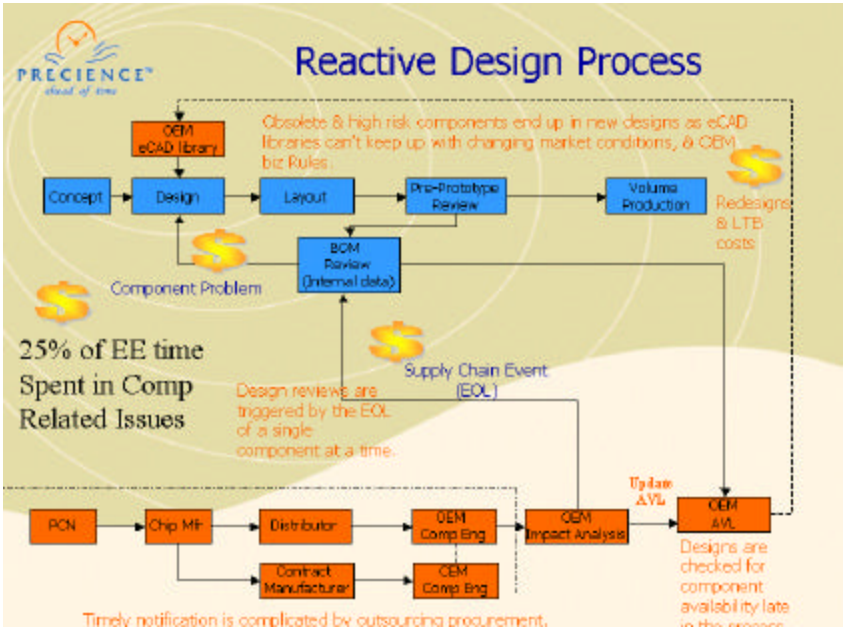
Bill of Material & AVL Organization and Component Lifecycle Management



Many OEMs are not surprise to learn that over 25% of engineers time is spent in part related issues, and over 70% of products cost is locked in at the design stage. Most of these costs are related to part related issues, varying from part organization, accuracy of data, and component selection to finally organizing supply chain sensitive bill of material.
Today engineering and PCB Designer spend many hours selecting parts, compiling and organizing a bill of material for final fabrication. Component engineers spend hours qualifying parts using mostly internal data, and in most cases forget to update the corporate EDA CIS databases. Organizing a good bill of material is a single most important critical engineering activity, which has impact on the overall profitability, time to market and product lifecycle.
Introducing new products for a company with a short design and product cycle is an expensive undertaking especially when revenues need to be recognized quickly and profits reinvested to continue bringing new products to the market.

Over 3000 parts change their status on a monthly basis. Surely some of these parts are possibly in your design, or in your EDA CIS databases. We find that in most cases, component engineers are now finally beginning to use commercial databases to qualify parts, and start looking at lifecycle data. In few cases the lifecycle data is actually loaded into the EDA CIS database process. Also a major flaw we see is that data within the EDA CIS library is loaded manually and not through automatic software automation. Hence most of these EDA CIS databases have “data latency” issues, ranging form days to months, even years. The data latency needs to be reduced to ideally minutes, if not then maximum 24 hours. This way we can be rest assured that data is about one day old.

Before we layout the guidelines for producing a good bill of material, we need to better understand the total lifecycle of a product and how it impacts profitably for an OEM. A bill of material once generated impacts downstream processes, such as manufacturing, maintenance, warranty and inventory allocation. All of these are part of the product costs and hence controlling these costs will maintain a solid profit margin. Selection of bad parts, will result is redesign, delays, scrap, and hence lower profit margins. Overall a 70% or more of a products cost is locked in at the design and development phases. One needs to understand how this cost can be optimized to increase profit margins. Following shows how we can improve this cost by better managing our material selection and hence more accurately aligning with the OEM & CEM supply chain constraints.

Following is a checklist for improving BOM organization:

Component & Material Selection:

