choice or because they just don't have the people who still know how to work on that version. Once this occurs, you are more vulnerable to the impact of system problems.
 - g. New SCADA system capabilities.
SCADA System vendors are always busy adding capabilities to improve their product. These capabilities can often be of great benefit to the SCADA System user and upgrading the system is often a better method of getting these features than implementing them piecemeal.
2. Determine scope of work.
This is one of the most important steps of the whole upgrade process. A good, well-defined scope will help guide every other step of the upgrade.
 3. Write specification.
The specification will give the vendor and your staff the details necessary to produce the desired upgrade. Preparing the specification will also be a great learning tool for your company because it will force people to decide many issues.

4. Get budgetary price from vendor.
The moment of truth – Did you specify more than your budget could possibly handle or is it within bounds? Working with the vendor can help you identify any areas that are particularly expensive.
5. Revise specification.
Update your specification based on the vendor’s budgetary price and technical evaluation of your specification.
6. Get internal budget approved for project.
This is often the most difficult part of the whole project. Making a business case for the need to upgrade a SCADA System can be quite difficult.
7. Get fixed price bid from the vendor.
Now is the time to get the vendor to commit to a fixed price for the scope of work as defined in the specification.
8. Issue purchase order and sign contract.
Assuming the price and terms and conditions come back reasonably close to what was expected, the purchase order and contract can be executed.
9. Work with vendor during upgrade project.
 - a. Status reports and project meetings.
To help keep things on track, periodic status reports should be issued by the vendor detailing the progress of the project. These reports should be reviewed diligently and any concerns addressed promptly. Periodic face-to-face meetings should also be held to ensure adequate progress is being made and that the work is in line with the specification. Both you and the vendor will benefit by identifying problems as early as possible.
 - b. Details about the system.
Be prepared to supply the vendor with any and all details about your system that will aid in their work. It may seem reasonable to expect the vendor to know everything about your system since they produced it, but it rarely works this way in the real world. Your system was put together by a small team of people several years ago. No one from this team will likely be working on your upgrade so you might as well accept that they will need you to bring them up to speed on your particular installation.
 - c. Database contents.
The SCADA System vendor will most likely be able to port your database to the upgraded system without much trouble. Be sure to keep a log of all database changes made between the time of sending a copy of the database to the vendor and the cut-over. You will need to re-enter these once the new system is up and running.

- d. Display formats.
This depends so much on how much the vendor has changed its HMI. Most likely the display formats will either move over as easily as the database or not at all. Plan on rebuilding all your displays from scratch if a new HMI is used in the upgraded system.
 - e. May send some non-essential equipment to be used by vendor.
To keep the cost of the upgrade down, it may be worthwhile to send the vendor some non-essential pieces of your existing system to develop the upgrade at the vendor's office.
10. Factory Acceptance Test (FAT).
A FAT document should be prepared and executed at the vendor's office to ensure the system meets the specification prior to shipping it to site. The vendor will have a much easier time fixing problems at its office and Dispatchers can lose confidence in a system if it arrives with too many problems. The system should pass FAT and all discrepancies should be fixed prior to shipment to site.
 11. Site Acceptance Test (SAT).
A SAT document should be prepared and executed after the system has been installed at your site. Remember, a lot of changes have happened to the SCADA System Software since your last system was installed. Test all functionality you depend on for your operations.
 12. Cut-over.
A cut-over document should be prepared and executed after the system has passed the SAT. Having a written plan will help to ensure adequate thought and planning has occurred to ensure an orderly transition.

Upgrading a SCADA System is often just as much work as purchasing a whole new one. By accepting this up front, the SCADA System user can prevent a lot of disappointment and frustration that will otherwise accompany the upgrade.

During the upgrade you will most likely confront a number of issues that make you question the SCADA System Vendor's motives. Common SCADA System upgrade pitfalls that really irritate:

- Hardware requirements for the new version are so much bigger, or different, that most or all of the existing hardware is obsolete. CPU, RAM, and disk requirements are often 100% or more higher in the new version. This is particularly irksome when the existing hardware is only three to five years old.
- Features that were in the previous baseline product are no longer in the current baseline. The SCADA vendors regularly find themselves in the position of not carrying all existing functionality into the next version of the software because some

change to the system requires rewriting another area. They will typically analyze which functions are important enough to rewrite and let the others lapse.

- Paying again to have custom features implemented in the upgraded system. Most custom features do not make it back into the baseline product or, if they do, are implemented differently to be more generic. Carefully review your current custom features that are not in the new baseline and decide if you really need them now. Sometimes users find the feature was not as useful as expected or a new baseline feature allows the same function to be accomplished without the custom feature.
- Determining for sure what features are in the current system and which of these were baseline and which were custom. Few, if any, SCADA vendors maintain good documentation about what custom changes were done for your system. This typically requires a software engineer to log into your system and review it in a fair amount of detail.
- Determining for sure what features are in the current baseline offering. SCADA vendors are also not very good about keeping records on exactly what features and capabilities are in each version of their software. Thus, determining what is new and what is gone is time consuming and you cannot be certain of finding everything.
- Rebuilding all your displays to support a new HMI. Most users have a large investment in their SCADA displays. They are time consuming to build and must be checked rigorously to ensure each dynamic field is connected to the correct database record and field.
- Rebuilding all your reports to support a new Report Generator. Many users also have numerous reports configured, some of which can be quite complex. Rebuilding these reports to use a new reporting mechanism takes time and often a certain amount of programming skill. Then each report must be tested to ensure correct results.
- Dispatcher training. A significant change in the HMI or system features may require your dispatchers to be retrained. New procedures may need to be developed to be consistent with the new system.
- Getting and keeping dispatcher support. Dispatchers, like many people, often resist change and may not want to be bothered with learning a new system. Keeping the dispatchers satisfied will do wonders for a smooth implementation.
- New operating system. If a new operating system is part of the upgrade, then your system administration people will also be affected. They will need to be trained in how to work with the new operating system and it will take awhile for them to become proficient with it.

KEY POINTS TO HELP ENSURE A SUCCESSFUL SCADA SYSTEM UPGRADE

- Be vigilant in monitoring the current state and capacity of your SCADA System. Hasty upgrades increase the risk and problems significantly. You want to be able to recognize the need for an upgrade in time to execute the upgrade in an orderly fashion.
- Don't be the first to upgrade from your current version to the vendor's current baseline. If at all possible, let someone else be the pioneer. The vendor will learn from the first few and you can gather good information from those who have preceded you.
- Determine early in the process how much of the upgrade work your company is able and willing to perform based on available time and expertise. This varies a lot from company to company. Some want a real turn-key project and are willing to pay for the vendor to do all the work. Others, to reduce the cost or to control the process more completely, accept the responsibility to do some of the work necessary for the upgrade. The important point is to decide what level you are comfortable with and ensure the contract sets the responsibilities for all parties accordingly.
- Have a contingency fund to cover unexpected items without having to go back for more money just when you have other problems. No one can foresee all the issues that will arise in an effort of this magnitude. Having a bit set aside for such issues can do wonders for keeping the project on track and the vendor relationship in good shape.
- Treat the process pretty much like purchasing a new system. The chance of success will be greater if all involved understand the magnitude and difficulty of the task at hand and have it actually turn out easier than expected.