

The Standard *etrix*

Welcome! We want to thank everyone for such a positive reaction to our first issue of *The Standard*, which was published this past spring and introduced at SEMICON Europa. *The Standard* is a new industry resource published by Cimetrix on a periodic basis to keep you informed of developments regarding the new SEMI Interface A standards.



The first issue contained background and summary information regarding the need for better quality and more data from equipment, the relationship between SECS/GEM and Interface A, and the role of Equipment Engineering Systems (EES). This second issue of *The Standard* details specific developments within the industry, as a lot is happening. Cimetrix continues to work with leading equipment suppliers on Interface A and TDI implementations, and we believe you

will find the article provided by Bostjan Pust of SEZ from an equipment supplier's perspective to be very informative.

We are also currently involved in a number of different "pilot projects" at semiconductor fabs. Interface A has now been working 24/7 for several months in some of these pilot projects. More importantly, fab personnel are starting to see the vision and associated benefits of using more modern technologies to obtain on-demand access to higher quality equipment data.

As always, we welcome any comments or suggestions for future issues of *The Standard* and we hope you will visit us at SEMICON West in South Hall 1841.

Happy reading and best regards,

Bob Reback
President & CEO, Cimetrix Inc.

Table Of Contents

Page 1	Welcome! Bob Reback, Cimetrix, Inc.	Page 5	Tool Data Interface (TDI) Compliance Brian Rubow, Cimetrix, Inc.
Page 2	Getting Started with Interface A Dave Faulkner, Cimetrix, Inc.	Page 7	Equipment Modeling: Part 2 in a Continuing Series Alan Weber, Paul McGuire, Alan Weber & Associates, Inc.
Page 3	ISMI Interface A Evaluation Program Matures Implementations Harvey Wohlwend, ISMI	Page 9	Getting Quality Data into Interface A Brian Rubow, Cimetrix, Inc.
Page 4	SEZ's Perspective on EDA Meta-data and Modeling Bostjan Pust, SEZ, AG	Page 11	Contributing Authors
		Page 12	Back Cover – ECCE Update

The contents of this newsletter are a copyright of Cimetrix, Inc. We respect your privacy. To discontinue receiving future newsletters, please send an email to newsletter@cimetrix.com with the word UNSUBSCRIBE in the subject area. Comments, suggestion, questions and letters should be directed to the editorial team: c/o Mark Button, mark@positio.com For more information on Cimetrix and Interface A, visit www.cimetrix.com

© 2006 Cimetrix, Inc.

Faster Time
to Market.

Passionate
Support.

State of the
Art Architecture.

The Standard **etric**

Getting Started with Interface A

by Dave Faulkner, Executive Vice President, Sales & Marketing, Cimetric, Inc.



The adoption of Interface A is progressing through the equipment supplier community. Most major equipment suppliers have selected a technology partner and are in the design phase of their new Interface A port.

But what about the IDMs (Intergrated Device Manufacturers)? The enormous amount of high quality data that will be available through Interface A needs planning and implementation expertise. In the spring edition of *The Standard*, Alan Weber & Associates identified “Fab Level Implementation Issues,” which are further analyzed later in this edition. Bostjan Pust of SEZ also identifies issues in this release that will need careful dialog between equipment suppliers and IDMs. Several IDMs have progressed into pilot projects or comprehensive data collection programs. Others are just getting started.

To assist with this process, Cimetric has assembled a three level set of ideas to help the IDM get out of the starting gate quickly, progress through a learning curve, and implement real production ready systems.

1. Interface A Starter Kit – This is a low cost starter kit to allow the IDM to understand and work with the Interface A technology in a lab or office environment. It includes an equipment simulator to generate simulated production data; a CIMPortal license used to output this data following the ISMI freeze version of the Interface A standards; and client tools to create Data Collection Plans and receive the Interface A formatted production data. The ISMI ECCE (equipment client connection emulator) available from ISMI, based on Cimetric technology, can also be used as part of this technology assessment kit.

