SCALING DATA MANAGEMENT TO MEET COMPLEXITY CHALLENGES:

RIGHT-SIZING A SOLUTION TO FIT YOUR NEEDS

LIFECYCLE INSIGHTS
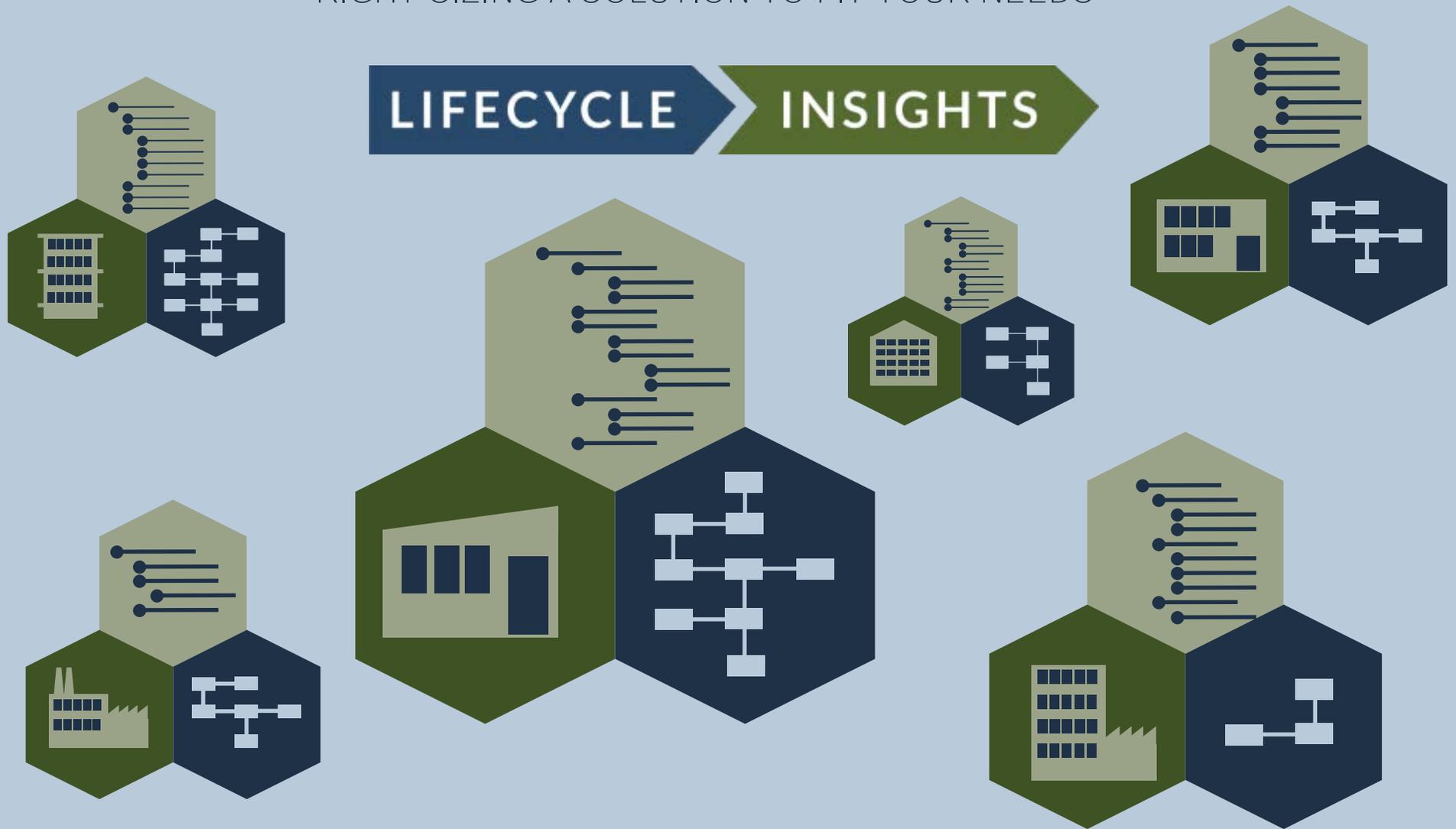
CHOOSING BETWEEN TWO EXTREME OPTIONS

In the past few decades, product development has changed in a myriad of ways. Design has become more democratic in the enterprise. More electronics and software have made their way into traditional mechanical products. Executives are demanding more transparency in engineering. Yet, one of the most important changes has been the digitization of the process: data has become the indispensable lifeblood of product development. Data offers definition of designs. Data holds predictions of product performance. Data carries instructions on how to machine components and assemble products.

Today, managing such data is crucial. Companies must have the right methods and technologies to manage, share and protect it at all times. They must control who can access it, know who changed it, know what data is the latest, and know what data is approved. Yet, despite the need for these critical capabilities, many companies still struggle with the basic ability to manage, share and protect data in product development.

