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# The Power of Visual Diff for Schematics & Layouts

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White Paper

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ClioSoft, Inc.  
[www.cliosoft.com](http://www.cliosoft.com)

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# The Power of Visual Diff for Schematics & Layouts

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## What has changed?

A document, whether it is stored as a simple text files or as a word processor formatted file, is often a living entity that is constantly evolving. A user may create a first draft, revise it multiple times, have other team members review it and make alterations, and refine it over time to keep up with new information and requirements. What has changed since the last revision becomes very important to know, otherwise you would spend a lot of time reviewing the same document in its entirety multiple times. Not only is this highly inefficient, it is highly frustrating and impossible to know if you even reviewed all the changes made since the last review.

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## Diff for Text

People have used various techniques to solve this problem. Different colored pens and highlighters were used before computers became pervasive. Word processors such as Microsoft Word and other office utility tools such as PowerPoint and Excel have built in capabilities to track changes so that it is easy to see who made what changes, when. If tracking has not been turned on, then users can also compare different versions of a document to identify the differences.

The text 'Diff' utility was developed in the early 70s for the Unix operating system and, of course, several variations of the same with GUIs are available today. This relatively simple utility is a key tool in a programmer's toolbox, helping to save innumerable hours of tedium and to fix issues before they are released. The diff utility serves many purposes:

- A programmer can review changes before checking in a new version.
- A colleague or supervisor can quickly verify changes made.
- A release engineer can find and merge changes made on different branches of development.

Today most programmers would find it very difficult to live without this incredibly useful tool. It is no surprise that digital developers programming in Verilog or VHDL have adopted many of the tools that software programmers use and that the 'diff' utility has become an integral part of the toolset.

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## Diff for Graphics

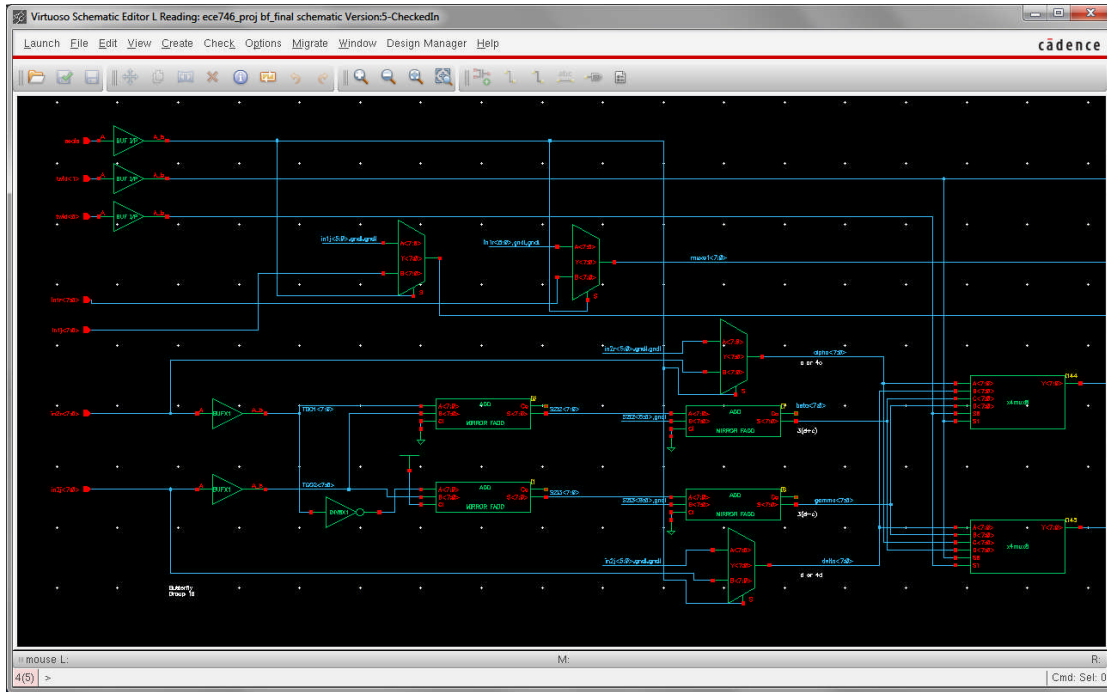
Tracking changes to graphics and comparing two versions is not only trickier but also harder to display. Even word processors that can track changes and compare different versions are limited to text and format changes but do not provide a good solution for graphics.

