Raising the Bar on Scalability

by Phil Couling, Product Marketing Director, Supervisory HMI & SCADA

Executive summary

Automation and information systems represent a major investment for industrial businesses, both large and small. Long-term protection of that investment should be a significant consideration when selecting a partner and a system.

Scalability on all levels is key to the true value and longevity of a SCADA solution. It is extremely important to be able to evolve solutions over time, expand them into previously unforeseen areas, and integrate them with other systems which may or may not already be in place.

Combining a truly scalable implementation with ease-of-use and outstanding functionality and connectivity will provide for a sound supervisory software solution and real investment protection for the future.

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Introduction

The term “scalability” has been so overused in regard to industrial software systems that most users, integrators and decision makers are completely desensitized to its use. Those same individuals, however, care deeply about true scalability. Scalability is not merely starting small and growing big. There are many dimensions to consider and most are critical to true investment protection for the end user. This white paper will explore these dimensions of scalability and hopefully set a new expectation for scalability for industrial software system purchasing decisions in the future by “raising the bar” on scalability.

The Challenge

Automation and information systems represent a major investment for all industrial businesses, large or small. Long-term protection of that investment is a significant consideration when selecting a partner and a system. Though technology lifecycles may precipitate change, it is extremely important to be able to evolve solutions over time, expand them into previously unforeseen areas, and integrate them with other systems which may or may not already be in place. In many cases, it is also important to consider the ramifications of potential merger or acquisition activity, and how systems may be affected by that eventuality. All the while, businesses must stay focused on protecting intellectual property, minimizing disruption to operations and doing so cost effectively. These requirements match system characteristics along dimensions of scalability, from small to large, one to many, current to future, simple to complex, single piece of equipment to entire enterprise. Meeting those requirements demands a level of architectural design of automation and information systems that is purposefully constructed to support scalability in all dimensions. Those kinds of demands cannot be met by “bolting on” interfaces, repeating expensive design work or rip-and-replace tactics. The result would be inadequate and unbearably costly.

To meet that challenge, requires a software architecture designed to be inherently scalable in all meaningful dimensions.

Functional Scalability

Traditional small projects involve low initial cost, low risk and short implementation time, which are all important characteristics. However, many small projects are difficult to functionally extend and very difficult to scale. In contrast, traditional large projects are more functionally complete and enjoy full-scale implementation, but they have much higher initial costs, require much longer implementation time and carry much higher risk. What is needed, is the ability to start with a small implementation and grow to the size needed, when needed, with modest incremental effort and without increased risk. Traditionally, the underlying software platform has been an enormous constraint; small systems simply have not been designed to grow into large systems without completely replacing the underlying architecture (see Figure 1, page 2). A truly scalable software platform, one explicitly designed with scalability in mind, effectively removes these constraints and enables a smooth evolution of the software solution from small to as large as the business requires, without replacing the underlying technology. A proven way to solve this scalability issue is to build the system around a plant model, which supports the gradual evolution of an application by permitting additional attributes and functionality to be added to the solution and deployed throughout the operation from any given development station.

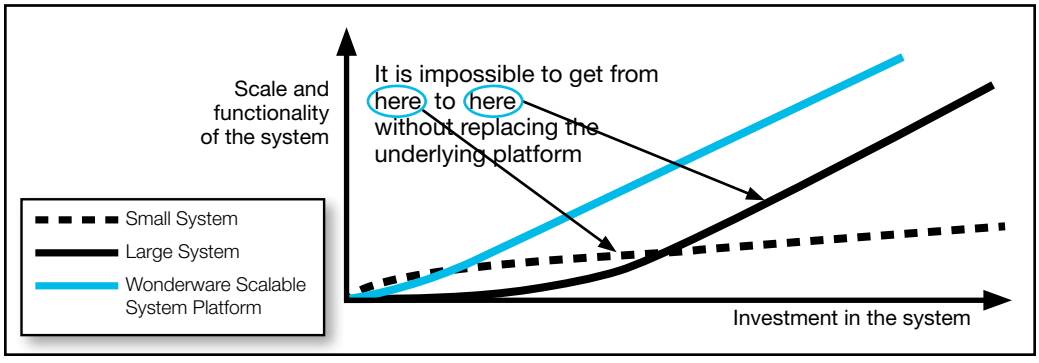

Figure 1
The Challenge of Functional Scalability

Solution Scalability

Growing a system from small to large requires another dimension of scalability in addition to functionality. True scalability demands that a solution can be easily extended from a single, simple application, perhaps a single machine, to a comprehensive networked solution serving the needs of an entire multi-plant industrial enterprise. Consider the common requirement to have multiple HMI or SCADA applications that are different but have similar components, which must be kept separate but benefit from each other's design and standards. Also, consider the requirement for those applications must be able to operate, evolve and grow independently. This is a typical real-world scenario which requires an underlying system architecture to support such evolution. Such an architecture needs to combine powerful object-oriented modeling capabilities, integrated and equally powerful graphical HMI and visualization capabilities as well as comprehensive device integration capabilities. As someone responsible for such a system, you would want maximum re-use of engineering effort where appropriate, with flexibility where required; common application logic with device-independence; consistent application visualization with standardization, security and application-specific detail; all of which can be deployed and managed from a centralized, standards-based environment.

