Expedited problem solving

A new software diagnostics tool is keeping plant control systems on track Martin Olausson, Magnus Larsson, Jan Lagnelöv

Large control systems running complex industrial plants consist of millions of lines of code and contain a number of third-party standard software modules for general aspects of process management. New versions of those modules are entering the market and operators of the control systems in a plant may install them to keep up to date. Operators sometimes also install other software not directly related to the control system; those changes in the software inventory of a plant may cause problems in its smooth operation. Although ABB is not the root cause for those disturbances in the plant operation system, it takes responsibility for the overall performance of the systems it has installed. ABB's service engineers are on standby 24 hours a day to support the operators in debugging failures in the customer's software installations.

To find the source of a failure is a tedious process given the complexity of the manifold systems that must cooperate, and it may take weeks of intense interaction among the plant operators to fix the problem. This is due to the fact that, for security reasons, the sensitive control systems are not directly connected to the Internet and thus do not allow for faster online analysis.

Determined to improve this less-thanideal scenario, ABB has developed a set of intelligent software tools to speed up the failure removal from weeks to hours with minimum interaction of the plant operators.

Diagnosis and safety

I magine an operator in a plant, which is run on ABB's System 800xA, reporting that the interaction with the system is very slow and unresponsive. He calls ABB support to get immediate help since this is an urgent issue. But without accessing the 800xA system, the ABB support engineer cannot obtain more information about the setup to resolve the problem.

A PC user who faces such problems would normally call his helpdesk, and the support expert would connect to the system and solve the issue in real time. This is different with control systems: They manage the whole production process in a factory, and the users do not want any risk of a potentially costly virus infection. For that reason, direct access from outside the system is not an option.

What to do then? The support engineer instructs the operator to collect data from different nodes in the system – a time-consuming, error-prone and complicated task. After data collection, the user has to send the data from an access point to the Internet, and the support expert can then start to analyze the case. Generally, all relevant data for the failure cannot be collected in the first round so the process has to be repeated.

This traditional way of analyzing the poor performance of a complex control system is time consuming, frustrating and expensive – in other words, unacceptable. But what if data relevant to the failure analysis could be collected automatically, with very little or no user interaction? ABB's new diagnostic collection tool (DCT) can do just that, and is the clear solution to traditional analysis methods.

Developing such an intelligent collection tool is not a straightforward task: The number of potential cases that may occur in real systems is large and requires the common effort of support engineers and plant operators to determine the events occurring with high probability. The development of DCT was thus accompanied by team interaction with support engineers, operators and software developers to focus on a pragmatic and efficient way to problem solve. When DCT is installed in ABB's System 800xA, relevant information about the system performance can automatically be collected and sorted according to the failure at the time.¹⁾ The operator's interaction then consists only of sending the data to the support engineer – there are no tedious, time-consuming searches, and no iterations.

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A concerted action

To effectively solve a problem at a user's site, different experts must give their input. The software developer has the best knowledge about the product and knows exactly what information he needs in case of a disturbance. What he does not know is the status of the software implementation at the specific site, as this may change from one day to the next, nor is he aware of other software packages running on the customer's system. Support engineers, on the other hand, know best what is going on at the 800xA user's site. Thus product developers and support engineers must share their knowledge regarding each specific case.

To facilitate access to the necessary information, DCT has been designed for extendibility. The tool is built upon plug-ins, which collect the data needed for specific software installed in System 800xA. A software development kit (SDK) is provided to make the implementation of a new plug-in as smooth as possible.

When, for example, a programmer develops a new piece of software, an SDK is used to provide a tailor-made plug-in for the DCT that is installed together with the new software. If a problem occurs later on, this plug-in is called from DCT to collect the data that the support engineer needs to provide a proper solution.

A flexible tool with many features

When DCT is started, several aspects of collecting, exploring and analyzing data are possible. All these are available through a user interface based on user tasks to ensure good usability.

Remote collection of diagnostics data To solve the difficulty that occurs when support engineers do not have access to the 800xA user's plant, DCT allows generation of an Auto Collector. The Auto Collector specifies what diagnostics data should be collected. The Auto Collector can be sent via email (or other media) to the 800xA user who starts the Auto Collector on any node in the system 1. DCT interprets this file, collects the data, and outputs a file containing all the data that the support engineer requested. The user finally sends back the result file (one single compressed file) to the support engineer.

