Industry White Paper

Living with the Dynamics of Electronic Components

The Importance of Component Event Management
in a PLM Strategy

Executive Overview

There is a fundamental disconnect in the lifecycle of products that contain electronic components that drives excess costs for OEMs and contract manufacturers that produce these products. This disconnect is not between the products and the electronic components that they contain, but between the *lifecycles* of the products and the *lifecycles* of the components. The root cause of the lifecycle disconnect is that the duration of an electronic component's market life is significantly shorter than the life of the product that contains it. This is often true for the active selling life of the product, but even more true for the maintenance portion of the product lifecycle. With component lifecycles shrinking, it is becoming more difficult to manage the lifecycle of products that rely on the components inside.

The impact of the product-component lifecycle disconnect is that manufacturers must expect and accommodate disruptions in component lifecycles during the active life of their products. This disruption can result in significant costs to the business, as well as significant lost opportunities. These costs can take many forms. In the extreme case, a component change could result in a part shortage that would shut down production or limit the ability to service a product. The direct cost and impact on customer satisfaction in these situations can be astronomic. More frequent scenarios fall short of those high-profile scenarios, but accumulate to significant costs. Parts may need to be procured at highly unfavorable rates because of reduced negotiation time, the company may be saddled with excess inventory, or they may face a critical shortage of inventory and need to buy through brokers at significantly higher costs. A commonly reported statistic is that 80% of a product's costs are locked in at design time. Without proactive management of changes in component lifecycles, that 80% cost is not only locked in as a minimum cost, it is also at risk to inflating rapidly because of a component lifecycle issue. To compound the issue, an increasing amount of product manufacturing is being outsourced, making the problem more complicated as the OEM, contract manufacturer and potentially third party design firms must coordinate to effectively respond to component lifecycle disconnects.

The most challenging obstacle to resolving component lifecycle disconnects is time. Given time, companies can react to component lifecycle problems. End of Life (EOL) notices and Part Change Notifications (PCNs) are an everyday occurrence, but many companies don't have a process to effectively monitor the impact of these changes, or "Component Lifecycle Events". With each passing day that an event is not identified and acted upon, the options for resolution become less palatable and more expensive. The time required to address a Component Event includes the time to identify the relevance of the event, to react to the event and to bring the event to a resolution. Without a disciplined process to identify, react to and resolve Component Events, they are like little bombs waiting to blow up the product lifecycle (or at least the P&L).

Component Event Management promises an answer. Component Event Management is a methodology to systematically detect and resolve Component Events in the most timely and efficient manner possible. This paper will introduce the philosophy of Component Event Management and introduce a new category of software that is being developed to help implement this concept and improve business performance.

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Product and Component Lifecycles - The Disconnect

Industries that rely on electronic components, such as medical devices, aerospace & defense, communications, networking, test & measurement, computer hardware, automotive and consumer electronics, struggle to keep up with a basic problem when managing their product lifecycles. The problem that these industries face is that the life cycle for their products, whether in active production or in service and warranty repair mode, is far longer than the average life of the electronic components inside of it. This means that companies in these industries must stay on top of changes in the lifecycle of the electronic components they use, particularly End of Life (EOL) notices and Part Change Notifications (PCNs).

The challenge in managing component obsolescence is not limited to new products, of course. Some of the largest challenges caused by obsolete components come from servicing products in use at existing customers. Product usage lifecycles are typically longer than the active product production, marketing and sale of the product, so older products don't always get the attention that they require. Older products provide another challenge as well, because the product information and bills of material are much less likely to be accurate and complete. Today's business suffers from past product and company acquisitions and reductions of force, resulting in much of the uncaptured product knowledge being lost. Component engineers that don't have the benefit of historical knowledge for products that they did not work with during development are at a disadvantage when it comes to identifying and resolving component issues.