2. Interface A Pilot Kit – This kit moves the technology from the office environment to actual production equipment. The Pilot Kit includes licenses for up to 10 CIMPortal installations on production tools to access data from the SECS/GEM port and other data sources without interrupting the normal operation of the tool. The resulting Interface A data can be consumed by the ISMI ECCE or IDM developed prototype Interface A (Equipment Engineering Systems) systems. While this approach is not as effective as new equipment supplied with a native Interface A solution, it is very effective for prototypes. Several IDMs are standardizing on this approach for their next fab rollout, which expect to have only a percentage of equipment supplied with native Interface A ports.
3. Cimetric Data Management Solutions Center – To help provide IDMs with expert knowledge and solutions based on industry best practices for deploying Interface A capable factory systems, Cimetric has a team of solution architects and engineers with experience in fab data management solutions. This team, combined with Cimetric Interface A technology, is uniquely suited to assist IDMs with evaluating, planning, designing, developing and deploying Interface A Data Collection Systems.

Now is the time to get started.

Faster Time
to Market.

Passionate
Support.

State of the
Art Architecture.

ISMI Interface A Evaluation Program Matures Implementations

by Harvey Wohlwend, Manager,
International SEMATECH
Manufacturing Initiative (ISMI)



During 2005, ISMI initiated a program to assist equipment suppliers by providing proactive evaluations and feedback on their Interface A solution designs. ISMI and its member companies identified this step as an important element of the successful maturation and adoption of Interface A by the semiconductor industry. The Commercial Equipment Data Acquisition (EDA) Port Evaluation program encouraged collaboration between ISMI and equipment suppliers looking at early Interface A implementations from the point of view of the end user in the fab. The evaluations use a structured approach based on consensus usage scenarios defined by the ISMI member companies. This structured approach is documented in the ISMI Equipment Data Acquisition (EDA) Evaluation Method, version 3, which is available at the ISMI website for all to use. The document can be found at: <http://ismi.semtech.org/docubase/abstracts/4664btr.htm>.

The evaluations focus on the ability of the equipment interface implementation to perform a normal, or so-called "happy path" operational sequence following the EDA Evaluation Method. The evaluations were not designed to encompass the rigors of complete conformance testing, but rather focused on the structure and completeness of the metadata, the basic functional attributes of Interface A, the ISMI Usage Scenarios, and some baseline performance metrics.

Execution of the program involved ISMI engineers, and in many cases member company engineers, performing the EDA Evaluation Method on the equipment at the suppliers site or installed at a production fab. The process involved an agreed upon upfront Statement of Work, performance of the Evaluation Method, problem follow-up, and agreement

on the final report. Final reports were presented to the member companies, which allowed them to see the progress made by the equipment supplier community. Both 200mm and 300mm equipment were evaluated. The process types evaluated included strip, metrology, RTP, sorter, plasma ash, CVD, and PVD.

The program allowed ISMI to get a detailed look at early implementations of Interface A and the equipment suppliers gained rapid feedback on the quality and structure of their interface implementation. The reports highlight improvements required of equipment suppliers, third party software packages, metadata structure improvements, performance issues, and identified clarification opportunities in the SEMI standards. ISMI would like to thank the equipment suppliers for their participation in this step up on the adoption curve for Interface A.

Questions should be directed to:
Harvey.Wohlwend@ismi.semtech.org

The Standard **etrix****SEZ's Perspective on EDA Meta-data and Modeling**

by *Bostjan Pust, Director
SW&HW Research &
Development, SEZ, AG*



Equipment suppliers are faced with the challenge of continuous modifications of equipment connectivity requirements, and supporting standards. EDA is an example of this continuous improvement. This article is focused on the complexity and activities related with machine model maintenance, and on the machine meta-data design. SEZ has finished a beta version of the EDA – Interface A implementation on our DaVinci platform, and had no major problems related to Interface-A libraries beside industry common open issues, like common EDA acceptance/security. However one major problem was identified – machine meta- data design.

In the package of EDA standards are two interesting standards E120/E125. E120/E125 describe machine hierarchy and clarify relationships between EDA parameters (variables) and events used in the Data Collection Plans (DCP). By using this information chip manufacturers will be able to understand the structure of machines, be able to locate parameters of interest, and keep track of them. This is known also as a self descriptive machine model. Machine models will eliminate written manuals, like SECS VID manuals. E120/E125 also introduce an important new concept – versioning.

Model Revision requires special attention because of the required maintainability effort expected on the equipment side. Machine model hierarchy of a multi chamber machine can be very complex and huge.

As SEZ finished the integration phase, the problem was identified that it is not known how customers will use the new capabilities released with Interface A.

