



SmarTeam for Electronics

*Collaborative PDM solution supporting
mechanical, electronic and software
design in an integrated product
development approach*



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1. Executive Summary

A growing number of products today rely on electronics in the form of integrated circuits (IC), application specific integrated circuits (ASIC), systems on a chip (SOC), system level integration (SLI), and other semiconductor-based chips and components as well as supporting printed circuit boards (PCB) and embedded software.

The demand for electronic circuitry in telecommunications equipment, weapon systems, computers, consumer electronic products and other electronic-based products continues to increase. Moreover, a growing number of traditionally mechanical products contain significant levels of semiconductor circuitry and software including automobiles, industrial machines, agricultural equipment, medical devices, and home appliances.

The product development process for electronic products differs from that of strictly mechanical products in two respects. The development process for electronic products is generally much shorter and more compressed: demanding faster design turnaround and lifecycles (6 to 18 months for consumer electronics and IT equipment, for example), in contrast to mechanical products that often continue in operation for decades. Secondly, whereas mechanical products typically contain various levels of custom-designed parts, predominantly electronic products are mostly developed using combinations of existing off-the-shelf components.

Because of the need in mechanical design to develop parts from scratch and manage these design files efficiently, product data management (PDM) has been used extensively as a critical tool during the last decade for these manufacturers in a market where investments in the technology are readily justified based on a return-on-investment (ROI) over comparatively long product lifecycles. In contrast, manufacturers of electronic products have not relied as heavily on PDM, often managing data locally on EDA (Electronic Design Automation) systems and in many cases using error-prone manual keep-track schemes.

Clearly, electronic product manufacturers could benefit from advanced PDM technology, especially with the emergence of so many mechanical products with electronic circuitry. But a gap exists in the PDM industry, with most systems not well-suited to managing electronics and software portions of designs.

SmarTeam for Electronics from SmarTeam Corp. is aimed at closing this gap, supporting a combined environment for managing mechanical, electronic and software design files. Specific functionality is aimed at providing a single source of data for all users, facilitating the creation of combined bills of materials, readily importing data from an EDA system, efficiently managing electrical components and embedded software, and enabling users to easily re-use knowledge and best practices in developing electronic designs.

Business drivers of such an integrated solution include faster time to market for innovative products and increased opportunities for greater profitability in a fiercely competitive market. The objective is to bring the new product from concept to realization as quickly and efficiently as possible. The solution facilitates the bidding process by moving information along to suppliers quickly and accurately.

In the conceptual design phase through release to prototype and into detailed design, the technology manages and tracks mission-critical product data enabling the faster development of innovative products and speeding overall time to market.

SmarTeam for Electronics provides an excellent infrastructure for a design innovative environment, allowing all teams to share the latest data. Use of best practices and knowledge capturing enables the solution to facilitate a larger number of design opportunities executed in a shorter time.

2. Market Perspective

A growing number of products today rely on electronics in the form of integrated circuits (IC), application specific integrated circuits (ASIC), systems on a chip (SOC), system level integration (SLI), and other semiconductor-based chips and components as well as supporting printed circuit boards (PCB) and embedded software.

The demand for electronic circuitry in telecommunications equipment, weapon systems, computers, consumer electronic products and other electronic-based products continues to increase. Moreover, a growing number of traditionally mechanical products contain significant levels of semiconductor circuitry and software including automobiles, industrial machines, agricultural equipment, medical devices and home appliances. Cars have been described as “computers on wheels” with circuitry, logic functions, and on-board software controlling engine functions as well as steering, braking, suspension, fuel delivery, air conditioning, airbag deployment, and a variety of other systems. Likewise, home appliances such as clothes washers and dish washers that used to be strictly electro-mechanical machines now have much of their control functions performed through electronics.

According to the Semiconductor Industry Association, 60 million transistors were manufactured in 2001 for every person on earth, and the number is projected to increase to 1 billion by 2010. Industry statistics indicate that the growth rate for semiconductor sales is expected to accelerate in the coming years, even as chip performance continues its exponential climb, driven by new technology and advanced wafer production methods.

