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White Paper
Fundamentals of Component Data Management

Fundamentals of Component Data Management by Clive "Max" Maxfield

If you are not exactly sure what Component Data Management (CDM) really is, or why it is important to you as en electrical engineer, you are reading the right article at the right time in your career.

The first thing we need to do is to define exactly what we mean when we say CDM. Let's say that we are focusing on CDM in the context of designing and building printed circuit boards.

Irrespective of whether a circuit board is large or small, it is going to carry a number of components, which may include resistors, capacitors, inductors, etc. A high-level and, as we shall see, highly simplified view of CDM is a process by which we manage the components we wish to use on a PCB, all the way through the board's development process. This starts with the original component selections made by the design engineers, and continues through the board layout to verification, component procurement, design-for-manufacture, and finally board population and assembly.

Why is CDM Important?

We should note that anyone designing a circuit board performs some form of component data management, even if, as an absolute worst case, all they have is a list of component names, numbers, package types, and suppliers jotted down on a piece of paper with an old, worn-out pencil. Of course this would be the absolute "bottom of-the-barrel" situation, since it leaves so much room for error and makes it impossible to share the database within an engineering team. Quite apart from anything else, someone might lose the piece of paper, and then where would we be?

The next step up the "sophistication ladder" would be some form of machine-readable document (like a spreadsheet) that can be easily shared and accessed by all members of the board design and implementation team. However, this still leaves the door open for inevitable errors, such as one person changing something without letting everyone else know, and the possibility of different people having multiple copies or versions of the spreadsheet. This is probably "business as usual" in most situations. At the other end of the spectrum is a full-blown CDM system that permeates every aspect of the board's design and development flow. This system would have access to any and all necessary component-related information, allow everyone who needs the information to have access to all appropriate component data, and ensure that no one can make changes without everyone knowing about it.

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What are the Benefits of CDM?

Assuming that we are in a position to implement a state-of-the-art component data management system, what benefits would we expect to realize?

First, we are going to see increased efficiency and productivity across the entire board design and implementation flow. Part of this increased efficiency and productivity comes from not having multiple people entering the same data numerous times. Another part comes from not having the same people completing tasks repeatedly in order to fix component problems that should never have arisen in the first place.

Second, we are going to see tremendous cost savings. Some of these savings obviously come from the points that were already discussed. But, we also see cost savings because the design engineers will be empowered to locate and select low-cost versions of the components. Similarly, the folks in procurement will have access to all relevant data with regards to cost and component availability.

In the cases where multiple boards are using similar components, (such as two versions of the same silicon chip from different manufacturers) the component data management system can help to ensure all boards use the same component. In turn, purchasing larger quantities gives added negotiating power to the folks in the procurement organization, all of which helps to cut costs and increase profitability.

Another benefit is the increased reliability of the final product. Using a modern CDM system ensures that everyone is working with the correct data. If someone swaps out a component for another with a different tolerance, for example, then everyone who needs to know will know about it. This means the verification group will be alerted, and will re-verify the board in the context of the new component tolerance. This ensures that the board will still work as planned, and that there won't be any unfortunate failures when the board is finally deployed into the field. All of this serves to reduce the risks and chances of error associated with the project. Last but certainly not least, the use of a modern CDM system will help to ensure that the board can be manufactured and assembled as planned without having to unexpectedly swap out a component or re-spin the entire board, both of which impact costs and introduce delays. This results in reduced time to market and – more importantly – reduced time to profit.

The Ideal CDM Deployment

The ideal CDM deployment begins with a database. Ideally this will be located "in the cloud", that is, it will be a secure cloud server that will be accessible to all members of the circuit board development team, even if they work for different companies around the globe.

Next, we load the database with a selection of components along with any relevant parametric information associated with each component, such as the manufacturer's part number, the cost, tolerance values, operating temperature ranges, and so forth. This data essentially embraces any and all information the engineers might want to search for in order to determine the right component for the task at hand.

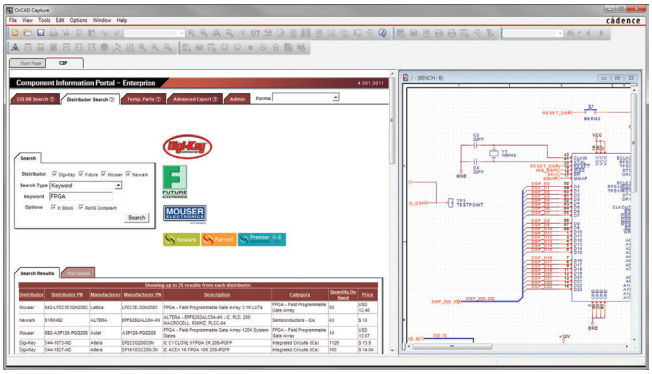
The next step will be to import any existing schematic symbols into our database. Then we'll import any layout footprints and associate them with the appropriate schematic symbols. Similarly, we will need to import any analog or digital simulation models, RF simulation models, signal integrity models, and so on.

