



DIGITAL INDUSTRIES SOFTWARE

# Five tips for large assembly performance

Improving CAD performance when creating and managing assemblies

## **Executive summary**

As designs become more complex, the number of parts in an assembly often grows. The performance of your computer-aided design (CAD) tool can suffer as a result – meaning lags or crashes. In this white paper, we examine five top techniques for improving performance when working with large assemblies.

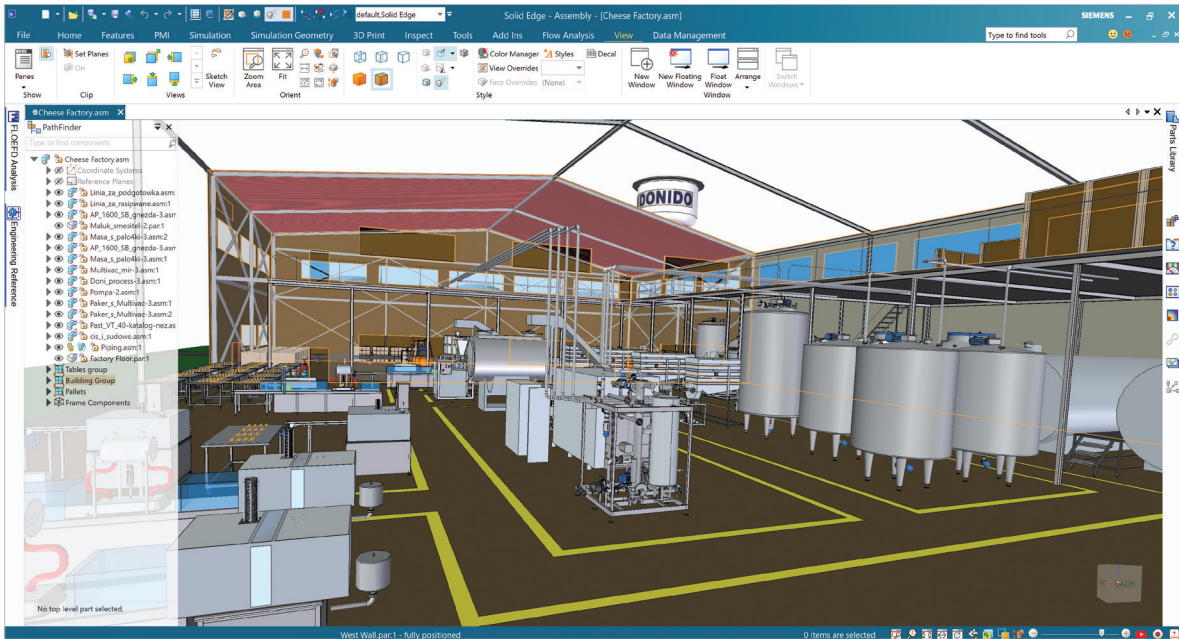
# Techniques for large assembly performance

## Improving large assembly performance

“Large assemblies” is a term with varying definitions and can describe assemblies from 1,000 to 100,000 parts. If the number or complexity of parts in your assembly poses a performance problem to your computer, hardware or network, then you have a large assembly, regardless of the number of parts. There is no single solution for improving the performance of large assemblies, or even for improving most performance problems. Getting the most out of your CAD solution when working with assemblies

of any size takes planning and preparation. By focusing on these five techniques, you can set yourself up for improved large assembly performance:

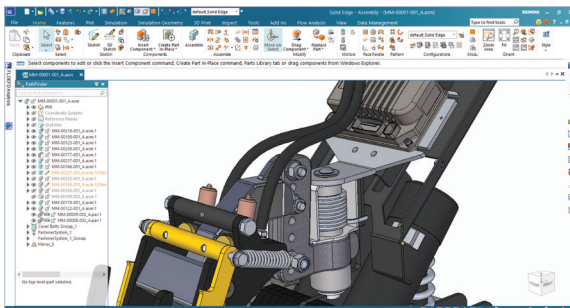
- Simplify your components
- Optimize your display
- Improve your model
- Take advantage of product data management (PDM)
- Pay attention to your drawings



