Smart Control of Data That Drives Production

Information fuels the system that *runs* the plant.

Laura Scholten

PCB manufacturers intent on pursuing growth and more profitable operations must proactively manage their production information and update their data management. Strategic planning must also include meeting the challenges created by market drivers. Last year, Gene Hendrickson of General Management Integration (Gaston, OR) described the challenges facing Tektronix Corp. (Forest Grove, OR):

- a steep ramp-up of SMT for new products, requiring ultrafine-line technologies and leading to the MCM-L, niche
- increasing customer pressure for significant improvement in quality and delivery
- customer plans to reduce the number of suppliers to a few of the best
- increasing pressure to improve financial performance.

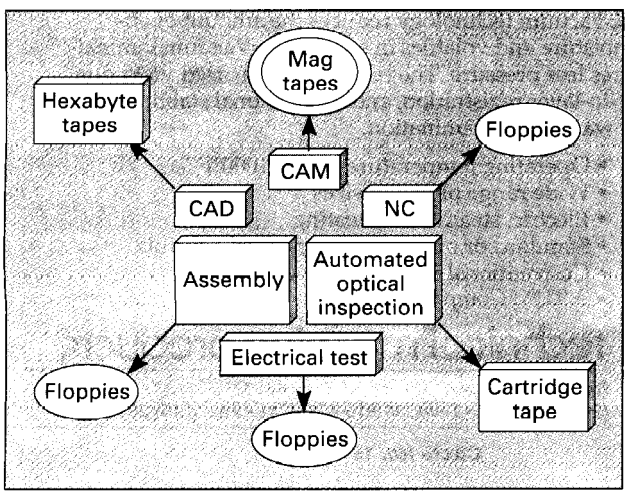

Figure 1. Disconnected archive.

This short list of critical factors is probably applicable for most fabrication facilities across the country, if not throughout the world, The product information management (PIM) systems addressed here exert a great influence on these issues.

Over the last 10 years, there has been explosive growth in the amount and use of production information in fabrication. In the early 1980s, most processes were done manually, from board layout to production tooling. Today, these operations are all performed electronically, creating data to drive production processes from photoplotting to AOI and ET. Managing the continuing explosive growth is essential. Improper management can have a serious adverse effect on the ability to meet market challenges and a devastating impact on a facility.

The Big Picture

The first and most important step is to consider the overall picture. Create a diagram of the general PIM concept. Don't focus on details charting the data path or creating a layout of the operation; concentrate first on a top-level view of the working concept.

For many companies, the PIM system is just a collection of archiving activities that occur when data is created or modified (Figure 1). The equipment or tools receive the primary focus, while the data files are stored off-line in disconnected archives. The tooling process has been depicted with the CAM equipment in the center. The design process has been illustrated with the CAD function also at the core. These views were correct in the past. However, today we recognize that it is the data itself that is the critical issue, and therefore the center of the system. In Figure 2 the data has the central focus, and the editing tools and production processes surround this core, interacting with it as needed. The data manage-

ment concept changes from one of archiving obsolete, raw data to managing active, usable production information.

Today's PIM system has a new core; the critical issue and heart of the system is the data. Editing tools and production processes properly surround the data and interact with it as needed (Figure 2).

The Heart of the System

After using CAM for years, many of us find ourselves inundated with data on tapes, floppies, cartridges, cassettes, and hard discs, on site and off. We need tools to manage this tremendous store of data.

Leonardo Da Vinci is famous for levers and gearing systems that enabled man to manipulate weight many times greater than he could manage unaided. A sound PIM system provides similar leverage to manipulate data more effectively than could be based only on knowledge and memory. It empowers companies to grow beyond relying on one individual who can remember the jobs and problems of the past.

The proper tool handles many data management tasks including:

- capturing all disconnected data archives
- transforming raw data from a relational database into useful information
- searching data by job attributes such as customer, date, operator, job type, and revision
- linking production information notes to data files
- providing complete revision control
- opening architecture to facilitate site integration with other systems
- providing facility-wide viewing
- releasing and controlling obsolescence on all product data
- ensuring that every new file is tied into the system
- providing protection from accidental data erasure.

How do these tasks combine to address the four challenges facing our industry? A few examples illustrate improvements in quality and delivery. Quick and correct access to part information facilitates faster tooling times on the initial product and future revisions. Conscientious archiving protects customer data integrity throughout the process. Data analysis and reporting tools provide valuable information for improving performance. Shop floor viewing helps ensure correct program selection. Instant access to information reduces trouble-shooting time and improves results. Data security eliminates delivery problems due to missing and corrupt files. Performance improvements in these and other areas help the facility become or remain one of the industry's best by improving financial performance and enabling production of higher-technology products such as MCM-Ls.