Vertical Scalability

An HMI or SCADA supervisory system is just one part of an industrial operation, albeit a significant one. In the same way that each department in an organization needs to integrate and collaborate smoothly, supervisory systems need to integrate and enable collaboration with other systems in an industrial enterprise. Effective industrial software solutions must be capable of efficient, scalable integration with enterprise-level systems such as ERP, Supply Chain Automation, Enterprise Asset Management and other corporate systems for planning and reconciliation. To satisfy this important vertical integration need requires purposeful architectural design, and great support for standards such as XML, OPC® and SQL complemented with Web Services and ISA-95/XML B2MML support (see Figure 2).

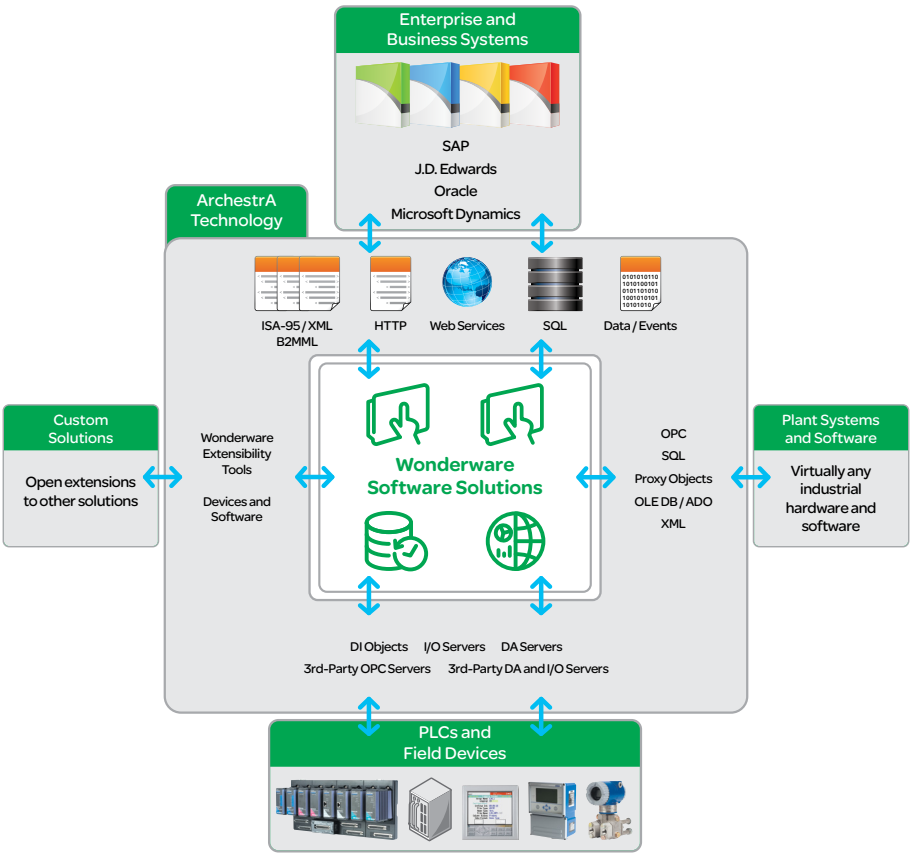

Figure 2

Overview of a Scalable Connectivity and Software Integration Architecture

Vertical scalability also means scaling to the plethora of field device connectivity requirements that exist today. While some SCADA and HMI supervisory systems may provide direct interfaces to physical devices such as RTUs and PLCs, these interfaces are typically simplistic and foster integration solutions which are too closely tied to the physical hardware; that simplistic builds limitations and constraints into the implementation. To achieve true scalability for device connectivity, a software architecture that provides a level of abstraction from the specific devices is required. What does this mean in practice? Well, it means for example, that a device independent application could be developed for a project using one specific family of PLCs, and making use of all of the connectivity capabilities provided by that device. This first step matches the benefits of the direct approach. However, real benefit becomes apparent when it becomes necessary to automate a similar area at a facility — one that was built at a different time and uses a completely different family of PLCs and automation equipment. With a robust and well-designed device integration architecture and software, the application can be easily re-purposed for a different family of hardware devices without incurring the engineering expense of changing the application. Multiply that efficiency over many pieces of equipment and many different hardware systems, and the result is a truly scalable software solution.
Of course, implementing the application is just part of the effort. For effective scalability, it is necessary to be able to configure, monitor and run diagnostics on multiple I/O interfaces from a convenient central location. Consequently, such an architecture requires comprehensive remote management capabilities, built-in diagnostics and the flexibility to deploy in a variety of architectural topologies to suit the needs of the industrial enterprise — the hallmarks of a truly scalable infrastructure.