The product development process for electronic products differs from that of mechanical products in two respects. The development process for electronic products is generally much shorter and more compressed, demanding faster design turnaround in response to short product lifecycles (6 to 18 months for consumer electronics and IT equipment, for example), in contrast to mechanical products that often continue in operation for decades. Secondly, whereas mechanical products typically contain various levels of custom-designed parts, predominantly electronic products are developed mostly using combinations of existing off-the-shelf components.

Because of the need in mechanical design to develop parts from scratch and manage these design files, product data management (PDM) has been used extensively as a critical tool during the last decade for these manufacturers in a market where investments in the technology were readily justified based on a return-on-investment (ROI) over comparatively long product lifecycle.

In contrast, manufacturers of electronic products have not relied as heavily on PDM, often managing data locally on ECAD systems and in some cases using error-prone manual keep-track schemes.

Clearly, electronic product manufacturers could benefit from advanced PDM technology, especially with the emergence of so many mechanical products with electronic circuitry and embedded software. However, a gap exists in the PDM industry that often hinders companies from taking advantage of PDM in electronic product manufacturing, with most PDM systems are not geared toward electronics design. Specific shortfalls of most mechanical-oriented PDM systems in addressing the needs of electronics design include:

- No integration of mechanical and electronics data into a single source
- Difficulties creating a single BOM with both mechanical and electronics data
- Limitations in effectively managing electronics components and embedded software
- Little or no inclusion of industry best practices or facilities to efficiently re-use designs

SmarTeam for Electronics is aimed at closing this gap with features in each of these areas, thus providing capabilities for manufacturers to tightly integrate mechanical and electronics design for their products.

3. Business Drivers

The main business driver for these types of integrated PDM solutions is faster time to market for innovative products and increased opportunities for greater profitability. SmarTeam for Electronics brings manufacturers the speed and flexibility of a comprehensive design innovation environment combined with the structure and efficiency of a leading collaborative PDM system that enables many diverse and often dispersed groups to work together on a product design.

The objective is to bring new products from concept to realization as quickly and efficiently as possible. The solution facilitates the bidding process by moving information along to suppliers quickly and accurately. In the conceptual design phase through release to prototype and into detailed design, the technology manages and tracks mission-critical product data enabling the analysis of more opportunities and speeding time to market. More opportunities and faster time to market translate into greater return on investment faster.