Use Cases which will differ from customer to customer are not known at this time. The result of this situation is the fact that we cannot design our final machine meta-data –

E120/E125. According to the standards we could model the machine down to single small modules, or subsystems, which would increase the maintenance problem of the model during the product life-cycle. Such over detailed machine models have also other disadvantages. They are huge, require longer time for model parsing, and maybe include information which has no value to the customer. The maintenance effort of the machine model depends on model complexity. We assume that maintenance of the model will require sophisticated configuration management applications. Machine model editors delivered with EDA software suppliers can only be used in the beginning. Later in the product life-cycle of the machine they will be not efficient.

The fact is that machine configuration is not a trivial topic. Special customer change requests require machine module release management in order to be used with EDA machine model. The model release process is a complex activity in production of the equipment. In the equipment production process this activity produces version numbers which cannot be directly re-used for the EDA machine model. The reason is that the goals of the production and EDA module change process are different in some details. This requires additional resources to maintain the EDA model.

If this model contains too many details we could be faced with the problem that the production versioning does not contains such data.

Chip makers do not have clear scenarios about how they will use the new EDA capabilities. What is clear after some discussion with them is they have different goals they would like to achieve by implementing EDA in the factory. Equipment suppliers have to find the correct level of detail information which would not require customer unique machine models. At this time it is almost impossible to predict the final level of data granularity which could be acceptable to chip makers and could be still maintainable for the equipment suppliers. The first chip maker who will set up a production environment for EDA will also probably set up a kind of standard meta-data model.

(Continued on page 8.)

Faster Time
to Market.

Passionate
Support.

State of the
Art Architecture.

Tool Data Interface (TDI) Compliance

by Brian Rubow, Product Manager, Címetrix, Inc.



Some Integrated Device Manufacturers (IDMs) in Japan have adopted the TDI concept by requiring some equipment suppliers to implement the Tool Data Interface (TDI) specification. Equipment suppliers shipping to IDMs in Japan need to make preparations to implement the TDI specification.

An Introduction

TDI is a specification for equipment suppliers to store historical data locally on the tool, provide local applications to use this data and make the data available to the IDM factory applications. SELETE (Semiconductor Leading Edge Technologies, Inc.) and JEITA (Japan Electronics and Information Technology Industries Association) cooperated to define the guidelines. In order to implement TDI, there must be a local database on the equipment to store the data for a period of time.

There are two main TDI documents published in English as listed below. TDI is not a SEMI standard, rather it is a specification that gives the equipment supplier much latitude concerning implementation details.

TDI leverages existing technologies and allows many details to be negotiated between the equipment supplier and IDM. For example, TDI does not specify or define a protocol for transferring historical data to the IDM's factory level systems. ODBC is one suggested protocol, but other protocols can be used if they meet the requirements. TDI does not define how available data is represented. Instead it can use SEMI standard E125 to document the available equipment data. Ultimately, the IDMs requesting TDI will narrow down the technical specification details, but it could vary from one to another.

The TDI specification documents are quite flexible. While this allows IDMs to create specific requirements to meet

their needs and choose the most appropriate technologies, it also could result in different IDM-specific implementations. A TDI implementation for one IDM might be insufficient or even violate requirements from another IDM. TDI solutions must be verified carefully for each IDM.

Requirements

There are two documents that describe TDI compliance.

1. Tool Data Interface: Functional Specification Document, Version 1.0.6-10, Oct 15, 2003.
2. TDI Data Schema: TDI Implementation Specification Examination Group, Version 1.0.3j, Nov 27, 2005.

Following is a short summary of the requirements from each document. There is some redundancy between the documents.

While some requirements are vague, others are quite explicit. Some of the requirements are optional while others include multiple suggestions with alternatives. At least one IDM is requiring remote access to the TDI database using ODBC, but other protocols could be required.

Functional Specification

The Functional Specification Document describes how the equipment must support the following:

- Polled data collection
- Event based data collection
- Database overflow management
- Accurate, synchronized time stamps
- An interface for IDM data retrieval
- Robust hardware recommendations
- Data access security
- Data validation
- Data access logging
- Database management logging

Data Schema

The Data Schema describes the following requirements:

- Database format

The Standard *cimetrix*

(Tool Data Interface... Continued from Page 5.)

