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e-diagnostics:

Moving beyond the data ownership issue

Ralph Castain,
Advanced Energy Industries Inc.
Fort Collins, Colorado

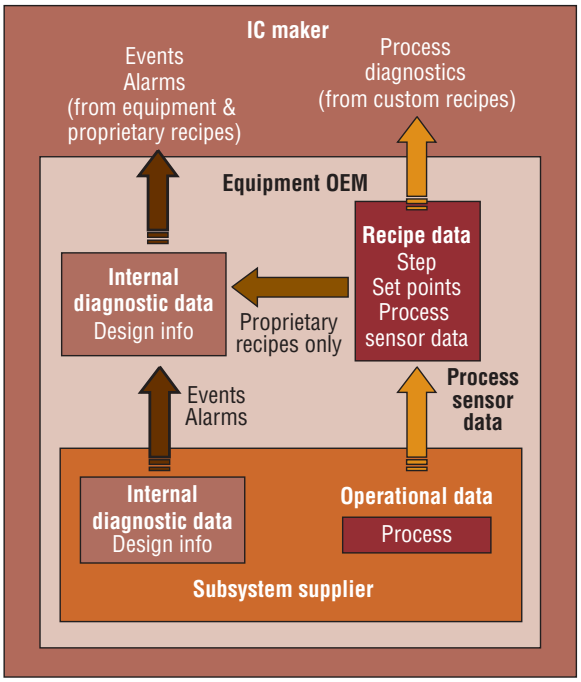
Bill Shade,
Advanced Energy Industries Inc.
San Jose, California

Enhancing overall operational efficiency in today's fabs hinges strongly on the ability to predict maintenance needs and rapidly diagnose faults on key systems. To date, the approach taken has focused on the definition of standards for communicating low-level data from subsystems and sensors on individual process equipment — providing transparent access across the fab to all information for any given equipment. One issue that needs to be addressed, however, is data ownership. How does an equipment provider protect its intellectual property while completely exposing all of its data? How does an IC maker prevent the flow of proprietary information out of the fab while still allowing remote diagnostics?

One way to address the logjam is to take a lesson from other industries that have encountered similar conflicts. In the transportation industry, for example, similar issues concerning connectivity vs. exposure of intellectual property are commonplace. Resolving the problem required stepping back from the connectivity details and, instead, defining the desired goal in terms of the necessary functionality at each level of the system.

In the automotive case, adherence to on-board diagnostics standards required the identification and communication of faults within major subsystems. Given this goal, the industry partitioned responsibility for creating the fault diagnostic signal by first acknowledging where the best expertise resided for detecting faults, and then agreeing on standards for communicating the resulting information.

Applying a similar process to the semiconductor equipment industry could help solve the data ownership dilemma. Although there will be some lack of definition at the boundaries, we can nonetheless begin the process by partitioning the semiconductor situation into the following two functional areas: equipment-level fault detection; and process-related diagnostics that are not directly tied to equipment failures (see figure).



The semiconductor situation can be partitioned into the following two functional areas: equipment-level fault detection; and process-related diagnostics that are not directly tied to equipment failures.

Responsibility for the latter functional area can be apportioned between the IC makers and original equipment manufacturers (OEMs). The OEMs could be assigned responsibility for providing fault detection and diagnosis for "built-in" recipes, and for providing the necessary "hooks" for IC makers to access sensor data and/or define fault detection and diagnostic algorithms for all "custom" recipes they program into the equipment themselves. In this way, IC makers and OEMs each protect their own key information while still accomplishing the overall objective.

If the industry wants to create the capability for rapid fault diagnostics and predict maintenance needs for process equipment, it makes sense to place the functional responsibility for identifying both incipient and existing equipment faults on OEMs. OEMs have unique knowledge and access to the specific equipment design that should enable them to meet and enhance these capabilities.

Likewise, since many of the most critical faults will occur

Ralph Castain is VP/GM of integrated controls at Advanced Energy Industries, 1625 Sharp Point Dr., Fort Collins, CO 80525; ph 970/407-6432, e-mail Ralph.Castain@aei.com.

Bill Shade is director of marketing-data management at Advanced Energy Industries, 6389 San Ignacio Ave., San Jose, CA 95119; ph 408/574-2504, e-mail Bill.Shade@aei.com.

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in subsystems provided by outside suppliers, the OEMs should extend requirements for fault detection, diagnosis, and prediction down to subsystem suppliers. Again, subsystem manufacturers are most knowledgeable regarding the failure modes of their particular subsystems. In addition, they have the ability to incorporate sensors and algorithms directly into subsystem design that can enhance these

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capabilities. Assigning responsibility for predictive maintenance and fault detection to the subsystem supplier also provides an incentive for it to improve the understanding of the fault modes of its systems, thus resulting in a trend toward higher reliability systems.

Given this methodology, the e-manufacturing standards process can move beyond the issue of data ownership to focus on the much easier task of defining the communication hardware and software standards for interfacing predictive maintenance and fault diagnostic notification messages. The emergence of these standards is a critical requirement in achieving the industry's desired objectives. Without them, proactive subsystem suppliers who incorporate fault detection, diagnostic, and prediction capabilities into their equipment will continue to struggle to communicate the results at both the equipment and the fab level. ■

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Advanced Energy Industries, Inc.
World Headquarters
1625 Sharp Point Drive
Fort Collins, CO 80525 USA
Phone: 800.446.9167
Fax: 970.221.5583
www.advanced-energy.com