Further complicating the management of component lifecycles is today's increasingly shortened component lifespan. The average lifecycle of an electronic component is short; some estimate the average to be about two to three years. Lifecycles have become shorter because of technological advances, but also for financial reasons – such as the sudden collapse of entire end markets, as we recently saw with the folding of many businesses servicing the telecom industry. Additionally, regulatory issues can also play a role in speeding the demise of components, as with the emerging international laws forcing manufacturers to lessen the contents of lead and other hazardous materials in their products.

Electronic Component Manufacturers, ECMs, try to adhere to an industry standard of 180 days notice before a part is changed or declared at end of life. Even with shortened design windows achievable today by better engineering practices and tools such as Product Lifecycle Management (PLM), rapid response to component changes is essential.

The Impact of Component Events

Electronic components are a major part of the design of many modern products, and are playing a larger role in products than ever before. As more products have become "smart", the requirements for even simple products to sense and react has led to the incorporation of more sophisticated electronic components. A component change or obsolescence that goes unnoticed or unaddressed in one of these products can result in significant costs to the business, as well as significant lost opportunities.

The cost of a Component Event is highly dependent on the time available to resolve the event. Ideally, a component event is identified during the design cycle for a product and addressed before any significant commitment is made to the component. Short of that, a substitute part or alternate manufacturer may be able to be identified, tested and approved for the product. If the part can't be substituted or replaced, then alternate sources of inventory may need to be identified. With enough lead-time, an adequate amount of inventory can be purchased through the regular channels and at a somewhat reasonable cost. Purchasing this inventory buffer has associated risks in potentially carrying unneeded inventory, but can provide a safety net. If too much time has passed and the regular procurement channels can't meet the demand, then the company may need to turn to alternative sources of supply such as brokers where the costs are very likely to be unfavorable. As a last resort, the product itself could be redesigned so that the offending component is no longer required, but the cost and lead-time required for this can lead to significant expense and may not be economically feasible.

The cost of a Component Event isn't limited to direct costs, however, because on the other end of a component shortage may be a customer waiting for a needed product. The direct cost of a mishandled Component Event may be compounded by customer dissatisfaction and lost business. But the direct costs alone can justify a Component Event Management strategy. Figure 1, which represents costs developed from the military sector, was derived from the GIDEP DMS Utilization Module. While these numbers can't be applied directly to any particular organization, they illustrate the increasing costs associated with less favorable resolutions to Component Events.

Alternative	Cost
Choosing an alternate part (equal or better specs)	$4000-$9000
Choosing an alternate part (worse specs)	$15,000 - $24,000
Aftermarket (not broker)	$41,000 - $59,000
Minor redesign	$82,000 - $153,000
Major redesign	$361,000 - $505,000

Figure 1: Relative Cost of Component Event Resolution Options
Source: Derived From GIDEP (Government-Industry Data Exchange Program) DMS Utilization Module.

GIDEP is a cooperative activity between government and industry participants seeking to reduce or eliminate expenditures of resources by sharing technical information essential during research, design, development, production and operational phases of the life cycle of systems, facilities and equipment. For more information see www.gidep.org.

The Fuses Have Been Lit

Component Events could be compared to a bomb with a fuse that has been lit, lurking unseen and waiting to disrupt the lifecycle and profitability of the impacted products. The first step in addressing a Component Event is identifying that the component change has occurred, and that it will have an impact. The number of component changes on a daily basis is large, and sifting through the multiple sources of information is demanding at best. According to studies conducted by PCNalert, which maintains the industry's most comprehensive database of component PCN and EOL information, as many as 20,000 components are materially changed or withdrawn from the market every month. Given that volume of change, it may be impossible to keep up with all of them manually, particularly given reduced headcounts typical in many component-engineering groups.

Component Events are not as simple as an End of Life (EOL) notice or Part Change Notifications (PCNs). While these notifications are the early indicators that a Component Event may have occurred, they are not meaningful until they are put into context. Component lifecycle changes must be associated and analyzed in the context of the products that contain them. A Component Lifecycle Event puts the EOL or PCN into the context of the impacted products and their associated lifecycles. Without the context of what products are impacted, the notifications are simply more raw information to sort through. When the notifications are matched against Approved Vendor Lists (AVL's) and product BOMs they can be identified as Component Events.

