

## New Automation Approach for Manufacturing and Process Industries

### Integrated solution with an Open Source Construction Kit

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*“What do Twitter, Amazon, Google, Facebook, Walmart or Ford have in common?” This question is asked by Helmut Martin-Jung in the Süddeutsche Zeitung<sup>1</sup> and answered immediately: “They rely on open source software. Open source, that's what you call programs whose original code everyone can see. This openness has long been established in many important areas compared to proprietary software.”*

Even in security-critical areas such as the banking industry, open source systems have long been successfully introduced. The pioneers in terms of high availability and virtualization are not found in the automation industry but in the banking sector. By contrast, automation companies and plant operators have so far failed to participate in the developments there and to benefit from them.

Against this background, it is not only the permanent cost pressure that makes it sensible to familiarize

<sup>1</sup> Süddeutsche Zeitung of 2016/04/07

yourself with the new possibilities of automating systems and facilities based on the ProviewR<sup>2</sup> open source process control system software. Merging established open source projects from the areas of virtualization, high availability, cyber security, performance monitoring and data security with the free and open control system software leads to an Open Source Automation Toolkit, with which you can implement system solutions that are clearly superior and whose future viability can be set much better than for proprietary systems, as each of these modular components continues to develop unabated and independent of the market decisions of individual companies. The motto in the world of open

<sup>2</sup> The ProviewR process control system was developed at the end of 1985 by the Swedish steel company SSAB and Mandator for the operation of the SSAB steelworks. In 2006, it was released as open source under a slightly extended GPL license and has since been available to everyone as automation software. SSAB still operates its steelworks with this system.

source is: “only the better is the enemy of the good”.

But where are the concrete advantages of automation with ProviewR and the mentioned “Open Source Toolkit”?

First of all, here is the natively economic reason, which is often seen as the main reason for the use of open source:

- There are no license fees for the software.

This argument weighs particularly hard here, because for proprietary control systems the license fee usually increases with the number of tags and an extra license as well as proprietary hardware is required for each operating station and / or screen. In addition, Microsoft Terminal Server-based remote workstations have license fees from the operating system manufacturer. In contrast, when using ProviewR we have:

- An unlimited number of tags.
- Likewise, an unlimited number of operator stations and controllers.
- A number of remote workstations that is only limited due to the computing power.
- The advantage that the system components can be used on standard (industrial) hardware.

These advantages alone result in savings of between 30 % and 50 % for automation projects with a volume greater than 200,000 €. In this context has not been considered that large additional savings can be achieved through the object-oriented engineering in ProviewR.

Even if these numbers could be decisive for a buyer of an automation solution, the main advantages of the sketched open source solution only come to light with a life cycle analysis of the overall system.

It comes into play that open source systems are widely independent of the hardware and the operating system and are usually “composed” of many individual open source modules.

While all components (software / operating system / hardware) needs to be replaced at the same time in proprietary systems as part of the major updates (at the latest every 5 years), open source systems can be maintained continuously. New or improved modules can be installed in existing systems and used without having to make a complete replacement of software and hardware. Conversely the hardware can also be kept up to date without this requiring the replacement of the software. When using virtualization technologies such as live migration, this is even possible with running systems.

Added to this is the advantage of almost unlimited flexibility. While adapting of individual requirements in proprietary systems requires “System Enhancement Requests” that are collected over long periods of time and implemented only when many customers express the same desire and an implementation is considered “lucrative” by the system manufacturer's management, in open source systems enhancements can be implemented at any time. For implementation numerous competent engineering firms and system integrators are available or, if available, can even be done by own resources and with the use of open source modules / libraries. Independent of the multi-year turnaround cycles, open source systems can therefore be adapted to the requirements and kept up to date with the requirements and the technology. This results in a significant relief during revamps, since the control system does not have to be replaced simultaneously with sensors, pipes, valves and motors and therefore is available for the decommissioning and commissioning of the individual components.