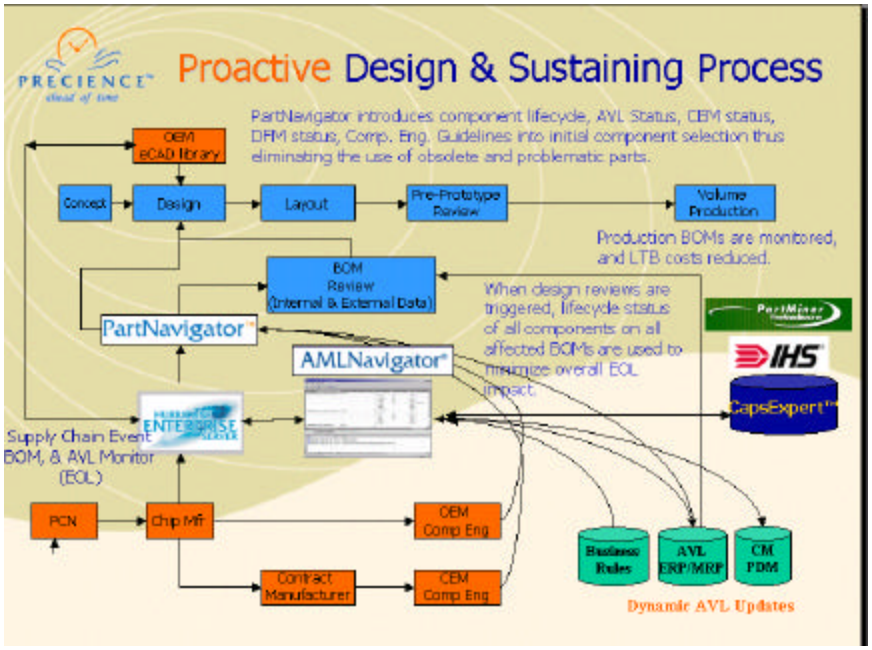
This area is a time consuming activity mostly related to poor component data organization, lack of data integration and information dissemination. A component database must be updated to reflect constant supply changes in the market, and at the same time meet internal procurement guidelines. The parts database must also provide "lifecycle" and other risk information. A lifecycle rating is key in selecting the proper component to match the product revenue life. This simply says how long this part will be in the market such as 3-4 years and risk rating is "Decline" etc. This will help in selecting parts with the correct lifecycle that matches the products service contracts. Also, a form-fit-fucntion analysis tools can also quick find similar parts, with better rating that engineers can select. This will reduce redesign, as parts become obsolete on a board. This is a critical issue for long lifecycle products, such as medical, automotive, and avionics.

Eight Steps to improve Material & Component Selection:

1- Part Obsolescence (End-of life EOL)- Over 2000 parts change status monthly. Is your parts database updated daily to reflect this change? Make sure your parts database is accurate and reflect latest market changes.
2- A preferred parts list or commonly known as "Approved Vendor List" (AVL) published by your procurement, material management, or component engineering department should be used. Do you have access to this data in your organization? Question the accuracy. Remember you are responsible for redesign effort, so lets focus on minimizing redesign in the future.
3- A preferred parts list published by your CEM partners. Most companies work with one to three CEM partners at a time, hence these parts lists

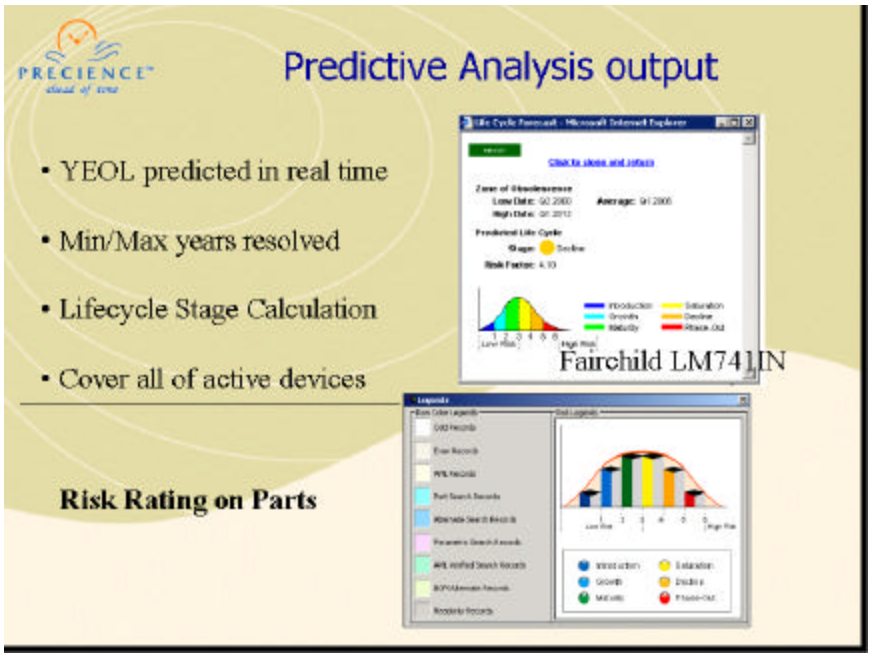
or AVLs should be available to you. If not request it from your CEM partners.

4- Access to an online component database that offers most up to date component information with status, PCN (Part Change Notice) and component lifecycle information. Commonly known vendors being Precience, I H S, I2, and Partminer.
5- Part – Reuse. Reusing parts that are already in the inventory and preferred will reduce risk in the long run (assuming lifecycles matches with your product). You can also use Form-Fit-Function rules for possible parts substitution.
6- Component engineering methodology in place to ensure BOM review, risk assessment and sign off.
7- Selecting Manufacturing materials that are suited for your CEM.
8- Having access to CEM manufacturing rules for PCB design process. Such as Valor ERF files, or similar data that describes "DFM" rules.
9- Select parts that have second sources available, this should be either defined by your procurement group, or from a commercial database such has "Precience, I H S etc."
10- Collaborate early with internal component engineering, and CEM partners to ensure that parts and design rules used will be accepted. You may have to pool your design rules from several supply chain partners, and create a master design rule file for PCB DFM. Same is true for component selection. Use common set of parts, which are acceptable by most of your CEM.