Component manufacturers, for the most part, will provide the appropriate notifications that a component is becoming obsolete. Following our analogy, this is point at which the fuse is lit, setting in motion three critical lead-times for an OEM's supply chain:

1. The first Component Event lead-time that needs to be addressed is the time from the notification to the time that a Component Event is identified. This time is highly dependent on the ability to analyze large amounts of data and put it into context.

2. The second Component Event lead-time that must be addressed is the time that it takes to react to the Component Event. Until the Component Event is delivered to the appropriate person to resolve it, no progress will be made. This time is highly dependent on timely notification and clear accountability for Component Events.

3. The final lead-time that must be addressed is the lead-time between the initial reaction and the resolution of the Component Event. This time is highly dependent on having the right information at hand to quickly analyze and react to the situation.

The combination of these three lead-times largely determines the impact that the Component Event will have on the business. Therefore, a key goal of Component Event Management is the reduction of these lead-times and increased efficiency in dealing with the Component Events.

The Windows of Opportunity Are Closing

The time it takes to resolve a Component Event is extremely critical to effective Product Lifecycle Management. In order to react to product changes, companies need time to select the best options. But, the windows of opportunity to choose and execute resolution options close rapidly with passing time. With enough notice, the component may be able to be designed out of the product altogether, manufactures of equivalent parts may be identified, or substitute parts validated for use in the design. As time continues to run out and the windows of opportunity for these approaches are missed, the only option may be to purchase additional inventory. Without adequate time to locate sources of supply and negotiate favorable procurement pricing, companies may be stuck purchasing on unfavorable contracts or through more expensive, secondary sources of supply like a broker.

Negative Impact Increases as Windows
Close on the Most Favorable Options
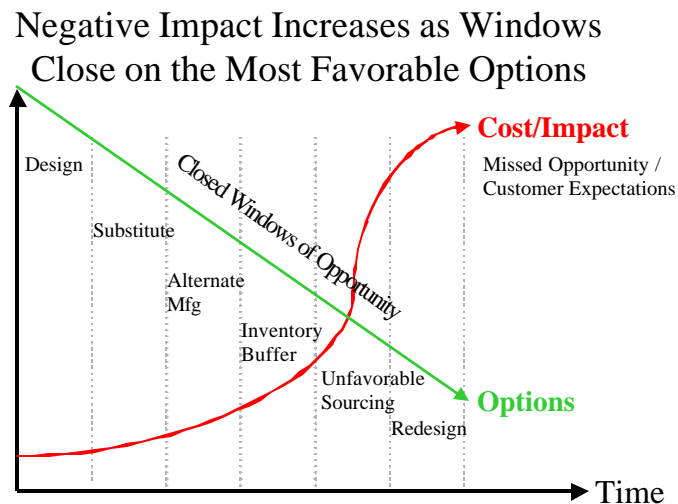
Figure 2: The Impact of Component Events by Time
Source: PCNalert

The options available to address component changes decrease with time, and the cost and impact increase as option windows close, making the time to react critically important to the business. The time required to resolve a Component Event is made up of several factors. The first issue, of course, is determining whether the Component Event will actually impact the company. Assuming the event will have an affect, in order for a company to react, they must not only be notified of the change, they must take action on it. Component change information is available from many sources. What is difficult, however, is isolating the relevant component change information, determining how it applies to the company's products, understanding what options are available to address the problems and then getting that information to the right people to act on it. In essence, the challenge is not just having the information. Although accurate and trusted information is a key requirement, for companies to benefit from the information it must be transformed into something actionable and delivered to the right person to act on it. This is not a trivial challenge in today's environment. Internal resources have gotten thin from successive layoffs in many companies. Mergers and acquisitions have increased the number and types of products being managed. And to make it even more difficult, the increasingly virtual nature of the supply chain is taking component decisions further out of the manufacturer's control.