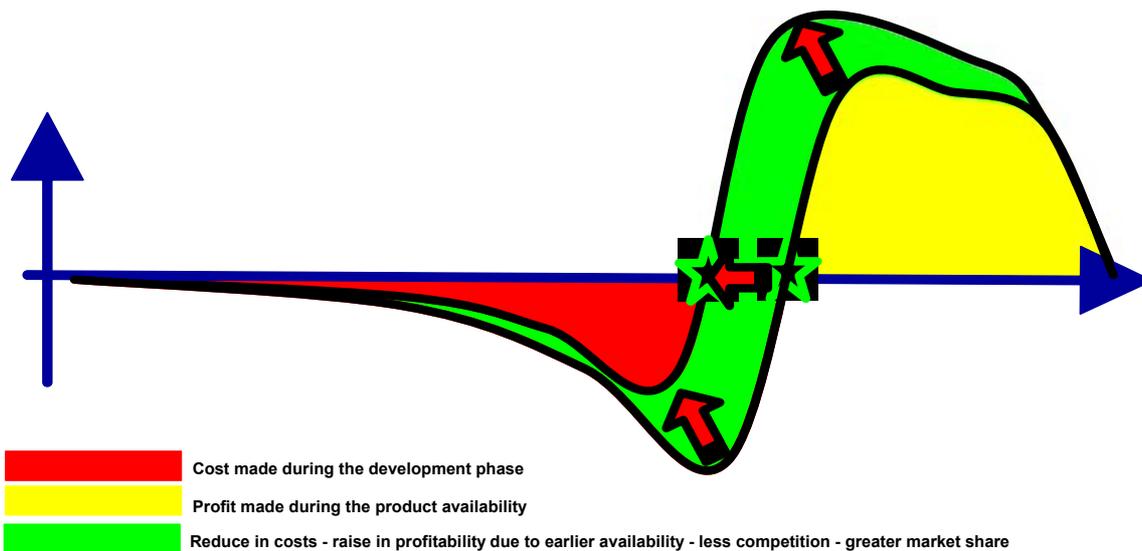


Figure 1

Faster time to market translates into greater profitability, especially in the electronics industry where products have comparatively much shorter lifecycles.

4. Challenges and Benefits

Few industries compare with the electronics industry in terms of swift turnaround, the growing demand for build-to-order products, complex bills of materials (BOMs), extremely high incidences of engineering changes, and the need to manage complicated supply chain infrastructures and extended enterprise efforts. In the face of this environment, major challenges facing the industry include:

- Short life and high cost of components in stocks
- High procurement costs
- Long time to design
- Early predictability and follow-up of product costs
- Demands to shortening time to market
- Cost/risk reduction

Because survival in this intensely competitive industry means supplying the latest goods at the lowest price as quickly as possible, SmarTeam has developed a range of tools facilitating cross-enterprise collaboration and real-time communication that meet the business needs of electronics manufacturers. The approach highlighted in the next session offers the following benefits to users of SmarTeam for Electronics:

- Efficient re-use of project information for design-time cycle reduction
- Data organization and links for fast access to accurate data and inter-relationships
- Reduced time to market
- Functionality for quick response, collaborative decisions, and process acceleration
- Component re-use for inventory writes-off and lower procurement costs
- Electronic BOM integration with mechanical design for early multi-discipline collaboration
- Information management and collaboration for better supply chain management

5. Implementation Scenario

SmarTeam for Electronics supports the combined environment of mechanical, electronic and software components. The approach starts with the re-use of product data from an existing project. By organizing the data in projects, a QuickStart function delivers optimal benefits by creating a new project environment with new and linked data. Re-use of this knowledge and data is the major time saving advantage at this stage.

Also during the design phase, SmarTeam for Electronics supports the full collaboration of different design teams, allowing all participants to communicate around a single source of data. Mechanical engineers using MCAD can create a BOM based on the document structure without affecting the manual created items. Electronic engineers on their ECAD systems can easily import data from EDA tools using the EBOM synchronization tool. Additionally, software engineers can link their versions of the software right to the right location in the BOM.

