

aicas news

News for software developers of critical applications

Spring 2007

↓ Editorial

Dear reader,

In the desktop and server markets, Java technology has long moved from hype to reality. Now the hype over Java in embedded systems is also fading. It is no longer revolutionary to use Java in embedded systems. It is just normal.

While visiting the SPS/IPC/Drives, I found it remarkable, how common the use of this platform independent programming language in industrial automation has become. Java is deployed in many products where it is neither advertised explicitly nor obvious from the outside.

With this newsletter, I would like to present some interesting projects where the JamaicaVM is being used in this industry: the Siemens drives Simotion and the CSEM assembly robot, as well as the visualization solutions JPC and XWeb.

We try to present new topics like these in each newsletter. If there is anything about Java technology you would like to see here, please let me know. I look forward to your suggestions.

I wish you a pleasant read.

Sincerely,

Andy Walter, COO

JamaicaVM 3.0 available now

Version 3.0 of our award winning VM brings many new features

Version 3.0 of the realtime capable JamaicaVM is now available on our home page. Our VM is particularly suited for customers from the industrial automation as well as the military and aerospace sectors. The Usability and configurability of the VM have been enhanced significantly and, through the addition of further Sun standard APIs, it has become even simpler to develop for embedded systems using the JamaicaVM.

A significant new feature of JamaicaVM 3.0 is support for debugging a target platform from the host. This feature simplifies finding and repairing programming errors. Since the implementation is based on the Java standards such as JVMTI and JDWP, any compatible debugger can be used. The programmer can leverage familiar desktop Java debuggers, such as the Eclipse or NetBeans debugger, for use in embedded projects greatly reducing development time.

Naturally, graphics, a feature that is becoming ever more important for many customers, has not been short changed. In version 3.0, support for the comfortable and yet flexible SWING graphics library has been expanded considerably. Through experience gained in numerous customer projects, the already good performance of the JamaicaVM's graphics support has been made even better.



Embedded requirements can vary considerably, so flexibility has not been neglected. Important properties of the VM, such as the number of threads and the size of the available memory, can be configured to change dynamically. So the VM can request additional resources from the operating system within given boundaries. On the other hand, these boundaries can also be set statically to support, for example, realtime applications and small systems.

These new features combined with the proven realtime and performance properties of the JamaicaVM, enable aicas' customers to develop nearly any embedded application in Java and to run them on small systems. With the new Version 3.0, the application of JamaicaVM is not limited solely to critical realtime systems, but is the Java solution for every type of embedded application!

↓ News

JamaicaVM at Update-Scout.com

Update-Scout.com is a new web service providing information about recent program updates. After the free registration, one can generate a personalized software notification list from the update-scout catalogue. The system uses this list to provide notification by E-mail or news feed whenever updates are available.

Safety Critical Java

The safety critical Java standardization effort lead by the Open Group and sponsored in part by the HIJA project has received official sanction from the Java Community Process through the acceptance of JSR 302. The HIJA Proposal, principally developed by aicas and the University of York, has been taken as a basis for further development. The

JSR is supported by major corporations including Mitre, Sun, Raytheon, Boeing, and Rockwell Collins.

JamaicaVM in the Siemens Simotion

Cost Effective solution for service and IT functions using HTTPS, XML, and realtime Java.

Internet technology in control applications has evolved from a desirable but optional feature into a substantial part of many modern system architectures. The integration of established standards from the IT world in automation technology creates new freedom for customizing machines, providing very cost effective and flexible support for special functions and facilitating the integration of production machines in operational processes.

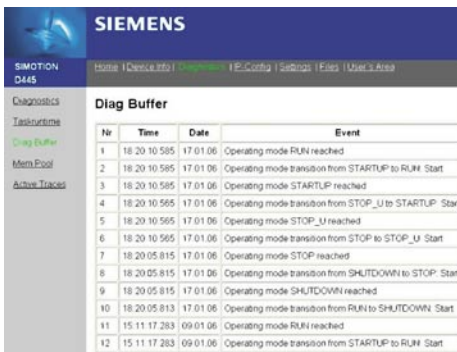


Figure 1—In addition to elementary diagnostic standards Simotion IT Diag enables the definition of comfortable customer specific user interfaces for setting up technical parameters of a machine.