- Specific categories required event data
- SEMI E125 documentation of the available data
- ODBC or another interface for IDM data retrieval
- Minimum clock accuracy
- Data access security
- IDM and Equipment clock synchronization
- Configurable automatic data deletion
- Tracking of equipment settings.

EEQA and EEQM

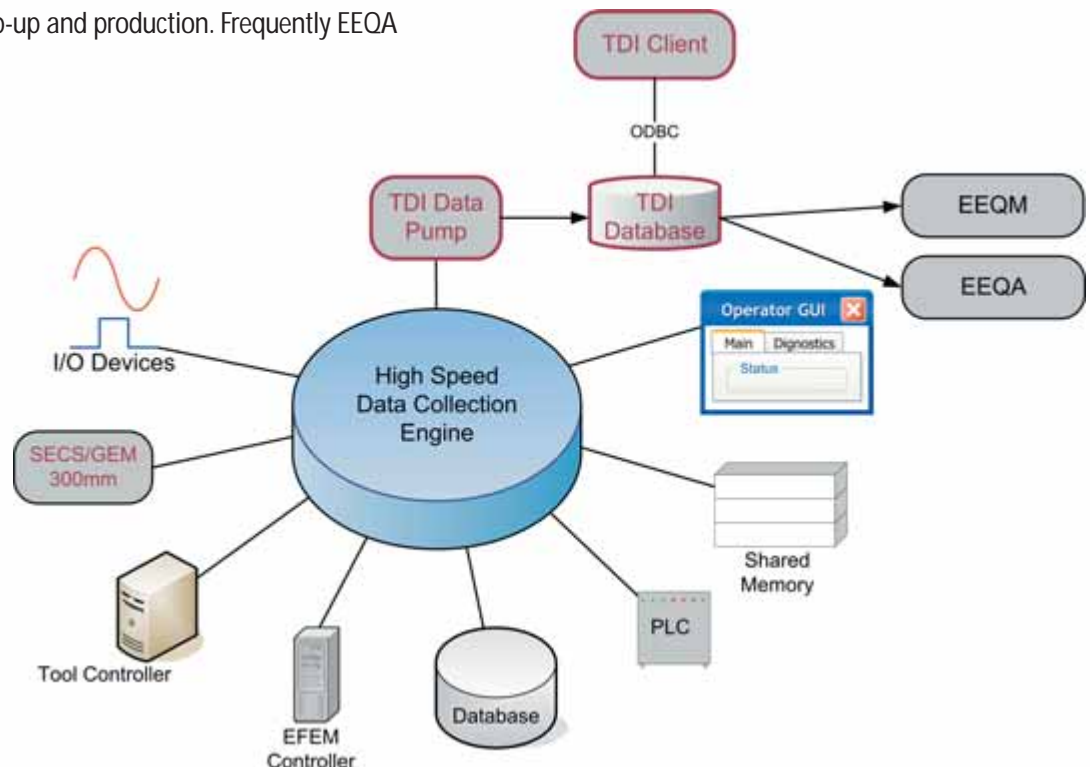
Enhanced Equipment Quality Assurance (EEQA) and Enhanced Equipment Quality Measurements/Tracking (EEQM/T) are two local software applications that are required by certain IDMs to be supplied by the equipment supplier as part of the TDI solution. EEQA includes JEITA requirements with local tests to ensure consistent equipment quality. EEQM includes JEITA requirements to implement a local fault detection system. EEQA is used primarily during tool assembly, installation and ramp-up, while EEQM/T is used primarily during process ramp-up and production. Frequently EEQA

and EEQM/T are part of TDI discussions, although they are supported by completely separate specifications. Although EEQA and EEQM/T can be implemented completely independently, it is logical for both to use the TDI database to access system data.

Summary

Due to the flexible nature of the TDI specifications, each IDM's TDI requirements may be different and require unique implementation details. If EEQA or EEQM/T is required, incorporate these into the TDI database solution. Equipment suppliers should carefully negotiate TDI requirements to achieve a practical, attainable solution, particularly during these days of early adoption.

Cimetrix currently has a beta program for its CIMPortal TDI implementation. The CIMPortal architecture is ideal for equipment suppliers that require both a TDI and an Interface A solution (see "Quality Data into Interface A" on page 9) due to the common data collection engine.