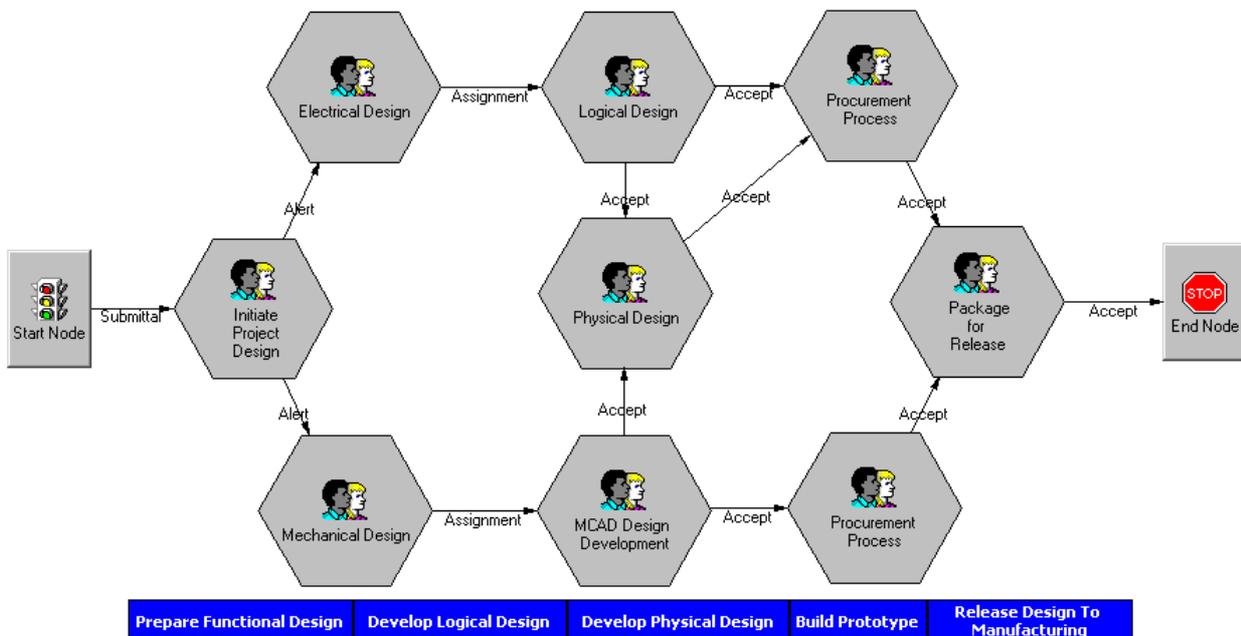


Figure 2

SmarTeam for Electronics facilitates an integrated product development process that yields significant time savings.

The SmartBOM Briefcase mechanism in SmarTeam for Electronics allows external contractors and suppliers to add, revise and upload data to share around the BOM. The web portal mySmarTeam allows teams outside the firewall to participate in the process.

Standard templates for component approval processes, change orders, and change requests allow the company to rapidly implement a collaborative environment with the needed processes in place. By having a process in place to replace these items at a later stage, SmarTeam for Electronics reduces the use of new parts, meanwhile allowing the process to continue without adversely affecting throughput time.

6. Where the Solution Pays Off

SmarTeam for Electronics yields impressive benefits in such a scenario by providing a single source of data for all users, facilitating the creation of bills of materials, readily importing data from an EDA system, efficiently managing electrical components and embedded software, and enabling users to easily re-use knowledge and best practices in electronic design.