Personnel

Before we plunge deeper into the fray, this is probably the right time to introduce two very important people (or groups of people in the case of large organizations)

First, we have someone who is known as the library manager. The library manager is in charge of making sure that all of the various aspects of the components are in sync with each other; for example a layout footprint and its corresponding schematic symbol. Also, that the various attributes, parameters, simulation models, and such are all in sync.

Next we have the component engineer. It's the component engineer who is in charge of evaluating the required component, and possibly selecting an alternative for one reason or another. The component engineer will also obtain all of the required data associated with the component, such as its layout footprint and simulation models, and work with the library manager to integrate the component into the database.



An example of OrCAD Component Information Portal (CIP)

Dynamic Component Data

At this stage it's important to note that all of the component data we've loaded into our database may be classed as "static", relatively unchanging. Conceptually, we may visualize another level of dynamic component data riding above our static data.

The type of issues we are discussing here are issues such as the current availability of the components, do we have enough on hand, and if not, are sufficient quantities available for purchase? Also, what is the current pricing of the components, Are there cheaper alternatives? If a component is no longer available or is scheduled to be discontinued in the near future, what alternatives are available?

In many cases, this dynamic data comes from other sources, such as an enterprise-level PLM system, or from one or more distributer's databases. The important thing is that both the static and dynamic data associated with components is available, so that the design engineers can select the most appropriate parts for the job, the procurement organization can start stocking up, and the manufacturing group can start preparing to "rock-and-roll."

Another aspect to all of this is the integration of the various design and management tools into the CDM system. For example, when the design engineers are looking for components, they should no longer be searching the schematic capture system's local database – instead, they should have access to all

static and dynamic data associated with that component, which will allow them to make the best possible selection with regard to what they are trying to do.

Example Scenario

Now that we have our component data management system in place, let's consider some example usage scenarios. We start with the design engineers. As we just noted, when they are capturing their schematics, these guys and gals should have access to all static and dynamic information that will allow them to select the best components for the job at hand. Hopefully all of the components they require will already be in the database. In reality, of course, things are rarely this simple. If an engineer fails to find an appropriate component, one scenario is that they have to place a request for a new component and wait for it to become available in the database, which will cause the project to grind to a halt.

A better scenario is to allow the engineer to search the web for a suitable component, and then to automatically import the parametric data and schematic symbol associated with this component. The ability to automatically import the component negates the chance for hand entered transcription errors. Such a part would be flagged in the database as not having been formally approved, but it would allow the design engineer to proceed in anticipation of the component engineer and library manager ratifying the component, or substituting an alternative, at some time in the future. When the schematics are handed over to the layout designers and verification engineers, the CDM system ensures that each group has immediate access to the data they require, and also that this is the correct data and not an out-of-date copy.

Throughout the process, members of the procurement team are monitoring the situation to ensure that all of the desired components are available when they are required and to take full advantage of costs of scale if multiple design projects require common components.

A key point here is that the various users should not be inundated with data that is of no interest to them. Only information that is appropriate to each task should be made available by default.

If anyone makes changes regarding the components, for example, if a design engineer chooses an alternative component type, this information should be automatically communicated to all interested parties for them to consider and confirm.

Eventually the board will make its way to manufacturing and assembly. Unlike non-component data management scenarios, when using a modern CDM system, there should never be any problems at this stage. On the other hand, if it turns out that the manufacturing organization does decide it is necessary to swap out a component for an alternative with a slightly different tolerance, form factor, or other characteristic, then the CDM system will allow this decision to be communicated and negotiated throughout the entire organization. This will ensure an optimal decision, resulting in the highest quality board at the lowest possible cost, created in the timeliest possible manner.

Conclusion

Of course there are a variety of CDM solutions available. OrCAD's CDM solution has already been implemented by hundreds of customers throughout the world, and has many unique differentiators when compared with other CDM solutions. It provides access to a centralized database, allowing you to properly manage your component data, and comes complete with a 5,000 part starter library to eliminate the work associated with populating a database from scratch. Once implemented, you can search six major part distributors at once for parts that meet your exact requirements, and then download the parametric data (including cost and quantity on-hand information) directly into the database. No manual entry required!

The OrCAD Component Information Portal™ (CIP) offers OrCAD® Capture CIS users a comprehensive 'off-the-shelf' component data management environment. CIP removes the barriers to implementing an effective component management process, allowing design teams to quickly and cost effectively realize the full benefits of a shared component database.

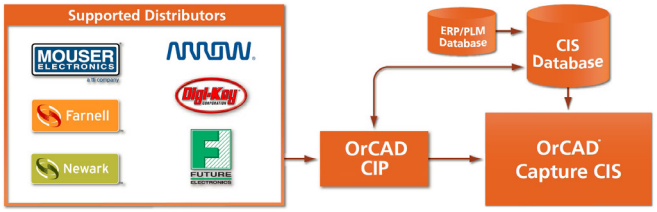


Diagram showing the different ways to access part information in OrCAD Component Information Portal (CIP)

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