Therefore it is not surprising that designers working with graphical design entry tools -- like schematic and layout editors -- have so far been denied this very useful capability, even though the design flows are more complex and the need to find differences is more challenging. Schematic and layout editors are complicated tools. The chance of accidental changes is higher than with text files and the challenge of finding the difference between versions is far more difficult.

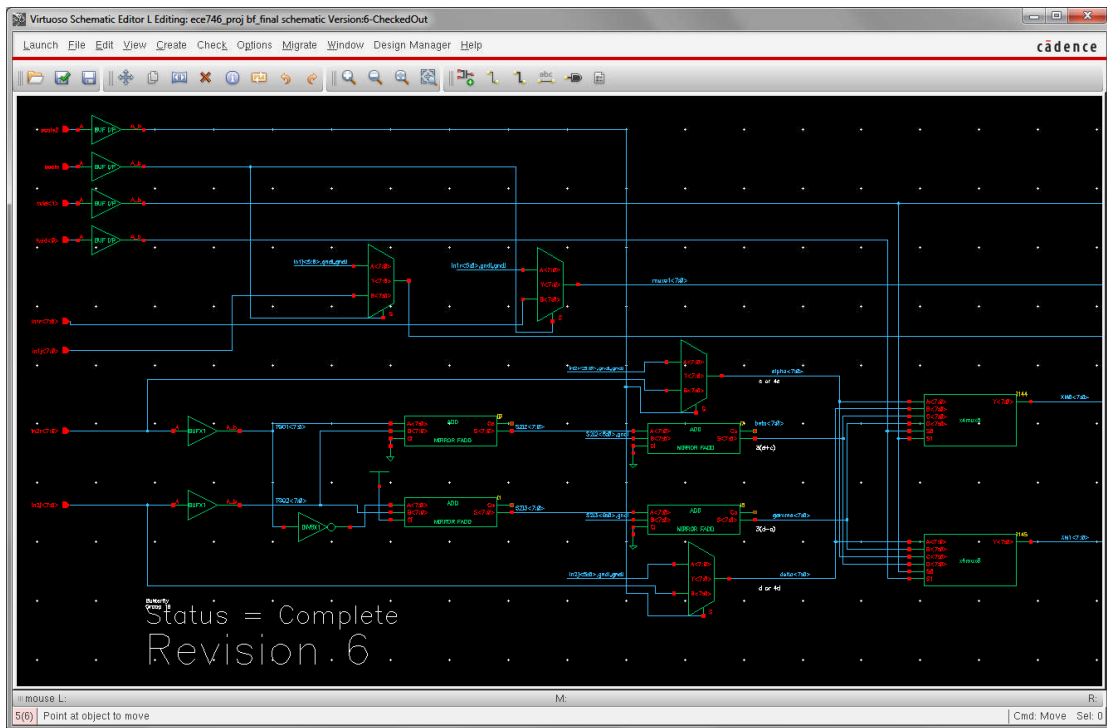
Additionally, if there are ECOs to a schematic after the layout has been created, the layout engineer has to make the corresponding changes to the layout view. Engineers can end up spending countless frustrating hours playing "Spot the Difference," which is especially difficult because they don't know how many differences there are and therefore never know when the "game" has ended.

Engineers often have to jump through hoops to solve this problem. Some attempts at automation have been made:

- Schematics are exported into text formats like EDIF or net lists and the text files are compared using text diff tools. This method is probably better than staring at two open schematics but it is still tedious and time consuming as the text differences have to be traced back to the schematic.
- Layouts are exported to GDS format and two versions of GDS can then be xor-ed to spot the differences. This is much better than diff-ing exported text files but it does take time and uses expensive tool licenses.