Separation of Church and State

The significance of the customer's original image data and the work it must perform are apparent. With

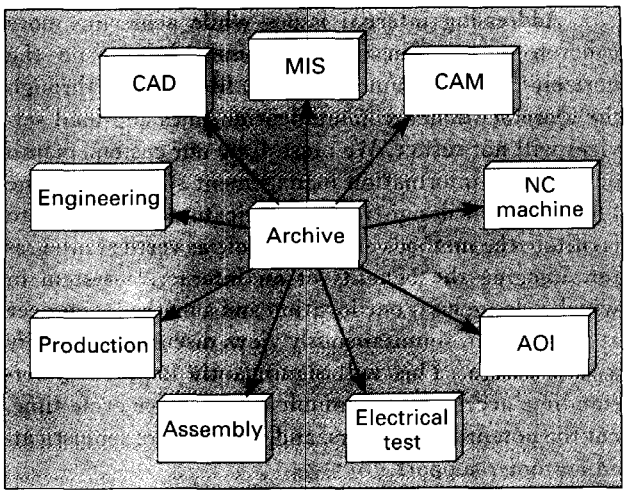

Figure 2. Centralized archiving system.

that understanding comes the decision to separate single-image work from the production programming manipulations needed to actually build the board. This is why, as shown in Figure 2, there is a distinction between the two areas.

To ensure the single-image data is correct and optimized for production, manufacturers bring their methods engineers closer to their customers. This is done through job definitions and communication tools, not geographically. A job definition can place all responsibility for the single-image data with the methods staff rather than distributing it across the tooling department. Engineers then not only specify the manufacturing process, create the router, and define data changes, but also make the changes. The methods engineers become the vertical integrators, managing the technical bridge between customer and fabricator. They guarantee that the customer receives the desired product while also ensuring its manufacturability. This shortens the customer communications loop and the tooling time, reduces the possibility of human error, and may improve quality and yield. Communication tools to support this work have so far been limited to shipping out the data and hard copy via phone lines and mail services, with no real-time interaction.

Along with the expansion of methods job definitions, there has also been growth in the tools for the single-image work arena. Software is now available to analyze jobs, determine production requirements and job routing, do costing, order material, and run shop-loading simulations more efficiently. These activities also address quality, delivery, and profitability.

The Future of PIM Systems

Many tools are available that support the core archiving concept shown in Figure 2. The current challenge to fabricators lies in implementing and consistently using these tools to achieve the benefits discussed.

Addressing internal issues while achieving more concrete integration with customers is next on the horizon. Typical connections via file transfer through the aforementioned communication lines and mail services will not suffice. We must draw our customers into our product information management systems. On-line links between designers and fabricators are needed to facilitate the methods engineer's role as vertical integrator. Imagine the benefits of an interactive system in which a designer at one location and a methods engineer at another can simultaneously view, discuss, and modify a new design. This will significantly improve understanding, accelerate communication, reduce cycle time, cut the potential for errors, and enable more sophisticated customer support.

Another opportunity for improvement exists in the current structure of production software applications. While it is now practical to access data from a variety of applications, the applications themselves do not have the ability to interact. For example, it is possible to create a drill program using one software application while using the step data created in another. Unfortunately, it is much more difficult to use the optimization routine from one application while programming with another. This potential integration of the actual applications themselves can lead the tooling area to its next advance in productivity.

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In the 1980s, a prerequisite to this kind of flexibility involved selecting a single supplier for all the tools, i.e., paying someone else to ensure your integration. This expedient, however, curtailed the user's choice in selecting the best software for each application. In the second-generation approach, a system manager was hired to work long hours to create links and network various applications together on a custom basis.

The third-generation answer comprises two parts. First, the central archiving concept is needed to support file access independent of application software. It acts as a data backbone to which the vertically integrated processes can attach. Second, the software tools must be based on a concept of modularity, using common standards so they work together in an integrated environment.

The CAD Framework Initiative (CFI) was created in the CAD community to address these integration issues within their own context. Perhaps a similar framework is needed, such as a Manufacturing Framework Initiative (MFI). Such an organization could be formed through the IPC, perhaps by a consortium, or independently with membership guidelines similar to those of CFI. The result could create an optimized yet flexible and integrated tooling system at each step, using the software tool defined by specific needs of the job and the fabricator.

Conclusion

A dynamic, productive tooling operation is critical to the creation of a world-class PCB facility. The demand for more and better product data will only escalate. It is essential, therefore, to plan for that growth. When doing such planning, it is worthwhile to examine an existing PIM system concept to see if the heart of its operation is indeed data. From there, implementation of an archiving system with the tools to intelligently manage the data is crucial. The next steps in data management require the involvement and support of suppliers in migrating to modular software development and defining and using standards. Growth in the amount and use of data in our operations is guaranteed. How we plan and meet that challenge is key to our overall success. FAB

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This paper was first presented at the IPC's 1993 Fall Meeting in Washington, D.C.