CIMPortal TDI Architecture

Faster Time
to Market.

Passionate
Support.

State of the
Art Architecture.

Equipment Modeling

Part 2 in a Continuing Series on the Fab-Level Implementation Issues of EDA Standards

by Alan Weber and Paul McGuire, Alan Weber & Associates, Inc.



In the first edition of *The Standard* we introduced a number of issues that semiconductor fab customers must face as they implement the new suite of Interface A standards, touching on a range of topics from SSL communications to performance monitoring and response. This time we will deal with one of the most important topics in more detail, namely the equipment modeling process that ultimately determines the content and structure (and usefulness!) of the data that is provided across the interface.

The equipment modeling process is not just a technical, engineering exercise. It is also a negotiation process between the equipment supplier and the end user regarding the level of detailed tool behavioral information that will be provided, since it is possible to meet the “letter of the law” without adopting the “spirit of the standard.” Suppliers may consider much of the detailed operational tool data their intellectual property, and be reluctant to make it available through the EDA port.

There is no one single approach that will fit all process areas or satisfy all customers’ objectives. Some common rules of thumb can be applied nevertheless, and the following thoughts on equipment modeling are offered as a starting point.

Technical Considerations

Because of the nesting flexibility inherent in the E120 standard, it is possible to have many different, perfectly valid models for the same piece of equipment, from very shallow

to very deep. However, getting this structure “right” in a given fab is very important, because it will most likely have a direct impact on the representation, management, and usefulness of the tool data in the consuming applications. To this end, ISMI has published a set of guidelines for mapping concrete equipment components onto the standard set of objects defined in E120. This is an excellent beginning, and will certainly evolve as the industry gains more experience in this area.

In addition to tool structure and behavior data, it is important to consider what production context information (product ID, recipe name/step, layer, lot/wafer ID, etc.) will be necessary to interpret the trace and event data, as it may be difficult to construct and analyze a particular situation from the time stamped parameter data alone. There are a number of ways to address this, from requesting that certain parameters and state variables are accessible as part of the data collection plans/reports, to using coincident GEM event reports to get the required data at the right time. Each approach will have different implications on the host systems that collect, store, and provide this information to the consuming applications, so these should be considered in the interface specification process.

The relationship between trace and event data is also very important in an EDA tool model. Since a process engineer will only care about the detailed trace parameter values some of the time, it is necessary to define events of sufficient number and granularity to enable the data of interest to be “framed” properly. These events may be used as start/stop triggers for the actual data collection process in well understood situations, or as query filters when the user wants to group and analyze different subsets of data that correspond to a variety of process/production conditions.

Taking this idea a step further, you may want to explicitly model (and request that the equipment generate) a set of “derived parameters.” For example, the logical “AND” of an SVID (RF power) and a state value (Wafer present) might represent the true signal of interest; if the supplier could

(Continued on page 8.)

The Standard etrix®

(Equipment Modeling...Continued from page 7.)

provide this value directly, it would simplify the query and calculation burden in the host system. Another example of a derived parameter might be a vector of aggregate univariate statistics for key process variables, such as mean, standard deviation, or min/max since some reference event.

It will also be beneficial to agree on an import/export format for the entire model (E120, E125 and beyond), as there is much development and configuration work that an end user can do with this information long before a tool or its emulator is delivered. This is certainly not a new idea, and a number of candidate XML representations have already been prototyped – the only real task is picking one that you and the tool supplier can agree upon.

On a completely different thread, it may be necessary to understand the mechanisms used by the equipment's embedded control system to sample, aggregate, and communicate low-level tool data as well as the accuracy of the tool's internal clock(s) before relying on timestamps to draw conclusions about equipment and process behavior. For example, in attempting to characterize the actual response of a particular component (say, a proportional valve) to a state change command, if the command notification event (open valve) comes from one part of the control system but the confirming sensor (valve position) comes from a different subsystem, it may not be possible to accurately relate the two. In situations where relative/absolute accuracy of timestamps is crucial, it may be necessary to modify the fab's time synchronization processes.

Business Considerations

In negotiating the content of an equipment model with the supplier, it will be tempting to ask for everything under the sun... just in case it might be useful. Or one might think that data should be collected at the highest possible sample rate; but collecting data at 50Hz is not necessarily 10 times

better than getting data at 5Hz. The tradeoff for higher-resolution data reporting is a tenfold increase in data to sift through at analysis time.