Functionality and data access to production machines are made primarily through control applications and their user interfaces. Access to these machines beyond this level requires expert knowledge, and most times also a programming device with an engineering system. To avoid the need for specially trained employees and a programming device each time a modification is required, a customized application or an add-on has to be supplied to manipulate production specific parameters.

This customization of machine functionality though additional applications increases development costs. A customized version of the basic control application of a machine series demands end user dependent version control from the machine manufacturer, in addition to parallel maintenance of the different application versions.

IT standards in controls

The integration of modern online technologies in machine control creates a

new way to equip machines with customer and technology specific control and information functions. In the simplest case, the controls provide HTML pages used by the service to query detailed status information for diagnostics. A standard internet browser is then sufficient for user access. Additional useful IT standards on server side include, XML and Java enable access to data and functions of a machine as well as its individual display. Therefore IT standards are predestined for simplifying the creation of special functions and hence their deployment in automation systems is increasing.

Common terms instead of internal Variables

Basically one must distinguish between static HTML pages, predefined by the controls manufacturer, and custom generated pages of process specific information. In most cases, pages predefined by the manufacturer show internal variable names and their value without any units, so interpreting this data requires system knowledge. Should the process specific meaning of the individual parameters need to be expressed, then the user or manufacturer must provide specially defined or adapted HTML pages.

With the help of an embedded Java program, that is processed by a browser, the data supplied by the machine control can be summarized, organized, processed, and displayed in a descriptive and user friendly manner. Without machine support, some manual work is required to associate machine parameters with process relevant labels and descriptions.

Installation, service and interactive office connection

For the widely used motion control system, Simotion, the optional package Simotion IT Diag provides such functionality. IT Diag makes use of the information from a Simotion project. Were expressive variable names are assigned during engineering a printing machine, for example, the function of a parameter for the color register, pressure tower, or cutting register, is obvious.

In this manner, the default pages generated by Simotion IT Diag are sufficient for a technically adept employee for di-



agnostics of the machine, especially since Simotion IT Diag translates all status codes to explanatory message texts. Thus programming of customer specific initialization and installation functions can now be omitted in most cases.

Basically read and write access to system variables with IT Diag is possible, whereas a separate process of the Simotion runtime environment controls and coordinates this access. Java script is supported, so that an simple method is available to store customer specific and ergonomic user interfaces on a machine instead of, or in addition to, the default pages of IT Diag. For example, routines to set technical parameters, install the machines, or for guided diagnostics by less qualified personnel can be made available.

Simultaneously interactive access to actual data of the production can be offered to the office world. With the help of embedded frames even information from different machines can be clearly arranged without using additional programs.

Documentations, service manuals, and other files can be stored and retrieved in the file system of a Simotion machine by IT Diag via a browser. Firmware and

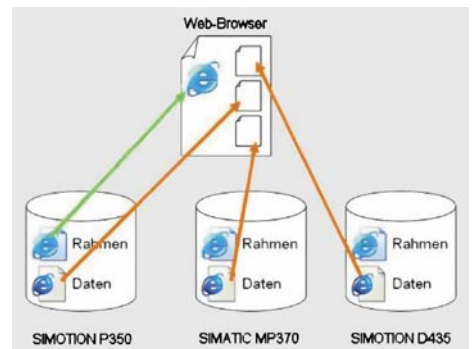


Figure 2—Web access.

project updates are available for remote maintenance as well.

XML as a standard interface to IT programs

While the strength of Simotion IT Diag lies in the simple interactive access to machine data, the package Simotion OPC XML-DA is designed for direct connection to IT processing. For example, production planning and control, quality control, or databases for automatic logging of production data can directly access machine data.