# Simplify your components

## Eliminate unnecessary details

One of the biggest impacts you can have on assembly performance is to simplify parts, especially if they are re-used often. For example, if your model includes a lot of hardware, you likely don't need details – like helical threads, markings on the head or small fillets of a bolt – to show up in the bill-of-materials (BOM) or the drawing. If showing head shape and the body of the screw extruded to the correct depth are sufficient, simplify your part accordingly. In many cases, modeling just the head of a screw or bolt is enough representation of a standard part in a large assembly.



Best-in-class CAD systems like Designcenter Solid Edge® software, which is part of the Siemens Xcelerator business platform of software, hardware and services, also support occurrence property options, which allow you to cull components such as bolts and fasteners from upper-level assembly models. With Designcenter Solid Edge, this capability is supercharged by both automated and manual simplification tools. These tools can intelligently detect and remove nonessential features from imported or complex components with minimal user input. With a single click, you can

transform a highly detailed vendor model into a lightweight, performance-friendly representation.

Also consider your analysis needs when determining how much detail to show. Unless you are the bolt manufacturer, you likely don't do in-depth stress analysis on bolts in your assembly, so very few companies really need to represent these parts with a high level of detail. If you do interference checks and mass calculations at the subassembly level, you need to have a fairly accurate representation of your hardware, but you might be able to get away with a very simplified representation of your hardware at the upper level.

Remember that the computer must draw every edge that you create, and if you have hundreds or thousands of screws, a single extra edge on the screw means your computer must redraw those extra thousands of edges.

The same sort of idea applies for electronics components on circuit boards, purchased motors or pumps with a lot of detail.

Designcenter Solid Edge offers advanced smart simplification profiles that can be applied automatically or on demand for vendor components. These profiles help you quickly eliminate performance-draining details, making sure your assembly remains lean and responsive while maintaining visual accuracy where it counts. Using Designcenter Solid Edge also enhances contextual simplification, allowing you to define rules that automatically adjust component details based on its position or visibility within the top-level assembly. This provides optimal performance without constant manual intervention, letting you focus on design, not data management.

### Simplify subsystems for in-context design

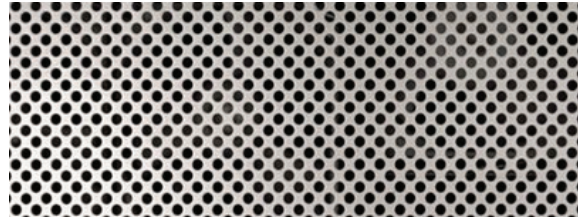
When your assembly includes a subsystem that is either purchased or provided by a supplier, simplifying it to a single part file enables you to design in context without impeding performance. Define cohesive sets of parts, features and constraints as a single functional system, and use this model in your actual design. The time you spend up front will improve both performance and model accuracy.

### Align detail and assembly structure level

Plan and determine what level of detail you need at a given level in your assembly structure. Understand that some types of detail are expensive computationally.

Large patterns of features or individual parts can cause assembly performance problems. Details like

extruded text, company logos and large numbers of textures displayed on-screen are unlikely to be needed at the top level.



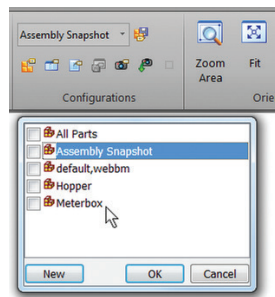
Large patterns of features can cause assembly performance problems.

Be particularly mindful of parts downloaded from vendors, as they can contain details like surface bodies, internal features or very small edges that impact performance without adding value.

## Optimize your display

### Set display configurations

Display configurations allow you to set the display of parts within an assembly on or off, and to save that state as a named configuration. From there you can continue hiding or showing parts, but it doesn't change the configuration unless you save it. This enables you to go back and reset your display with the same configuration state after you have made several changes.