BOM Optimization and Analysis

A BOM analysis must be performed to check it's health for a specific lifecycle support, and maintenance. This involves making sure that all parts used are approved by all supply chain vendors, and meets internal quality, and procurement guidelines. There are automated BOM analysis tools, that can take an Excel formatted BOM, and analyze for all possible defects, including making sure all parts meet your internal procurement standards, optimized for reuse, and no notices are issued by the manufacturers such as EOL, or PCN. See figure one for a typical BOM Analysis report, one can construct by hand, but lifecycle data is something you have to pay for. Guessing lifecycle on a part can be disastrous.



BOM Preparation and Hand off:

Most companies utilize Excel as a common format to organize and share information. Although it has worked well in most cases, however for structural more complex BOM, Excel is normally not a good fit. A specific custom format will need to be generated to accommodate a smooth transfer to a CEM. Such formats can only be generated through automated PDM, PLM & CSM systems, such companies are Agile, MatrixOne, Precience, Omnify and others. Creating BOM by hand will result in data entry errors, it is always recommended to use some automated tools to manage this process. We recommend the following steps should be taken in ensuring a successful BOM preparation and hand off to a CEM.

1- Assign an internal company part number for each part.
2- Assign Manufacturer Part Number, and Name for each item.

3- Provide meaningful description for each part. Technical attributes can be included as well here.
4- Provide alternates to each part or second sources if available.
All information provided should be in a format that can be viewed, and shared. We recommend use of BOM collaboration tools here for markup, and sharing.
5- Place the BOM in a collaborative workspace so that it can serves as a single product data source for the enterprise in a single location. Using email and sending changes back and forth will introduce version errors, and ultimately production delays.
6- Use automated tools to compile BOM information directly from the design tools and avoid error prone cumbersome process of compiling BOM information by hand.
7- Safeguard information by making sure only company approved CEMs will receive the information that have signed NDA (non-disclosure agreement).
8- Review all the information with your CEM partner for completeness, and ask for a confirmation. This will eliminate finger pointing should any delays occur in transfer.
9- Create meaningful file names.
10- Start early by sending CEMs a draft BOM, and design information before the final release.
11- Many CEMs can analyze design and component information for DFM, and also for obsolescence. Ask for this service if your organization does not have these processes implemented internally.

Ensure accurate information is shared within the organization, which is critical to a company's success. Time to time audits must be conducted internally to improve the engineering, and supply chain processes. Once the product BOM is rolled into manufacturing, usually sustain engineering will take over and monitor the progress. It will analyze BOM for risk assessment, health of a BOM for obsolescence, and process changes on devices. This needs to take place in order to sustain product and production support. Having an automated enterprise software system which manages the BOM release and component supplier management results in following:

- Accelerated new product introductions with first turn success
- On time production ramp up in an outsourced global manufacturing facility
- Accurate delivery and quality for engineered-to-order products
- Reduced warranty risk and product liability
- Ensure production runs and reduce component availability risks
- Optimized and Automated decision support system
- Speed information to the engineering value change

In summary the common thread in making a successful product involves direct and open communication between a manufacture and an OEM. Sharing of information not only with the outside world, but equally important internally as well. Having access to all the current supply chain constraints will determine the profit margin of a product. In most companies engineering is a neglected asset in terms of executive management influencing engineering to better align to companies profit margin and supply chain

goals. More attention is needed to control 70% of the product's, which is locked in at the design stage. New forms of data automation are needed to create a real-time data access network, and decision support. It is all about making informed decision, which leads to first turn success. Your decision to select a material is only as good as the amount and quality of information available to you. Many times, good information is buried in islands of information within an organization; this needs to change to effectively compete in the fast moving global economy.

Biographical Data on Ahmed Khan
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Ahmed Khan received his BS degree in Electrical Engineering from Stevens Institute of Technology (NJ) in 1985. He holds a patent in microelectronics, and works for Precience, Inc as Founder & VP of Enterprise Product. Prior to Precience, he founded CADSoft Solutions, which was acquired by Precience. He also worked at VIEWlogic (now Mentor) as Sr. Application Engineer for fours years, responsible for addressing customer design problems, and demonstration for synthesis, and simulation software tools. Prior to Viewlogic he worked at RCA Advance Technology Labs (GE), as a Sr. Design Engineer. Ahmed has been actively serving the EDA software industry for the last twelve years.

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