It is far more productive to first think about the questions you want to answer and the problems you hope to solve with the capabilities of the EDA interface – then decide what data actually supports these objectives. The analogy of a car's engine control module may be overused, but it still applies: just because the ECM contains a great deal of information about the engine's internal states and behavior doesn't mean that the driver has any real use for (or right to) this data. For data collection at high sample rates, it is important to isolate these samples to critical process windows so that high resolution data collection and storage costs are not incurred during uninteresting parts of the process.

Finally, from an industry evolution standpoint, having a clear sense of what information is considered proprietary, and what can be shared with the larger user community will shorten the EDA cycles of learning, and accelerate the benefit of this technology for all stakeholders. A supplier-developed equipment model, based on industry standards and best-known methods, is the clearest way of defining the equipment data elements intended for access by the customer.

(SEZ's Perspective...Continued from page 4.)

The worst case scenario would be a machine model unique to each customer. In this scenario exists the problem of the quality of data contained in the machine model. As the quality of the machine model is the precondition for usability of the EDA in the fab, this could become a significant problem. SEZ is prepared to discuss and resolve these issues with industry experts so we all gain the maximum benefit from the EDA standards.

Questions should be directed to: bpust@sez.at

Faster Time
to Market.

Passionate
Support.

State of the
Art Architecture.

Getting Quality Data into Interface A

by Brian Rubow, Product Manager, Cimetrix, Inc.



If you are an equipment supplier investigating Interface A implementation, here are some items for consideration:

- Interface A is all about transferring quality data from point A, a source inside the equipment, to point B, the client.

It sounds easy enough on the surface.

- Remember that Interface A messages are all SOAP/XML, transferred using the HTTP or HTTPS protocol using a web service.

Well, this could be some work.

- IDMs (Integrated Device Manufacturers) expect the highest data quality, better than the traditional SECS/GEM experience. Data quality is critical and will be validated.
- Not too surprising, but it will definitely require some careful architectural design.*

- IDMs require equipment to support 50 or more data points per process chamber at 10 Hz. The underlying technology should be capable of 10,000 data points per second.

Wow, that's really fast for SOAP/XML over HTTP! This needs some advanced design work and experienced software programmers.

Taking Interface A implementations too lightly can result in delayed acceptance and rework. Following are some guidelines to help get it done right the first time.

What kind of data gets transferred and where does it come from?

There are six types of data to deal with: events, exceptions, parameters, E39 objects, object attributes, and job lists. A

complete Interface A solution handles all of these elements. Clients won't gather all of the data all of the time; just a subset of the available data as needed.

Events asynchronously notify the client when something of importance occurs, such as when processing starts, finishes, and intermediate steps. Events are triggered by software milestones or state changes during equipment operation and diagnostics. Some events are triggered by changing hardware signals and state changes. Yet other events are caused by outside influences like material arrival, operators, or factory automation. Any equipment device or module can report events to notify when any subsystem changes state. Events allow clients to keep track of equipment activity and also allow the critical high speed data polling to occur only during the important operational phases.

Exceptions notify clients when something unexpected failed and when the situation is resolved. This may be a detected by hardware or software. Some exceptions shut down equipment operation while others serve as warnings for potential problems. Any device or software module that can report a significant failure can provide an exception.

Parameters are data points with values that are floating points, integers, Booleans, arrays, structures, or other types. Parameters can be associated with specific events or exceptions. A parameter might be directly associated with a digital or analog signal on an I/O device, memory in a PLC, a memory location in software, equipment settings, operating system property, software state, hardware device property, switch on an interface, or a calculation from various inputs. Literally any hardware or software component might be associated with a set of parameters; therefore any component must be able to provide the data by some means. While critical data might be polled at rates of 10 or 20 Hz and therefore require a high performance internal implementation, all data does not need to be updated at such a high frequency.