Configurations enable you to work at the top level with less visual clutter, which of course translates into less work for the graphics card, and better performance. Designcenter Solid Edge takes this a step further with an upgraded graphics engine that leverages modern graphics processing unit (GPU) capabilities, offering smoother real-time interaction even with complex visual effects. It also introduces adaptive display quality, dynamically adjusting the level of detail rendered based on user interaction (for example, full detail when stationary, simplified during rotation) for a consistently fluid experience.

### Define zones

Zones make working with massive assemblies even more manageable, and boost performance by allowing you to define a permanent range box to isolate areas of large designs you are responsible for at a subsystem level. Intelligent caching allows retrieval of only the parts in the zone, without having to open component files to determine if they lie in the zone or not. This creates a significant performance boost when switching zones or opening a large assembly. Building on this, Designcenter Solid Edge refines zones with intelligent load-on-demand capabilities. This means components are loaded into memory only when they are actively needed or within your user-defined work zone, significantly reducing initial load times and memory footprint for even the most massive assemblies.

### Reduce visual effects in upper-level assemblies

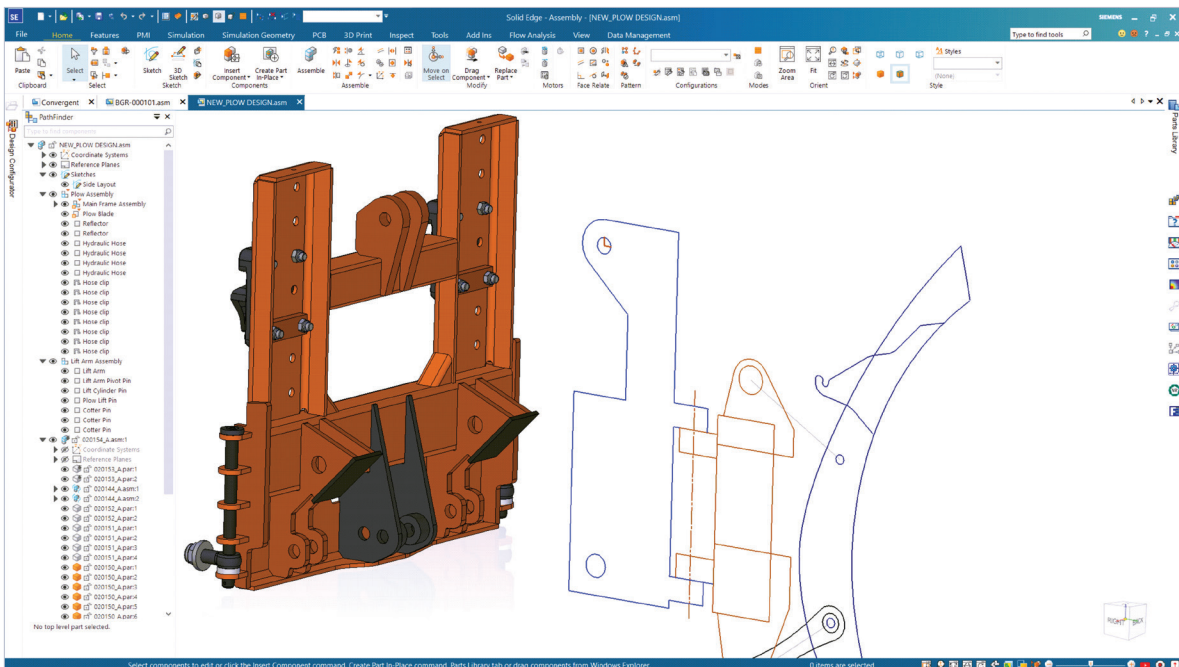
Visual effects can help convey an accurate look and feel, and create a realistic look to communicate with partners, customers and your shop floor. But in upper-level assemblies, where system performance becomes an issue, consider the trade-off between

parts that look cool and faster modeling capabilities.