A truly scalable approach separates application code from device communications management, so both can be easily managed and updated:

- Takes a flat communications model and adds structure and better manageability
- Makes individual communication paths available globally for any application to use
- Enables communications and device naming to be different for the same application, facilitating re-use on any machine

Horizontal Scalability

Supervisory, HMI and SCADA systems do not operate in isolation. They need to integrate smoothly and reliably with a wide range of peer-level systems including MES, DCS, Historians, LIMS, Workflow, Field Mobility Solutions and Quality Management systems. Historically, the solution to these kinds of integration challenges has consisted of crude interfaces using proprietary interfaces, middleware and limited data-level integration. These approaches, while barely satisfactory for standalone solutions, are the antithesis of scalability, and require custom engineering approaches and significant expenditure for system integration work. A truly scalable solution for horizontal integration of this kind requires an architecture designed with scalability and integration capabilities built-in (see Figure 2). Embracing standards such as OPC, SQL, OLE DB/ADO and XML with an object-oriented architecture delivers the most easily scalable industrial software solution set available.

“Baked-in” Scalability

Traditionally, scalability cannot be added into operational systems after the fact. True scalability comes from purposeful design. Legacy systems can be integrated into a scalable infrastructure, but the real benefits come from starting with the right software platform. A truly scalable platform must be developed from the ground up to provide ease-of-use on day one, and scalability for the lifetime of the operation. This “baked-in” scalability comes from a powerful, pragmatic, object-based engineering environment that enables valuable engineering and best practices to be re-used and securely deployed across multiple facilities, without physically visiting each facility. This scalability also comes in the form of centralized management, which permits oversight, configuration, diagnostic analysis, and security management of entire automation systems deployed across numerous computers that are geographically distributed across a multi-site industrial enterprise. Training, skills and familiarity with automation systems

in one area of operation are immediately transferable to different areas. This kind of scalability delivers tremendous economies of scale as automation solutions are rolled out to new areas of the operation. A unique, logical abstraction of details, through a model view versus a deployment view (see Figure 3) provides unsurpassed capabilities to retain and re-use engineering efforts put into a system, while increasing application functionality, one step at a time.

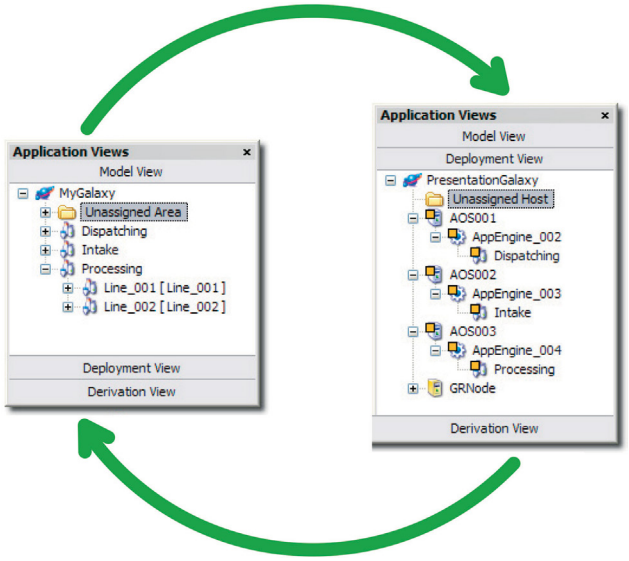

Figure 3
Model View and Deployment View

Summary

Functionality, ease-of-use and scalability are the most important characteristics of any HMI or SCADA solution. It is these characteristics, which provide real investment protection for the future.

Wonderware software's scalable design and easy-to-use tools uniquely embody these characteristics — specifically, the powerful Wonderware System Platform and InTouch visualization tools. With the broadest range of integration options, powerful MES, workflow and mobile solutions, Wonderware has set a new benchmark for combining the deepest functionality with ease-of-use unparalleled True Scalability.

To learn more about Wonderware's Supervisory HMI Software Solutions, visit http://global.wonderware.com/EN/Pages/WonderwareHMISCADA.aspx.

About the author

Phil Couling has over 30 years of experience working with industrial computers, software and technology. From designing industrial software systems, to writing code for them, advising on strategic uses of them and evangelizing them, Phil has worked as an engineer, consultant and marketer for some of the most influential companies in industrial automation and control: Siemens, Logica, Westinghouse, Honeywell and Microsoft. Since 2006, he has led Global Marketing for Wonderware Supervisory HMI software as part of Invensys and now Schneider Electric.

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