E39 objects, object attributes, and job lists typically

The Standard **etric**

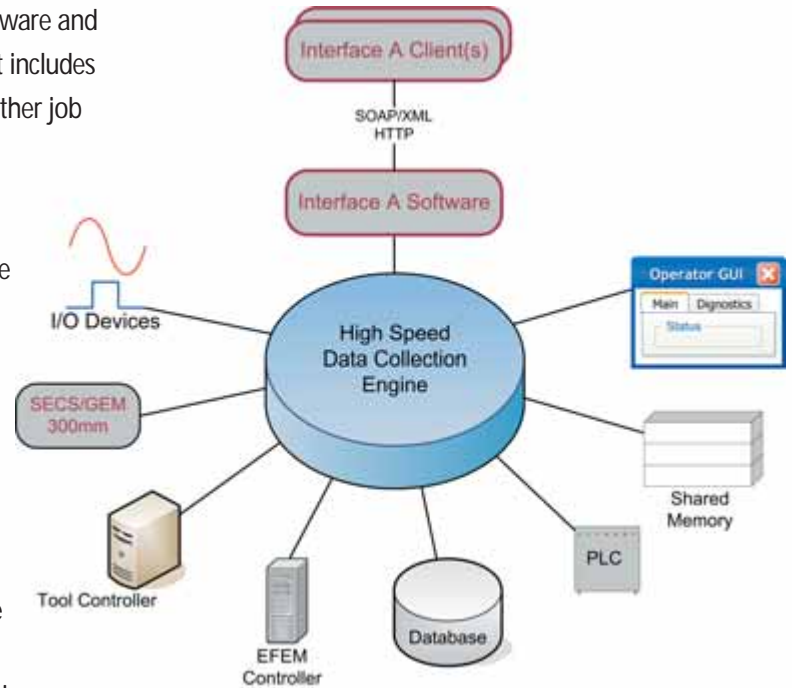
(Get the Data... Continued from page 9.)

originate in the SECS/GEM/300mm interface software and related equipment supervisory software. A job list includes recipes, process jobs, control jobs, and possibly other job types.

An architecture for success

Every equipment is a combination of multiple hardware and software modules including multiple hardware devices, Programmable Logic Controllers (PLCs), and often multiple computers that might even be different operating systems. It should be clear that all hardware devices and software modules can contribute to Interface A data. While it might be easier to design based on existing layered technology, the best architecture to meet IDM expectations mandates inserting Interface A software with a high speed data collection engine capable of gathering data as directly as possible from the variety of data sources. In order to achieve the desired data rates and robustness, select proven software technology that has demonstrated the ability to achieve the target frequency, volume, and reliability.

This implementation allows the critical data to be gathered at the highest frequency while less critical data is gathered at slower rates. In other words, the data collection implementation must be appropriate to the data. It also allows all of the software and hardware components to contribute directly to Interface A without interdependencies or layers to degrade data quality. Even if all of the components do not contribute data in the first version, such a system allows for easy data plumbing later with minimal effect or change in the earlier implementation.



CIMPortal Interface A Architecture

Summary

It is not a simple task to implement Interface A. The implementation architecture must acknowledge and accommodate the wide variety of data sources that must contribute Interface A data today and tomorrow. Plan for the future and for success by using a solution that won't have to be replaced as new data and higher frequencies are requested.

Cimetric created the CIMPortal product with a solid, proven architecture to satisfy the demanding Interface A requirements. The CIMPortal Server acts as a high speed data engine where one or more Data Collection Interface Modules (DCIM) can acquire data directly from a number of different equipment components and deliver it via the Interface A standards.

*Faster Time
to Market.*

*Passionate
Support.*

*State of the
Art Architecture.*

Contributing Authors



Dave Faulkner is Executive Vice President, Sales and Marketing at Cimetrix. He joined the company in August 1996 as Executive Vice President of Marketing. Prior to Cimetrix, Mr. Faulkner was employed from 1986 to 1996 as the Manager of PLC Marketing, Manager of Automotive Operations and District Sales Manager for GE Fanuc Automation, a global supplier of factory automation computer equipment specializing in programmable logic controllers, factory software and computer numerical controls. Mr. Faulkner holds a Bachelor of Science degree in electrical engineering and a master's degree in business administration from Rensselaer Polytechnic Institute.