To optimize upper-level assembly performance:

- Turn off reflections
- Turn off drop shadows
- Turn off cast shadows
- Turn off silhouettes
- Use shaded (without edges) or single edge color (if you use visible edges)
- Use culling
- Set sharpness to low
- Turn off view transitions
- Turn off glow

Keep in mind, reducing visual effects is sound advice when working with many general CAD systems, but Designcenter Solid Edge has an enhanced graphics engine and intelligent culling algorithms, meaning you can often maintain more visual fidelity without sacrificing performance. It intelligently culls hidden or occluded geometry more effectively, further optimizing display by not rendering what isn't visible, even when some visual effects are enabled.



# Improve your model

## Beware of a massive multibody

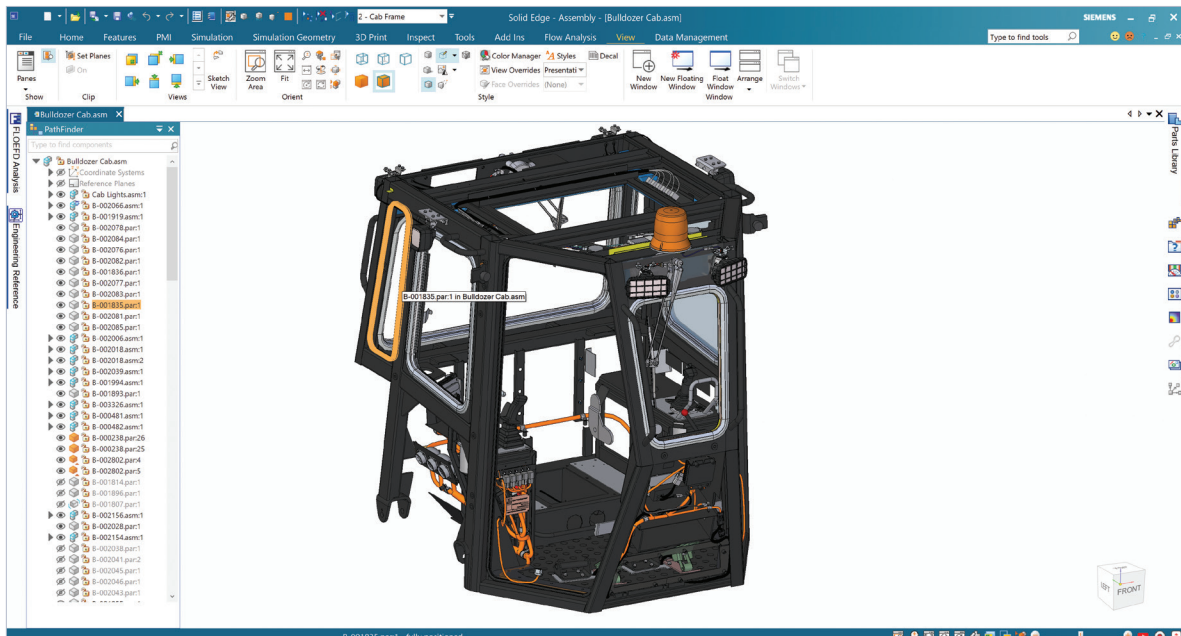
An easy assumption to make is that saving a large assembly as a single part will make it perform faster, since part files won't be distributed across a network. But assemblies have special abilities to re-use information that multibody parts do not. If you have one part with 100 occurrences, the assembly recognizes the repetition and responds accordingly. But a multibody part treats each body occurrence as a different entity, which has a negative impact on performance. There may be other reasons to create multibody parts, but assembly performance should not be one of them. However, Designcenter Solid Edge supports improved performance for multibody operations, making them more efficient when their use is unavoidable or intentional for specific design workflows.

## Costly assembly operations

Some things you do in the assembly take up more computational resources than others. Assembly

features, for example, require the assembly to make sure the parts are updated, bring the parts into the assembly, position all the parts and then add a feature to the positioned parts, with potential differences between part occurrences. That can really add up.