The interface between the controls and the program is defined in standard XML format. Data interchange is conducted thereafter over a standard network connection. The special feature is that neither at creation of an interface to an external program nor when changing the XML interface definitions, an export

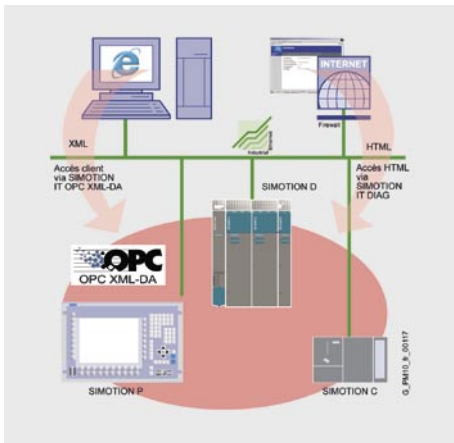


Figure 3—Front office integration.

from the engineering group is needed. Simotion interprets the XML format directly on the controller.

User functionality without a user program—the realtime Java kernel

A major cost factor of engineering is often the development of user functions that are only needed during machine initialization, setting up a new product, or for maintenance, service, and diagnostics for product installation.

What these functions share in common is that they facilitate the basic functionality of the machine, as it is defined in the user program, but would not need to be part of the user program itself. Such functions can be implemented in Simotion as Java programs. The Simotion runtime environment contains the realtime capable Java Virtual Ma-

chine JamaicaVM. With the deterministic garbage collector contained therein, programs processed by it can use and monitor elementary machine functions as well as complex, user implemented functions, in realtime. These Java programs can be reloaded by Simotion, so here too, no support is necessary from the engineering system. Special functions for a machine can be developed and modified without the need for an engineering environment. A Java development environment is sufficient.

Even the secure remote control without direct line of sight is supported. The required security mechanisms are provided on the system side by Simotion. They can also be used by programs running in the Java subsystem.

Compatible and secure

To protect the PLC, motion control, and regulation functions of the CPU, Java programs in the Simotion run in an encapsulated and monitored environment. Since the Java kernel and HTML server are built into the Simotion firmware with adequate resources, both performance and deterministic use of machine functions are guaranteed, even during intensive use.

New synergies through integration of established IT standards

The deployment of IT standards like HTML, XML, and Java for machine customization provides machine manufacturers and end users far more flexibility

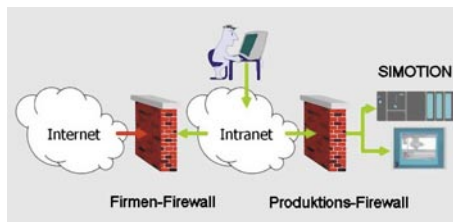


Figure 4—Access control and secure transmission of data via HTTPS protocol is a standard in the Simotion IT options. Browser compatibility ranges from Windows 95 Internet Explorer 4.0, over all important recent browser versions to Suse Linux 10.1 and Konqueror 3.5.

than with proprietary interfaces. Customer specific functions can now be developed independently of a machines basic functionality and standard operation and this independence includes time, place, system, and personal resources. As soon as the most important interfaces are defined, special functions required for the current project can be programmed in parallel with the classic engineering of the machine functions,

↓ **Events**

We would like to welcome you to following events.

Embedded World 2007,
Nuremberg, 13–15 February 2007

ESC Silicon Valley 2007,
San Jose, USA
1–5 April 2007

Java Forum 2007,
Stuttgart, 5 July 2007

without conflicts in personnel or system resources. Since the customer specific functions implemented in HTML, XML, or Java standards are maintained inde-

Security as Part of the standard

An important prerequisite for the seamless integration of current IT standards in production environments is a consistent communication and security standard. Through the dominance of TCP/IP in the IT communication, this standard is packet oriented data transmission, used by the internet backbone, ethernet, industrial and realtime ethernet, profinet, and profibus. By using the possibility of remote access—be it from the office layer or within the scope of global service concepts—protection from unauthorized access is necessary. For this, the machine controller has to support the established and proven security standards of the IT world, such as Secure HTTP (HTTPS) and the authorization of data traffic by means of certificates. Firewalls and virtual private networks (VPN) can support this security concept.

pendently from the classic application program, the number of application versions and

variants that need to be maintained decreases. Furthermore the complexity of a application program decreases significantly, since the special functions for initiation, installation, and service no longer burden the application. All this leads to a noticeable reduction in engineering effort needed and an improvement in reliability.