Paul McGuire is a senior manufacturing systems consultant at Alan Weber & Associates, and is a specialist in mission-critical distributed manufacturing system design and implementation. Before joining AWA, Mr. McGuire spent his most recent two and a half years at KLA-Tencor's Control Solutions Division, where he was the software technical lead for the Catalyst product. In his previous employment as a National Semiconductor assignee to SEMATECH, he helped formulate components of the SEMATECH CIM Framework, based on a C++ prototype implementation. While working at National, and previously at General Electric's Factory Automation Division, he gained a broad exposure to manufacturing domain applications which included manufacturing execution systems, statistical process control, process specification and automated planning, document revision management, and recipe management and automated download; as well as manufacturing systems implementation technologies, including legacy network and relational databases, and message bus and CORBA distributed systems. Mr. McGuire earned his Bachelor's degree in Mechanical Engineering at Rensselaer Polytechnic Institute, and a Master's in Manufacturing Systems Engineering at the University of Texas at Austin.



Bostjan Pust is a director and chief architect of the software and hardware Research and Development department at SEZ. He has 20 years experience in the semiconductor industry, and has

designed semiconductor equipment control systems for the past 15 years.



Brian L. Rubow has been a principal engineer at Cimetrix since June 1993, and a software programmer since 1988. He has been working with the SEMI communication standards since 1995. Mr. Rubow holds a Bachelor of Science degree in mechanical engineering and a masters of science degree in manufacturing engineering from Brigham Young University.



Alan Weber is the President of Alan Weber and Associates, Inc., a consulting company specializing in semiconductor Advanced Process Control, e-Diagnostics, factory integration and communications standards, and other related manufacturing systems technologies. Prior to this, he was the Vice President/General Manager of KLA-Tencor's Control Solutions Division, acquired from ObjectSpace, Inc. in March 2000. Before joining ObjectSpace in early 1997, Alan spent eight years at SEMATECH and prior to that, spent 16 years at Texas Instruments. Mr. Weber holds bachelors and masters degrees in electrical engineering from Rice University. He is on the Board of Directors of Cimetrix Incorporated. Mr. Weber is also a Senior Associate of the Standards Technology Group, a company dedicated to the industry's learning and adoption of factory integration standards.



Harvey Wohlwend is a Program Manager in the Manufacturing Methods & Productivity division of International SEMATECH, Austin, Texas. He currently leads International SEMATECH's e-Diagnostics initiative. He also leads the deployment of an ISMT developed software tool (TP2), utilizing automatic data collection to capture equipment and fab operations performance data. Mr. Wohlwend joined SEMATECH in 1994 and previously worked in software quality and software process improvement. He also led ISMI's Y2K Readiness program. Prior to joining International SEMATECH, Mr. Wohlwend worked at Schlumberger and Control Data Corporation, and is a mathematics graduate of the University of North Dakota.

ECCE UPDATE

The ECCE, or Equipment Client Connection Emulator, is an Interface A reference client which can be connected to any equipment supporting Interface A to exercise its functionality. See the Spring edition of The Standard for more details. The ECCE was based on consensus requirements from the ISMI member companies and is provided royalty free to the industry through the ISMI website. Cimatrix was selected in July of 2005 to develop the ECCE, which is widely used as a reference EDA client during equipment software development and verification. Later this year, the ECCE source code will be offered to the industry following industry standard "open source" licensing. If you don't have a copy of the ECCE, visit the ISMI website, <http://ismi.sematech.org/emanufacturing/ecce.htm>.

The ECCE was the first step by ISMI to provide a testing path for the Interface A standards. The next step was the

publication of the ISMI EDA Evaluation Method. This set of guidelines to evaluate equipment supplier implementations is available at <http://ismi.sematech.org/docubase/abstracts/4664btr.htm> and can use the ECCE to perform the evaluation steps. ISMI is now working with technology suppliers to develop an automated scripting tool that is capable of automating the method defined in the ISMI EDA Evaluation Method. This will be called the EDA Interim Evaluation Utility (EIEU) with expected products from a variety of suppliers (including Cimatrix) during the second half of 2006. Finally, ISMI has published a specification for an Advanced Software Tester (AST), <http://ismi.sematech.org/docubase/abstracts/4672beng.htm> which will validate the conformance of the integration and automation capabilities of semiconductor manufacturing equipment primarily to SEMI standards and industry guidelines, including Interface A. It is expected that products conforming the AST will be available during 2007.

Faster Time to Market.

Passionate Support.

State of the Art Architecture.



CORPORATE OFFICES

6979 South High Tech Drive
Salt Lake City, Utah 84047-3757, USA
Phone: 801.256.6500
Fax: 801.256.6510

www.cimatrix.com