Interpart relations are also costly for the same reasons. This is one of the reasons why synchronous parts and assemblies are recommended for better-performing assemblies. You can create relationships between parts in an assembly only when needed, without the associative links. Using Designcenter Solid Edge enhances synchronous technology's benefits by offering smart interpart relations. These relations can be set to automatically freeze or simplify their computational load when not actively being edited, providing performance gains without losing design intent. The system can even suggest optimal times to freeze links, taking the guesswork out of optimization.



### Internal component management

For engineers grappling with large vendor files, internal components offer a highly efficient solution. Instead of maintaining external links to hefty vendor parts, Designcenter Solid Edge can embed these components directly into your main assembly file. This eliminates the headache of broken links, simplifies file management significantly, and makes sharing projects much more robust, as all necessary vendor data is self-contained within the assembly.

This embedding process isn't just about convenience; it's also about optimizing assembly performance and storage. When a vendor part becomes an internal component, Designcenter Solid Edge can strip away unnecessary data, retaining only the essential geometry. This optimization leads to a reduced overall storage footprint and smaller assembly file sizes, which in turn improves opening, saving and general performance. It's an ideal

strategy for integrating "black box" vendor parts that don't require internal modification, streamlining your workflow and keeping your projects lean.

### Errors

If you have broken links in your assembly, the software is going to spend a lot of time looking for those files. Even broken links in mates, conflicting mates and lost texture files will cause the software to work harder to try to fix the problems. Try to resolve errors as you work instead of allowing them to accumulate. When you go back to try to fix the assembly, it is much easier to solve a series of small individual problems rather than try to detangle a layered set of issues. Designcenter Solid Edge includes proactive error detection and guided resolution tools that help identify broken links, conflicting mates, or missing texture files in real-time, often suggesting fixes before they accumulate into major performance bottlenecks.

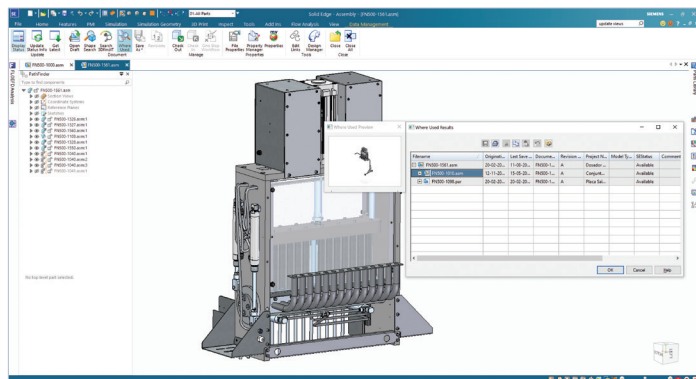
## Take advantage of PDM

### Improving the performance of shared files

Another common source of performance problems comes from referencing files stored across a distributed network. The best way to avoid performance problems due to networked files is to use a product data management (PDM) system. PDM systems can be more cost-effective than many companies realize and can result in substantial performance gains.

While the PDM vault is in a central location, when you check files out to use them, they are copied to your local machine. The PDM system can accomplish this in a way that doesn't cause problems with duplication, overwriting or permissions. This gives you the advantage of working on shared files, without

the normal disadvantages of sharing files across a network. PDM also helps you avoid complicated rules aimed at avoiding overwriting other users' changes, revision control on solid models and tons of additional and confusing file management problems. Designcenter Solid Edge deepens its