Virtual supply chains and outsourced design and production are also transforming the resolution of the component issue from a cross-departmental problem, which is already challenging, to a cross-enterprise problem. Time to react is a factor of getting the right information to the right person at the right time, and with already thin resources, companies need to spend scarce design resources on resolving problems and not sifting through piles of disorganized information. Reacting to the change must also be managed effectively in order to compress the time required to develop a resolution. Proactive management of component issues is also required to compress the resolution time, particularly when the resolution is managed across departmental and corporate boundaries.

Enter Component Event Management

Component Event Management is an approach for the proactive management of electronic component lifecycles to provide faster identification, analysis and resolution of component events caused by product changes (PCNs), obsolescence (EOLs). Effective Component Event Management minimizes the risk and cost associated with Component Event impacts on the lifecycle of the product. This new discipline, and the software applications that support them, should be a part of the PLM Program for any company that relies on electronic components within their products.

Component Event Management provides a time-based, event-focused element to Product Lifecycle Management. According to Cliff Frescura of PCNalert, the pioneers in the concept of Component Event Management, there are 6 fundamental elements of Component Event Management. These 6 elements are critical to a complete Component Event Management Strategy in order to identify, react to, and resolve Component Events in the most efficient and cost effective manner.

The 6 basic fundamentals of Component Event Management are:

- **Monitor** changes to component lifecycles in the industry
- **Analyze** the changes to determine which are applicable
- **Identify Options and Alternatives** (including the impact)
- **Notify** the appropriate people (with actionable events)
- **Manage** through to resolution
- **Learn** to allow continuous improvement

Component Event Management is important throughout the lifecycle of a product. The challenge of shorter component lifecycles than product lifecycles leads to an unavoidable problem later in the lifecycle of the product. But problems can be avoided, or at least delayed, by addressing the component lifecycles throughout the life of the product. Starting early in the design phase, components should be evaluated for current and potential changes. As product designs are revised, or old designs re-used for new products, components should be evaluated for the potential of changes and obsolescence. Given the dynamic nature of the electronic components industry, this review should be done on an ongoing basis, and incorporated into stage-gate and design reviews throughout the product design and further through the life of the product. Profitability starts with a good design, and designing in bad parts is a sure way to increase risk, cost and downstream problems. Real-time, accurate visibility to component lifecycle information plays a key role in avoiding the impact of component problems. By applying these fundamentals in a unified Component Event Management Program, companies can reduce the time, effort and cost associated with disconnects in the component and product lifecycles.

Implementing Component Event Management

Companies that are embarking on an initiative to adopt Component Event Management must first gauge their current Component Event Management capability, or Component Event Management Maturity. There are four levels of Component Event Management Maturity identifiable by some key characteristics of the way the company identifies and manages component events. The first level represents a totally reactive environment, so it is classified as Level 0. Each successive level of Component Event Management Maturity is a step towards a more controlled, and more proactive Component Event Management environment. The top level, known as Level 3, represents a maturity level that incorporates the best practices for world-class organizations. A company must know where they currently fall on the Component Event Management Maturity Matrix (see Figure 3) and map their path from their current level to the desired level. It is possible to pass through more than one level at a time with a Component Event Management initiative, but there will be a need for more careful change management to adopt the new business processes required.

| Maturity	Monitor	Analyze	Options	Notify	Manage	Learn
0	Reactive	Manual	Manual	Manual	No Process	No Process
1	Internal Collection	Periodic BOM Scrubbing	Manual	Manual	No Process	No Process
2	Multiple External Sources	BOM/AVL Matching	Available Alternative Data	Workflow	Manual Repeatable Process	No Process
3	Single External Source	BOM/AVL Intelligent Matching	Alternative Data with Event	Workflow	Workflow Driven Process	Defined Process

Figure 3: The Component Event Management Maturity Matrix
Source: Tech-Clarity

New business processes are most effectively adopted in association with enabling technology. Leading companies are increasingly turning to software applications to drive changes to the way they do business. Because identifying and reacting to Component Events has become so time-critical, new applications have emerged that are aimed at providing faster recognition of component-related design problems, quicker reaction time to the changes, and compressed resolution times. This need has resulted in the creation of Component Event Management software applications.