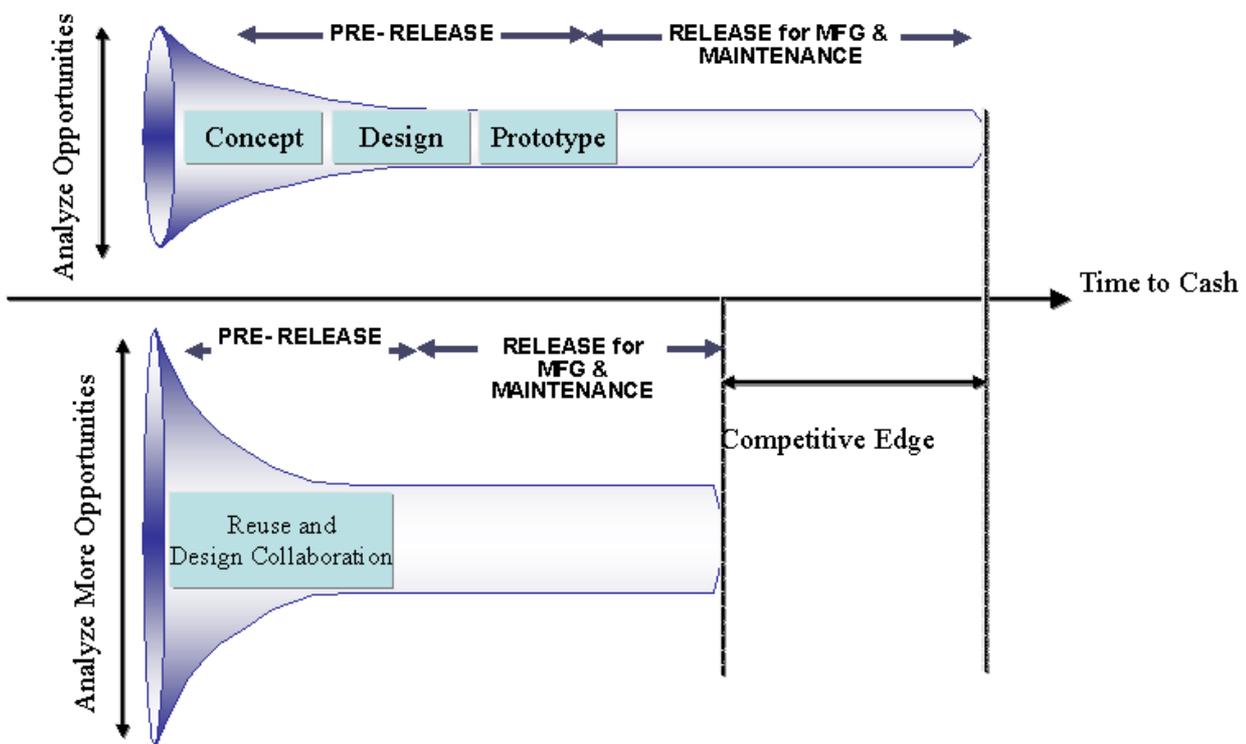


Figure 3

Through design collaboration and re-use of knowledge and best practices, SmarTeam for Electronics compresses the development cycle and enables companies to take advantage of more market opportunities.

Single Source of Data

SmarTeam for Electronics provides a data model that allows companies to store all product related data. The bill of materials (BOM) is often used as the central placeholder for product related data. All teams (both internal and external groups) working on the product can quickly find and retrieve the most up-to-date data and also add their relevant data.