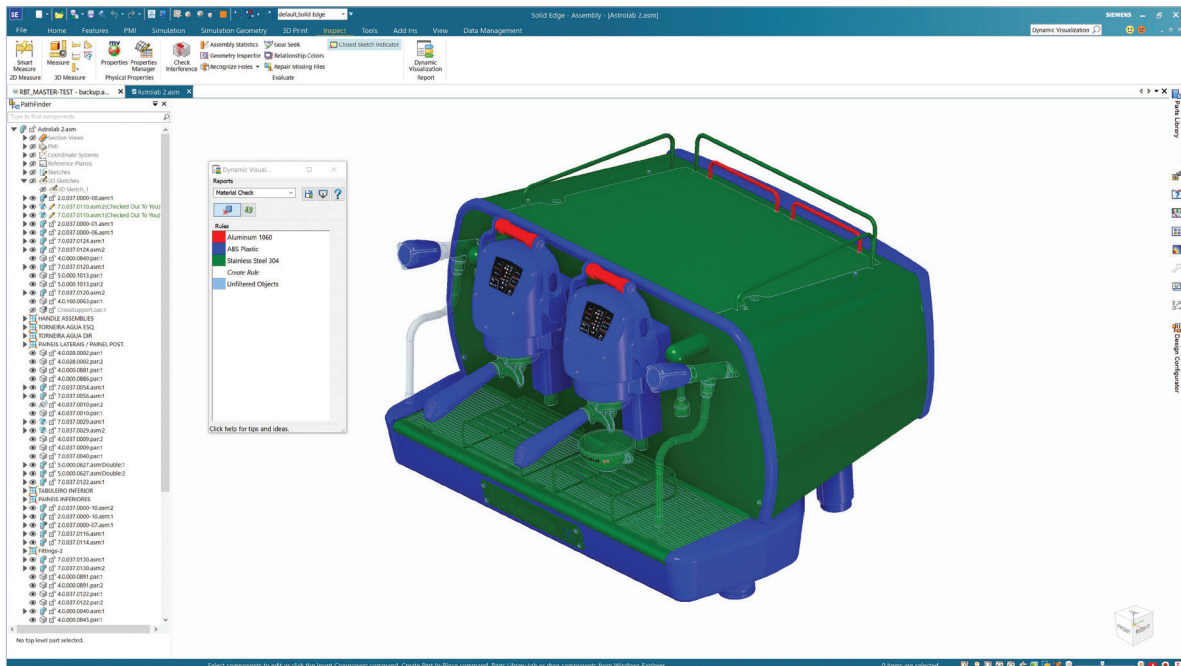


## White Paper – Five tips for large assembly performance

integration with the Siemens Xcelerator portfolio, including the Teamcenter® Share app and Teamcenter X software. In Designcenter X Solid Edge, built-in cloud data management powered by Teamcenter X keeps designs organized, accessible and secure – with revision control, check-in/check-out and release workflows included. This offloads heavy calculations from local machines, further improving performance for shared projects.

If you're concerned about assembly performance, a simple PDM tool should be a priority.

Network speed is a separate infrastructure issue impacting performance - but a PDM solution can greatly improve how your system performs within your existing IT constraints.