The advantages of a purely open source-based automation system, which could only touched on here, with good system management, result in savings of up to 50% of the total life-cycle costs over the entire life

cycle of a system (approx. 20 years). This mainly results from the dissolved know-how and technology loyalty, which inevitably arises with pro-

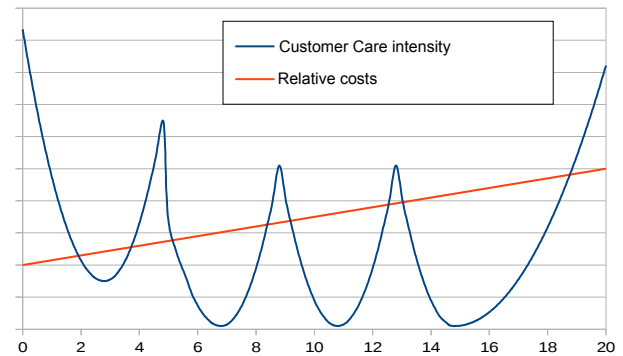


Fig. 1: Course of the system manufacturer customer care interest over the lifecycle of the system, as well as relative costs.

proprietary systems and invites the system manufacturer to “lucrative after-sales”.

A last important, albeit little known reason should not go unmentioned: Due to the mismatch of permanently rising relative costs and the peak-like care intensity by the system manufacturer shown in Figure 1, with the increasing duration of the system often necessary for the operation updates or replacement moved by hardware or not performed. The resulting system and production failures often amount to many times the total life-cycle costs!

## The Open Source Toolkit

### 1. The Open Source Control System ProviewR

ProviewR is controller and control system in one. Due to its outstanding

properties, ProviewR can not only be used for the automation of process and production facilities, but also for building automation, energy monitoring and management, for condition monitoring as well as for special purposes like water management. For the latter purpose, the separation of controller and operator stations is essential, which is perfectly suitable for Scada applications, since signals are transmitted change driven and only for tags that are contained in the currently open operating screens.

In addition, ProviewR has many important features for practical use:

- Emergency operation of the controller possible (by means of the normal operating screens, which are also available in the controller).
- Online diagnostics at any level of the system via Runtime Monitor.
- On-site operation during commissioning, repair or adjustment work via tablet (via normal operating screens and / or the runtime monitor).
- Standard SQL database for recording of real-time data, alarms, order data and other.

As a unique feature, ProviewR has the ability to process complex data objects in the controller. For exam-

ple, complex job orders can be transferred to the controller, and can be used and accomplished with order-related process data (consumption, quality,...). In conjunction with the function modules for the BEA and Websphere Message Queue, ProviewR can be coupled directly with SAP or other ERP systems, so that in many cases an MES system and the necessary matching can be dispensed with.

During the engineering phase, the ProviewR user benefits from the object-oriented structure, which enables significantly more efficient engineering, and the built-in simulation mode.

## 2. Predictive Maintenance

With the addition of the Nagios Infrastructure Monitoring System, all hardware and software components of the system can be monitored so that in many cases errors are detected before they lead to complete system component failures.

When properly conceptualized, the most common models of reactive and preventive maintenance can be replaced by predictive or condition-based maintenance. This can save the unplanned downtime costs of the reactive as well as the “unnecessary” costs of preventive maintenance. For example:

Network switches, vital nodes in the flow of information whose failures repeatedly lead to complete plant shut-downs, do not crash suddenly in 90% of cases, but herald this by increasing error rates on the channels. The permanent detection and evaluation of these error counters - e.g. with Nagios - allows the targeted replacement of these important components and leads to a safer operation, since the "state" of the system components is always "known". Other such examples could be enumerated.

### 3. Virtualization

By using free virtualization mechanisms such as Xen or kvm / libvirt, the utilization of the computer hardware can be increased while simultaneously increasing the availability (which is automatically recorded and evaluated by Nagios for the monitored components). All components can be virtualized, from the operator stations to entire networks, including firewalls, to the controllers of the control system.

### 4. Cyber Security - Data Protection

Database based backup systems such as Bacula or Bareos not only provide GMP-compliant solutions, they also provide a basis for compliance with data protection requirements in accordance with the new European General Data Protection Regulation (DS-GVO). This seems far-fetched at first glance, as it is "only" about personal data. However, when you realize that all modern control systems have operator login tracking, annotation, and operator action journal features, it is immediately clear that any privacy policy will be fully applied once one of these features is used.

With our *Cyber Security Open Source Toolkit* and the *Cyber Security Appliance*, secure connections to the corporate network can be established. We have written a guide for this purpose, which you will find on our website.