Schematic Revision 5



Schematic Revision 6

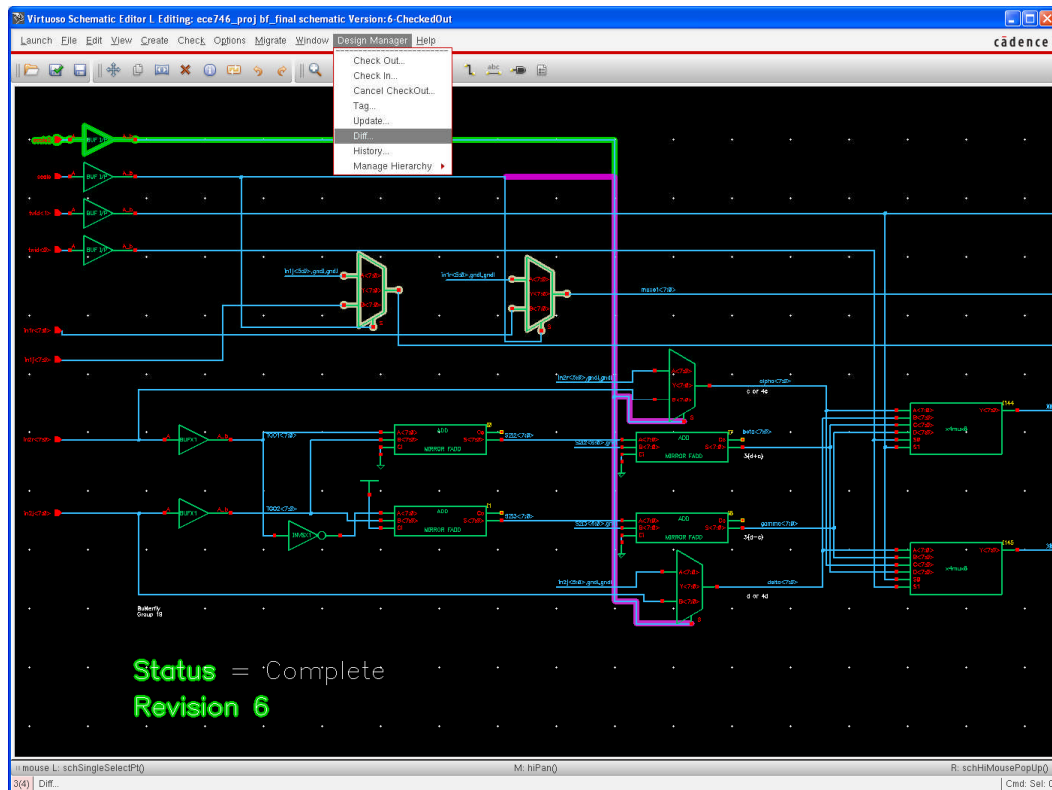
**Figure 1: Spot the Differences between Revision 5 & 6?**

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## Visual Design Diff

The difficulty of the process and the time required to find differences between versions of schematics and layouts hinders engineers from reviewing their changes before checking them in. For this same reason, peer and supervisor reviews are also limited, even though overlooked differences can directly lead to project delays and deficiency in product quality. Design teams can benefit tremendously by having the capability to quickly and easily identify the changes between different versions of graphical design objects.

Currently, major EDA vendors do not provide graphical design 'diff' capabilities. To fill this void, ClioSoft has built a [graphical diff utility](#) that visually highlights the differences between two schematics or layouts, or two versions of the same. For the Cadence Virtuoso™ flow, for example, changes to nets, instances, layers, labels and properties are detected and highlighted directly in the Cadence Virtuoso schematic or layout editor. The differences and details are presented in a list allowing users to step through the changes.



**Figure2: ClioSoft Visual Design Diff in Cadence Virtuoso**

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## Conclusion

A graphical difference engine for schematics and layout brings the power of 'diff' to mixed-signal and custom designers that software and front end digital engineers have long enjoyed. Designers can quickly check changes before publishing a new revision of a cell-view, managers can review changes before approval, layout engineers can identify modifications made to schematics, and layout ECOs can be reviewed without the time-consuming process of generating and comparing GDS. Visual Design Diff relieves engineers from the tedious task of finding differences and guarantees that all changes are highlighted. This encourages checks and reviews, which directly increases productivity and improves product quality.

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