# Pay attention to your drawings

## Avoid interferences and reduce detail

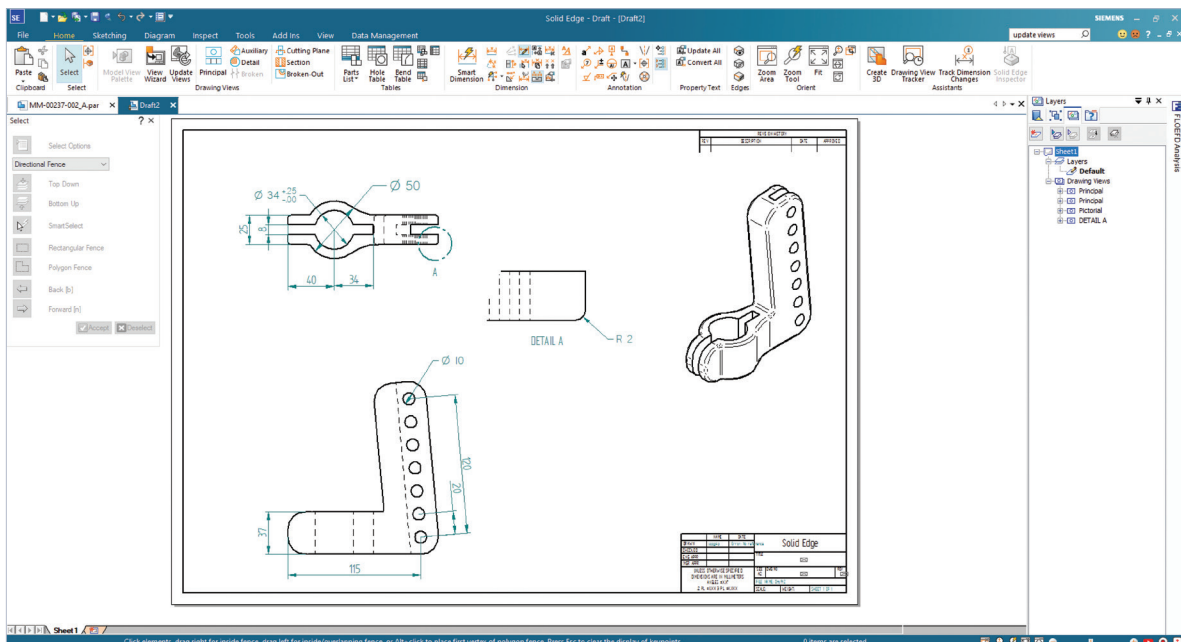
Drawings have a big job when it comes to large assemblies. Multiple views of each assembly, including multiple parts – and potentially cutaway, detail or exploded views – mean that your CAD tool must manage the display of a lot of different states.

Avoid interferences where possible to keep your drawings performing well. When your solid model has interferences, it causes display issues, which means that your system is spending more time calculating that bad display than it should. Make sure to check for interferences if you see anything amiss in your assembly views.

Details are great, and enthusiastic new 3D users sometimes get obsessed with how much detail they can create. You can make bolts look very realistic, right down to the grade markings on the head, rounded edges, textures and highly detailed helical threads.

The problem with detail is that it is costly in several ways. First, detail takes a long time to create.

Second, it takes a long time to display it every time you need to do so. Too much detail can have a critical impact when it comes to drawing performance. Drawings must calculate every edge, and then decide if they are hidden, shown, grayed out or dashed – for every part, every time it is shown. Excessive detail can make your model look more realistic but causes performance losses as a result. Designcenter Solid Edge supports significantly enhanced drawing view generation algorithms, drastically reducing the time it takes to create and update complex drawing views, especially for large assemblies. This includes improved multi-core processing for view calculations and intelligent detail management within drawing views. Engineers can define automatic simplification levels for components in drawing views, ensuring clarity and performance without manually suppressing features. This includes intelligent culling of hidden geometry and optimized edge processing, making your drawing creation process smoother and faster.



# Conclusion

Good performance comes with good planning. Some of the techniques mentioned in this paper might not have as much impact on assemblies with fewer parts, but practicing good habits will prepare you for when a need arises. Practicing these techniques and keeping the purpose of your assembly in mind will help you optimize performance while meeting your goals. By combining these proven strategies with the advanced capabilities and intelligent automation found in Designcenter Solid Edge, engineers can achieve unprecedented levels of efficiency and performance in large assembly design, allowing them to innovate faster and deliver higher quality products.

Assembly performance isn't all settings and simplification. There is a fair bit of higher-level thinking required to keep a large collection of data light on its feet. File management and link management are important as well.

Part of good planning is keeping the objectives of your work in mind. Each model and associated drawing has a purpose or a set of purposes – whether it is a concept model, inspection drawings or a model that will be used to create a complex injection mold. Once you know the purpose of your assembly, then you can decide how much detail you need.

Practicing these techniques and keeping the purpose of your assembly in mind will help you optimize performance while meeting your goals.