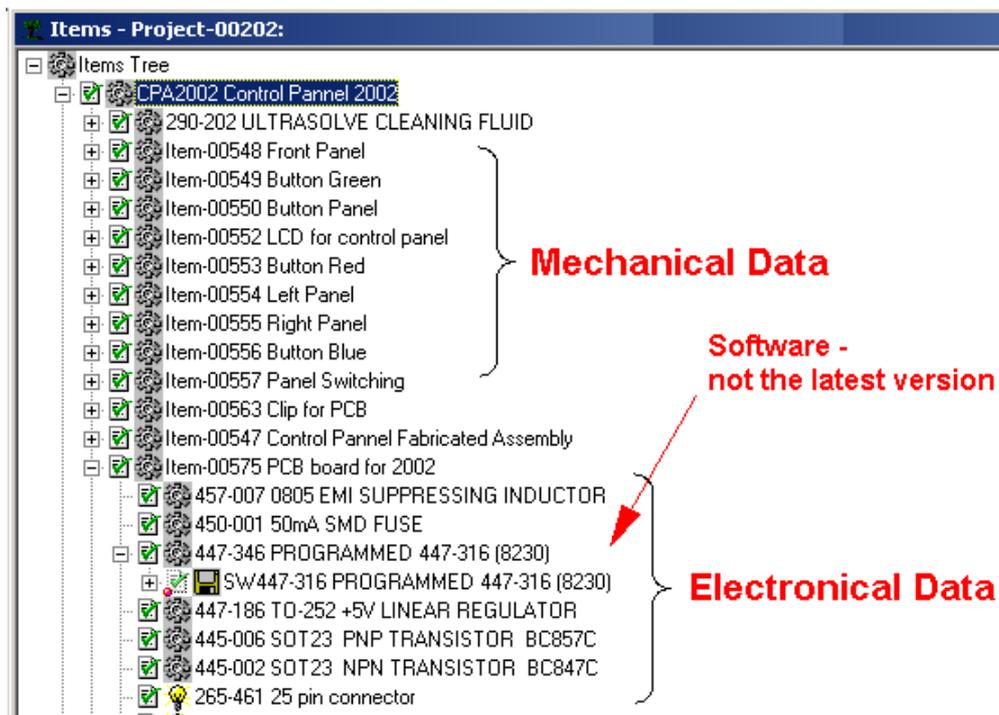


Figure 4
SmarTeam as a single source of product data

It is clear that a single source for product data lowers the design costs and reduces design time, due to the fact that no distribution process is needed to synchronize design teams. SmarTeam’s object-oriented approach for data modeling allows the company to have a system that contains recognizable information, using the company’s known business objects. Traditional PDM systems often have data models designed to work around a BOM; however the integration to the authoring tools (MCAD, ECAD and software) often lacks a tight integration, making the process of sharing actual data cumbersome and dependent on error-prone manual procedures.

When teams want to do a design review, it is important that all actual data and its status are available. SmarTeam for Electronics allows teams to update their data in a very lean way, allowing design reviews to take place on the actual data with minimal loss of time. This efficiency minimizes time to prepare for the reviews and also encourages users to have reviews when needed, improving design quality and reducing rework due to errors.

Easy BOM Creation

SmarTeam for Electronics enables sharing of BOM data in various ways. Using tight integration with MCAD systems, SmarTeam extracts the BOM automatically from the design system. The created BOM is often called the engineering BOM and matches the structure the mechanical engineer has defined.

SmarTeam for Electronics offers the Create Item Tree function to prepare and maintain a BOM based on information in the structure defined in the engineering BOM. Immediately items and their related design documents are visible in the BOM, so other people in the company can start working on the BOM too, adding their related information and manually adding new items to the BOM that are not related to a CAD design document.

For example companies might add service items to the BOM, like a manual, a cleaning kit etc. When the mechanical engineer decides to change the engineering document structure, he is able to reuse the Create Item Tree function to update the BOM for the latest engineering changes. Manually added items to the BOM are not affected. By using lifecycle behavior on the BOM in this phase, all engineers are able to compare differences between different versions of the BOM. The Create Item Tree function is one of the functions that reduces time to deliver accurate data to the teams.

EBOM Import

Also ECAD systems create a BOM for components used in the schematic. The difference between the engineering BOM coming from a mechanical system and the electronics BOM coming from an EDA system is that the mechanical BOM is document-oriented whereas the electronics BOM is item-oriented with many related documents. SmarTeam for Electronics uses the generic EBOM Import function to allow electronics engineers to import their BOM data to the central available BOM.

