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Emerging technologies and processes take project execution off the critical path

Engineering in the Cloud, standardized processes, automated data management, smart input/output (I/O) systems and soft marshalling are helping decouple hardware and software engineering activities. These processes lead to faster startups, while decreasing complexity, increasing predictability and taking project execution off the schedule's critical path.

Engineering in the Cloud. Virtualization, emulation and simulation, together with cloud computing, are among the emerging technologies being utilized.

Virtualization, emulation and simulation can be used to enable application software testing to be conducted in a Cloud environment without requiring the hardware. This approach removes the cost and time associated with coupling simulated I/O for functional testing of the application software. Testing application software in the Cloud allows hardware to be shipped to the site much earlier, which leads to an expedited completion of installation and field loop verification.

With emulation and simulation, Cloud computing can be used to apply engineering support tools to perform automatic testing and documentation. Using proprietary application software, testing tools allow for broader and more comprehensive coverage of testing activities than can normally be achieved, given today's financial and time/budget constraints.

Cloud computing also paves the way for "virtual commissioning" using pro-

cess models, which can significantly boost the value of functional testing by providing more realistic feedback. This approach results in fewer required changes and modifications onsite during commissioning.

Standardized processes. Through increased familiarization and reducing the need for training with respect to bespoke project-specific designs, standardization is one of the biggest factors in driving down costs and reducing time spent during the design phase.

Cloud computing is used to make standard designs, engineering workflows, methodologies, lessons learned and engineering support tools accessible to all project execution groups. It can also collect reusable artifacts and turn them into design standards, leading to the development of a common approach to automation engineering across all projects.

Major large-scale projects involve several engineering, procurement and construction (EPC) contractors, often located in a different countries, who must work to a common set of design requirements and objectives. ABB has many globally based project delivery centers, and Cloud computing allows the company to provide a sole project engineering entity that works from a single engineering database and a set of common standardized designs. The advantage is the ability to interface with the various EPC contractors in the local language.

Automated data management. Cloud computing is used to transfer engineering data and auto-generate application software and project-specific documentation.

The workflow manager tool, for example, is used to facilitate the management of the overall project engineering workflow. This allows the project manager to efficiently deal with inevitable change requests, such as modifications to the customer-supplied data. The tool electronically tracks project progress and uses that status to ensure that the right people in the engineering process are quickly informed of any changes, and are immediately linked to the data that has changed. The tool can also assist in quicker turnaround times for determining the impact that the change requests have on the overall completion cost and the delivery schedule.

Using auto-code generation is not only quicker, but it also reduces systematic errors caused by "humans in the loop," which means it reduces the cost and time spent during testing. This turns "ordinary" software testing into virtual software commissioning using realistic process models as feedback. This leads to reduced cost and time associated with hardware manufacture and build.

Soft marshalling. Soft marshalling enables software engineering to be decoupled from hardware engineering. This decoupling allows hardware and software engineering activities to run in parallel,

which results in a shortened project execution schedule and reduced project cost and delivery times. This means that future projects can start and finish more quickly.

Soft marshalling eliminates the need for project-specific junction boxes, armored multi-core field cables and marshalling cabinets. Traditionally, hardware engineering such as field cabling design, and software engineering like I/O allocation, were inextricably linked and resulted in a serial, task-orientated project workflow. Expensive junction boxes and cabinets were required to marshal I/O signals in multi-core cables towards a particular programmable controller I/O system. These, in turn, required fusing, signal conditioning using external equipment, and cross-wiring to designated I/O modules before being coupled to a particular programmable controller.

Serial workflow is the result of hardware engineering associated with field junction box and multi-core cabling design having to be completed before the software engineering task of I/O allocation. Often, several iterations of this serial execution are required before all project I/O has been addressed. Each iteration adds cost to the project and time to the schedule.

Now, with software marshalling, additional signals and changes to signal types (e.g., from digital to analog) can be accommodated far more easily with less cost and schedule impact than with a traditional approach.

Hardware can be delivered to site much earlier than conventional project execution methods. Application software and hardware are plugged together using signal names (tags) much later in the project lifecycle. Application software can be tested without the hardware in an engineering Cloud, using virtualization, emulation and simulation. This means that plugging together can take place even later in the project lifecycle. As such, application software engineering—including design, implementation and testing—can be completed in parallel with the site activities associated with hardware delivery. Once the application software is fully tested and the hardware has been installed and fully tested on-site, they can be plugged together to allow commissioning to start.

Flexible I/O. One way to dramatically reduce cost and time implications is to make more use of I/O interfaces that are based on fieldbus or industrial Ethernet. Hardware is then significantly reduced and greatly simplified compared to conventional I/O. The I/O signals effectively become marshalled in the software.

The benefits of soft marshalling can be applied to all I/O signal types encountered by a typical automation system used in the oil, gas and chemical industries.

The I/O signals coming from FOUNDATION Fieldbus (FF) devices connected via FF high-speed Ethernet (HSE), third-party process packages and

from LV, MV and HV electrical equipment, as well as I/O signals coming from 0/4.20 mA analog and 24 VDC binary field devices, can be soft-marshalled to multiple programmable controllers via an industrial Ethernet I/O network.

This flexible I/O approach provides I/O for local and remote I/O installations to reduce installation costs, smart devices using fieldbus technologies for improved diagnostic monitoring and access, and redundant Ethernet-based, single-channel I/O, called Select I/O, that changes the way projects have been done for 30 yr using concepts like soft marshalling.

Standard junction boxes containing smart configurable I/O become smart junction boxes. These can be procured from stock and installed in any convenient location. Field devices are simply cabled to the nearest smart junction box. The I/O loops are quickly and efficiently tested and verified by taking advantage of digital communication technologies, such as HART. **HP**



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