(Johannes Birzer, Siemens A&D)

Visualization and Control on Windows CE

NetModule WebT and JPC together with the JamaicaVM

The visualization and operation of a machine should be simple and intuitive, look good, and follow a customer specific philosophy, so that operators can recognize a machine from a given manufacturer just by using it.

In particular, an appealing visualization can earn a market premium. The company NetModule has developed the NetModule WebT, a versatile and cost effective visualization platform, just for this market. The WebT is based on a powerful XScale processor and focuses (amongst others) on Windows CE 5.0 as its operating system.

Java, as a platform independent programming language, is ideally suited for implementing individual, customer specific interfaces.

NetModule's JPC (Java for Process control) takes full advantage of Java technology and enhances it with an intelligent client/server architecture and visualization components into a programming environment for sophisticated, complex visualizations, and interfaces.

NetModule relies on the proven JamaicaVM from aicas and the companies expertise. For NetModule, the wide range of platforms supported by JamaicaVM was an important criteria. NetModule customers use the JamaicaVM not only on Windows CE, but also on OS-9 and VxWorks as well. The JamaicaVM, JPC, and WebT provide the basis for a new, cost effective operating terminal that is already in use in industrial automation.



The WebT from NetModule

Here the platform independence of Java proves itself, whereby existing visualizations can be ported to a new platform with little or no effort.

(Thomas Siegrist, NetModule AG)

XWeb

User interfaces for smart systems

Under the tight memory and processing power constraints in the embedded sector, the design of an appealing high performance user interfaces is a great challenge.

With Xweb, the company Xcc Software AG offers an alternative with many useful features. XWeb user interfaces are visually appealing, offer the comfort common to PCs, need little memory, and still exhibit high performance. Especially for rapid prototyping or for generative approaches, where parts of the interface generated depends on external parameters, XWeb excels. Another advantage is the great flexibility of XWeb when confronted with sudden requirements changes. The interface can be fully tailored to your ideas and requirements to provide optimal product branding.

XWeb is suited for deployment in PCs, as well as web pads, PDAs, cars, and operation terminals.

XWeb, in its current version, has been optimized for use with the JamaicaVM in close cooperation with aicas.

For further information about the XWeb technology, please request our white paper via E-mail to info@xcc.de

(Edgar Schüber, Xcc Software GmbH)

Mini Robot with Java Controls

CSEM develops completely Java based robot control

In micro assembly, speed and precision are the key factors for which miniaturized robots are far better suited than big machines. The Centre Suisse d'Electronique et de Microtechnique (CSEM) in Alpach (Switzerland), developed an industrial robot, named 'PocketDelta', optimized for micro technology applications. With dimensions of just 120x120x200mm, the machine is capable of executing up to 3 motion cycles per second with a positioning precision of just a few μm .

The mini robot's controls are fully integrated. A PC104 card with an AMD Geode CPU forms its core. Peripheral device cards offer digital I/Os and a CAN-bus for communication with the servo amplifiers of its drives.

The robot control itself is entirely written in Java and runs with the JamaicaVM on the realtime operating system QNX. The requirements of the control are mapped hierarchically onto Java classes. An important part of the software consists of the drivers for the PC104 peripheral devices cards. The drivers are partially active, that means they have internal tasks. For example, the driver for the CAN-bus card has a realtime task that processes CAN signals in a periodic cycle of 2 kHz. A 'RobotController' class adjusts the drives, whose movements are coordinated by the 'TaskPlanner' class, which in turn accesses a class, that contains the geometric parameters of the robot. A state machine controls the operating state of the robot.



PocketDelta Robot of CSEM

With a web server on the controller, the robot can be controlled and configured via a web browser. For example, by using virtual cgi scripts, motion commands for the path planning can be generated.

About 20 parallel tasks run on the controller, approximately 12 thereof are high priority 'RealtimeThread' objects.

Contact: <http://www.csem.ch>

(Marcel Honegger, CSEM)

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