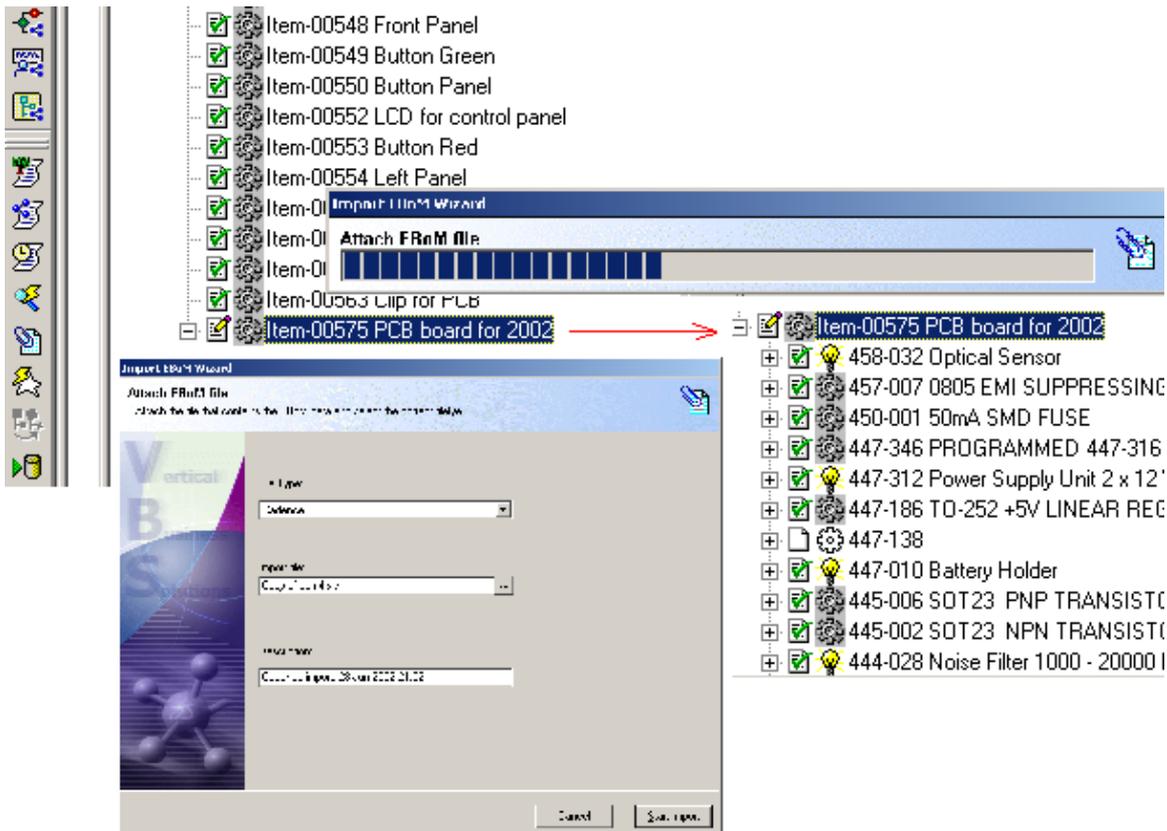


Figure 5
EBOM Synchronization

The EBOM Import function uses standard functionality from EDA tools, which are (in most cases) able to export a structured file. Such a file can be selected by the EBOM Import function and creates a BOM in SmarTeam based on the data in the file. Existing items will be recognized as well as quantity and reference designators. When items are not known in SmarTeam, they are initially added as temporary items.

There are several big advantages for combining the MCAD and ECAD data into one single point. Aside from eliminating islands of information, the combined BOM can be used for early costing and facilitating faster decision making during early project phases.

Component Management

The component approval process is more visible and better managed when items are imported into SmarTeam. Traditionally, the component engineer works on data related to components available in the ECAD system and then adds this data to the PDM environment. The approved manufacturers are often defined in the ERP system. SmarTeam for Electronics allows the component engineer to work from one information system. Data that needs to be updated in other systems can be synchronized in the background either by using standard systems like SmartGateway or customization.

In SmarTeam for Electronics it is much easier to recognize parts that have reached their end of life (EOL) stage or price, based on input from the ERP system. Additionally, all the related documents to a component, such as a data sheet, are also available, making use of SmarTeam's document management capabilities.

Software Components

Even embedded software can be part of the BOM and the related object code to the latest version of the software can be stored and secured in the vault. Since the whole BOM is lifecycle managed, it is possible to review immediately if actual versions of the items are used. In the case of embedded software, this means never working with a previous release of the software unless the engineer decides to do so.

In addition SmarTeam for Electronics uses SmarTeam collaboration tools, like SmartBOM, mySmartMeeting and mySmarTeam. Especially in a market segment where more than 50 per cent of the work is done by outsourcing, it is critical to have an infrastructure that supports sharing of the BOM, both on-line and off-line. The SmartBriefcase mechanism is unique in its capabilities to integrate suppliers and subcontractors into a BOM sharing environment.

Re-Use of Data

The reuse of knowledge and similar best practices dramatically affect product time to market and initial startup costs. Products in the electronics market have a short life cycle and this makes companies assume that reuse of data is not worth the investment. However in this competitive market segment it is important that companies innovate their products without redesigning them from scratch. Reuse of designs means lower risk, shorter design time and leveraging knowledge already gained.