Component Event Management software is complementary to current Product Data Management (PDM) and Product Lifecycle Management (PLM) applications, adding additional information and event management capabilities to better manage the component lifecycle. There are two key aspects that make Component Event Management different than PDM. The first is the concept of an "event". Component Event Management ties actions around externally driven events that must be addressed in a timely manner to avoid significant costs. The second is context. While PDM systems will likely contain electronic component part information, the information that is stored is only the information that is relevant to the company in the way the component is currently used in the business. A Component Event Management system will contain a broader set of information about the component, information such as substitute components, alternate sources of supply and detailed specification information not typically required until a Component Event occurs. In addition, the Component Event Management system will typically contain information about many more components than a typical company will have in use at any time, providing ready access to alternates parts and manufacturers.
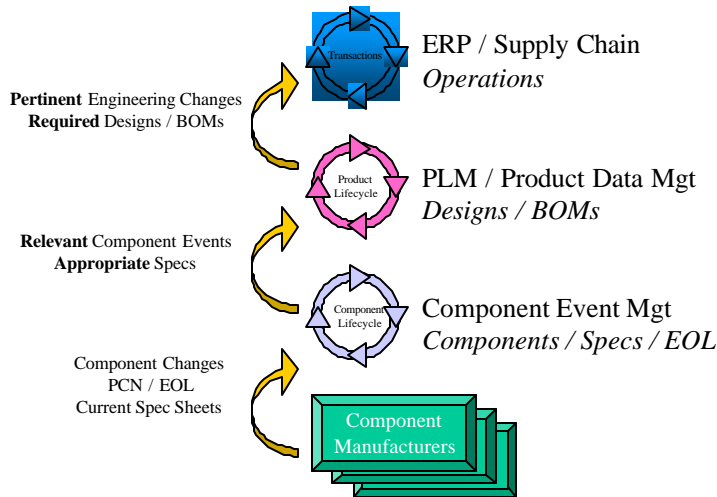
Figure 4: Component Event Management Complements ERP/PLM/PDM
Source: PCNalert

Recommendations

- Companies that have electronic components included in their products should view Component Event Management as a strategy for overall business process improvement, and include it in their PLM Strategy
- Examine component lifecycles before components are included in new designs
- Routinely review and monitor older products for component events
- Component lifecycle events happen frequently, include component lifecycle analysis at all phases of the product lifecycle
- Integrate Component Event Management with existing PLM systems
- PLM vendors that focus on markets that rely on electronic components should look for ways to offer Component Event Management
- Companies that are attempting to move more than one level up the Component Event Management Maturity Matrix with a Component Event Management initiative will need to pay more attention to change management issues, may require more outside assistance, and are more reliant on technology enablement of the new business processes

Conclusion

The key challenges in dealing with the disconnect between product and component lifecycles are having the time to react, and having the right tools to react rapidly. As design windows continue to shrink, this is a bigger challenge. With time, the company has more options and can reduce the costs and other impacts of unmanaged change. As companies are making their way through this difficult economy, many are taking the downtime to improve processes to position themselves to scale during recovery. Managing component changes and the impact on associated product lifecycles is an area that is ripe for process improvement to position companies to take advantage of the recovery without having to hire additional resources because of improved efficiency and reduced disruption from better management of component lifecycles.

About the Author

Jim Brown has over 15 years of experience in management consulting and application software focused on the manufacturing industries. Jim is a recognized expert in software solutions for manufacturing and has broad experience in applying enterprise applications such as Product Lifecycle Management, Supply Chain Management, ERP and CRM to improve business performance. Jim is a frequent author and speaker on applying software technology to achieve tangible business benefits, and serves as the PLM Specialist for Technology Evaluation and the related PLM Evaluation Center. Jim can be reached at jim.brown@tech-clarity.com.