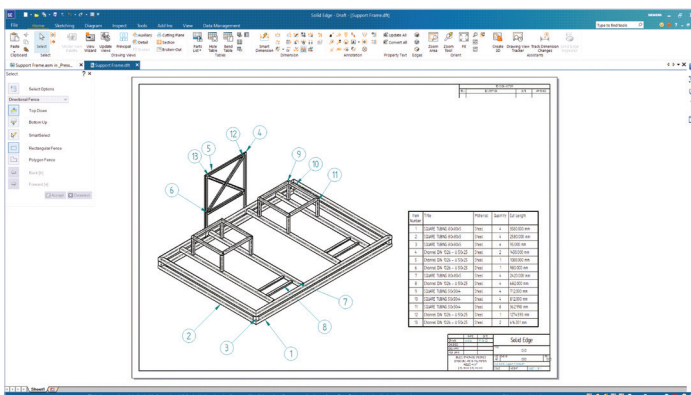
## The powerhouse for large assembly creation and management

Good techniques are essential, but the right tools unlock your potential. With Designcenter Solid Edge, Siemens delivers industry-leading performance for large assembly design and management, making sure your execution never lags your ambition.

Designcenter Solid Edge empowers users to quickly and easily create, manage and collaborate on even the most massive assemblies without frustrating lags or crashes.

Designcenter Solid Edge elevates large assembly performance:

**Intelligent simplification with artificial intelligence (AI):** Designcenter Solid Edge includes AI-powered simplification tools that automate the creation of lightweight representations. From individual components to entire subassemblies, these tools intelligently detect and remove internal voids, small features and intricate details. This works seamlessly with imported data, transforming complex vendor models into performance-friendly assets with minimal effort, allowing you to focus on the design intent, not the data overhead.



**Next-generation graphics engine and adaptive display:** Experience unparalleled visual responsiveness with the graphics engine in Designcenter Solid Edge. Leveraging modern GPU capabilities, it provides fluid interaction even with the most visually rich designs. Adaptive display technology dynamically adjusts the level of detail rendered based on your interaction (for instance, full detail when stationary, simplified during rotation), ensuring a consistently smooth experience whether panning, zooming or rotating intricate designs.

**Smarter zones and intelligent load-on-demand:** Building on the powerful concept of assembly zones, Designcenter Solid Edge features intelligent load-on-demand capabilities. Components are loaded into memory only when actively needed or within your dynamic work zone, significantly reducing initial load times and memory footprint for assemblies containing hundreds of thousands of parts. This means faster access to your data and more efficient use of system resources.

**Enhanced synchronous technology with smart relations:** The renowned Solid Edge synchronous technology remains a cornerstone for efficient large assembly design, enabling rapid, flexible edits without the traditional overhead of history-based modeling. Designcenter Solid Edge enhances this with smart interpart relations that can be computationally optimized or frozen when not in active use, providing significant performance gains without sacrificing design intent.

**Seamless collaboration:** Cloud-based data management and deep integration with the Siemens Xcelerator portfolio means Designcenter Solid Edge users benefit from robust PDM capabilities for secure data management, version control and cloud-accelerated collaboration. This makes distributed large assembly projects more efficient than ever, ensuring all team members are working with the latest, most performant data.

**Accelerated drawing view generation:** Significant advancements in drawing view generation algorithms and intelligent detail management in Designcenter Solid Edge make sure that creating and updating documentation for large assemblies is faster and more intuitive. Automated simplification options for drawing views combined with enhanced multi-core processing, mean you spend less time waiting and more time communicating your designs.

Using Designcenter Solid Edge allows you to create an exact representation of all components – including tubes, pipes, wires, weldments and sheet metal – in a complete digital mockup that allows for more accurate design and analysis. It helps you quickly detect and fix clash and interference issues, generate assembly instructions, and conduct customer reviews – all while reducing the need for costly physical prototypes.

With Designcenter Solid Edge, you're not just managing large assemblies; you're mastering them, turning complexity into a competitive advantage.

For more information on Designcenter Solid Edge for assembly modeling, visit [siemens.com/assembly](https://www.siemens.com/assembly)

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