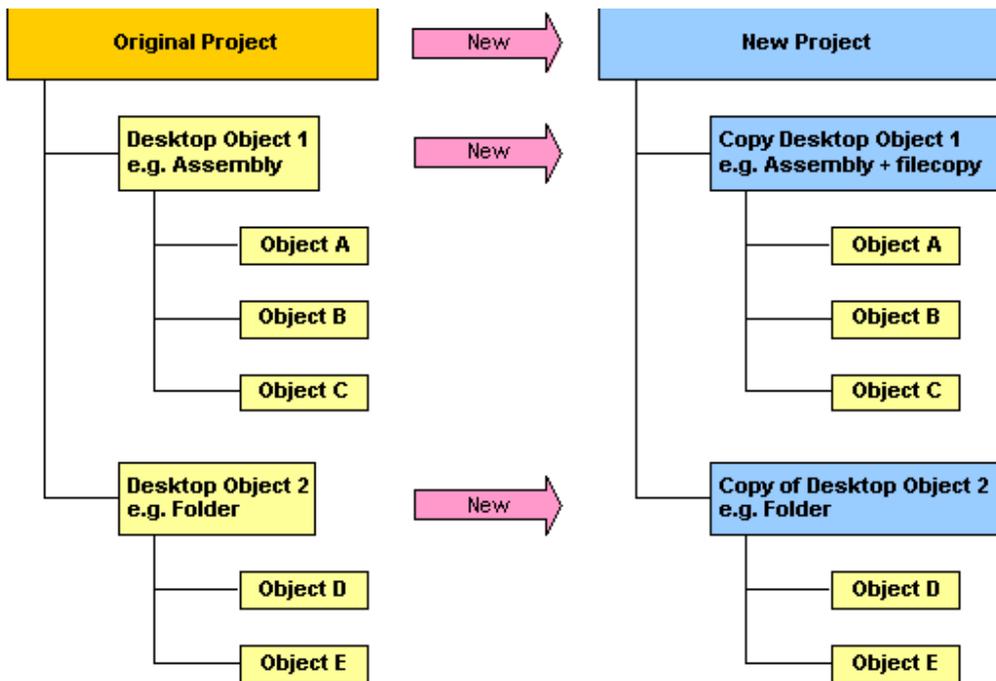


Figure 6

The original product information is transferred to the New Project via QuickStart™. New Data is created for desktop linked information.

SmarTeam for Electronics allows companies to structure their data in such a way that reuse is part of the initial methodology, instead of being dependent upon the engineer's decision to search and reuse data. The QuickStart™ function from SmarTeam for Electronics is designed to reuse project data, documents, BOM and other information. Which information can be reused by default depends upon the specific implementation. In addition to the advanced search capabilities of the PDM system, SmarTeam for Electronics supports additional functionality to copy (new data based on existing data) or link product design data.

Industry reports confirm that within the initial design of the product 70 to 80 per cent of its costs are defined. Therefore, it is important to use qualified data and to have all product data available as soon as possible. Both sharing the BOM in an early stage to make the right decisions and the reuse of data allow the company to lower the cost of the design.

Benefits of this approach to re-use of project data are significant. In one case, design time was reduced from 48 days to 35 days by modifying circuitry from one project into another instead of building the new design from scratch. In another case, process automation is credited with streamlining procedures so they could be completed in only two days instead of two weeks using previous methods.

7. Conclusion

SmarTeam for Electronics is a very strong initial offering in the design innovative environment. Differentiators in relation to other PDM systems are:

- Fast implementation, due to the preferred methodology and template
- Easy links with existing systems thanks to an open API and EAI tools like SmartGateway
- Reusable out-of-the-box best practices functionalities based on customers input
- Multi-discipline collaboration allowing all teams to work around one single source of data
- Process centric methodology streamlines communication without overhead

SmarTeam for Electronics provides an excellent infrastructure for a design innovative environment, allowing all teams to share the latest data. Usage of best practices and knowledge capturing enables the fulfillment of the SMARTEAM vision to facilitate a larger number of opportunities executed in a shorter time.

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