Comparison of installed software For the support engineer, it is often crucial to know what software is installed on the user's system. To enable

DCT main menu



The Auto Collector gathers data without the need for user interaction.

| 🙎 Auto | Collector | | | | | | |
|-----------------------|---|--|--|--|--|--|--|
| 2 | Collect Support Information. Page 3 of 4 The selected action is currently being performed. | | | | | | |
| The wiza execute t | rd has compiled enough information about your system and will now he task. | | | | | | |
| Collecting Data | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Hel | | | | | | | |

2 DCT indicates software inconsistencies.

| Compare with a saved collection Compare between | nodes | | |
|---|---------------------|-----------------|-----------------|
| Options | | | |
| Compare Build number 🛛 w | ith SEVST-W-CRC5514 | * | |
| Software | SEVST-L-CRC5512 | SEVST-W-CRC5513 | SEVST-W-CRC5514 |
| ABB 800xA for Advant Master 4.0.0/1 | 4.0.1798.13384 | 4.0.1798.13384 | 4.0.1798.13384 |
| ABB 800xA for Advant Master 4.0.0/1 Servi | 4.1.1999.18878 | 4.1.1999.18878 | 4.1.1999.18878 |
| ABB 800xA for Advant Master 4.0.0/1 Servi | 4.1.2140.22273 | 4.1.2140.22273 | 4.1.2140.22273 |
| ABB 800xA Instructions | 4.1.2000.34679 | 4.1.2000.34679 | 4.1.2000.34679 |
| ABB 800xA System Checker Tool | Not Installed | Not Installed | 1.1.1984.15960 |
| ABB AC 800M Connect 4.1.0/2 | 4.1.5.4 | 4.1.5.4 | 4.1.5.4 |
| ABB Batch Management Client 4.1.0/0 | Not Installed | 4.1.60217 | 4.1.60217 |
| ABB Batch Management Environment 4.1.0/0 | 4.1.60217 | 4.1.60217 | 4.1.60217 |
| ABB Batch Management Primary Server 4.1 | 4.1.60217 | Not Installed | Not Installed |
| ABB Central Licensing System 4, 1,0/0 | 4,1,0,1086 | 4, 1, 0, 1086 | 4,1,0,1086 |

Integrated search in multiple files as well as ABB Library

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|---|--|----------|--|---|--|
| Search Phrase: | 800xA | | | Search | |
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this, DCT contains a feature to view and compare the installed software in the system 2. The reference installation is the one used when the system was first installed; all changes are registered and reported against this reference. A detailed description is the basis for finding possible software inconsistencies.

Comparison of running software Support engineers must also be able to compare the software that is currently running on specific nodes to identify inconsistencies. For example, two redundant servers most likely should have exactly the same software running all the time.

Text-based search integrated with ABB Library

When DCT has collected the requested information, support engineers must find their way through all of the data. The engineers want to search these files for known text strings, such as error messages and warning texts. The search function is a tremendous help in this case; it also looks for and opens documents in ABB Library (ie, ABB's documentation database) for further reference **3**.

Schedule collection of diagnostics data DCT can be configured to automatically collect data with a specified interval. This feature is used for preventive support since the data is already available if the support engineer is recruited to resolve a problem.

Standard plug-ins without 800xA dependencies

DCT also contains several standard plug-ins that can be used on nodes running Windows – with or without 800xA installed. Plug-ins that collect information on shared library usage and information from the Windows registry and from the Windows Event logs are just a few examples of the standard plug-ins provided by DCT.

When DCT is installed in ABB's System 800xA, relevant information about the system performance can automatically be collected and sorted according to the failure at the time.

Problem solved

By making use of all these features, the problem-solving process is very simple and swift: An 800xA user detects that the system does not respond as usual. He is in urgent need to solve this problem and calls ABB support. The support engineer uses DCT to specify the diagnostic data he needs from the user's system. DCT completes the task by providing an Auto Collector. The Auto Collector is sent to the user and automatically gathers the relevant data. When the data collection process ends, the user is informed about how to return the data to the support engineer. The support engineer receives the collected data and analyzes and solves the problem within a very short time.

Satisfying customer needs

DCT has proven to be useful tool not only for support engineers, also for ABB's customers. Lee Tolman, system administrator at Dow Corning's Hemlock Semiconductor Corporation and frequent user of the tool, said, "With approximately 250 nodes, DCT allows us to remotely gather valuable information from all these nodes without requiring us to log in into every node. DCT saves time and allows us to gather required information without disrupting operations."

Future challenges include providing consistency checks of system configurations, automatic control of correct software installation according to ABB recommendations, and the ability to trigger an alarm upon particular data changes on specific nodes.

Martin Olausson

Magnus Larsson ABB Corporate Research Västerås, Sweden martin.olausson@se.abb.com magnus.larsson@se.abb.com

Jan Lagnelöv

ABB Process Automation Västerås, Sweden jan.lagnelov@se.abb.com

Footnote

¹⁾ DCT is available from version SV5.0 Service Pack 1 of ABB's System 800xA.