Listening to the expert guidance, one would think that selecting the right technology to support data in product development would be easy. If your company is large, then you need a full-blown Product Lifecycle Management (PLM) system. If your company is small, then you need the simplified scaled down version of Product Data Management (PDM). However, there is a terrible fundamental flaw in that guidance. Not all large companies execute complex product development processes. Likewise, not all small companies run simple product development processes. In reality, there is a gradation of product development complexity, going from simple to complex that is independent of company size.

For companies running simple product development processes, even the simplified scaled down version of PDM can be overpowered, overly complicated and need too much effort for deployment and maintenance. Nonetheless, other basic IT tools like shared drives and emails have serious drawbacks. These companies are left between two poor choices: one that is overblown and one that is too problematic. The good news, though, is that new options built using Computer Aided Design (CAD) capabilities on top of cloud-sharing services are now emerging. This offers a new real option to consider for such companies.

That's where this eBook comes in. It describes ways to right-size data management to the complexity of product development instead of according to company size. First, it details the range of needs that should be considered for such a discussion. Second, it specifies the advantages and disadvantages of the technology solutions that are available. Third, it offers some research on the state of data management adoption today.

When it comes to data management technology, most companies have resigned themselves to choosing between two poor options. Yet, in reality, there are more options to consider that are better for companies that run simple product development processes.

GAUGING PRODUCT DEVELOPMENT COMPLEXITY

The data management solution that a company should select is dependent on the complexity of their product development process, not their size. But how exactly do you know if yours is of high, moderate or simple complexity? Well, it is driven by a number of different factors that we'll cover in this section.

MULTI-CAD COLLABORATION IN THE SUPPLY CHAIN

One place to begin to assess the complexity of your product development process is your supply chain. Now, you may not have access to other companies' supply-chain information for comparison. Yet, you can determine your company's supply chain intricacy by assessing one major factor: What is the number and variety of CAD formats in which you *receive* design data?

If your company receives designs in a variety of CAD formats, you'll need some advanced capabilities to manage that complexity. Files from different CAD applications have their unique proprietary formats, many of which are not understood by computer operating systems.

Organizations that work with small supply chains, or without suppliers at all, often develop designs in one CAD format. Simpler solutions are feasible in these cases.

ELECTRONICS AND SOFTWARE DEVELOPMENT

Another characteristic to assess for development complexity is the means by which your company designs and builds the electronics and software that goes into your products.

While nearly every product includes software and electronics today, not every manufacturer is involved in those aspects of product development. Some companies treat this as a black box, outsourcing it to a competent supplier, and working with the final compiled software or finalized PCB design. These companies don't have complex data management needs.

On the other hand, some manufacturers do much of this type of development work internally or want to be intimately involved in the effort. That requires coordination between hardware, software and even system engineers. This kind of close collaboration effort demands a full-blown PLM system or even an Application Lifecycle Management (ALM) solution.
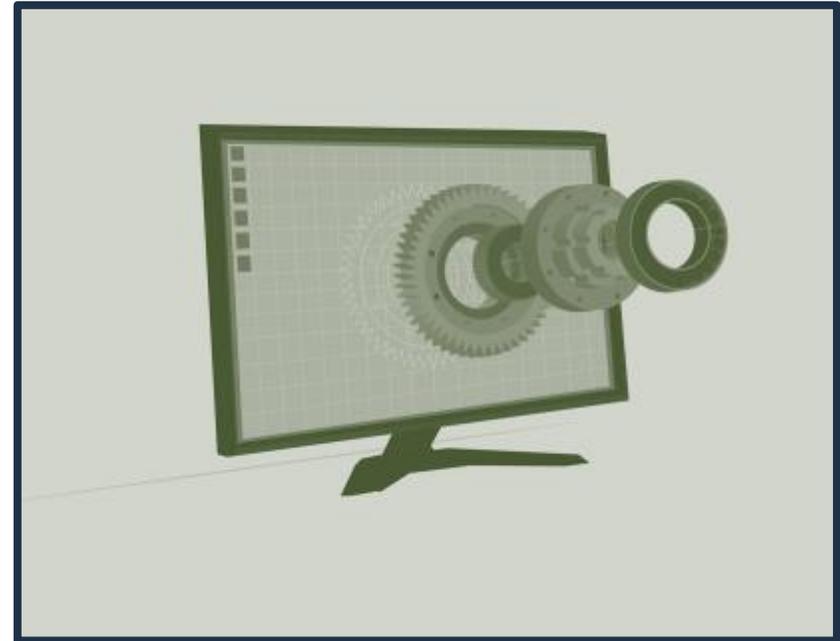
VOLUME AND COMPLEXITY OF ANALYSES

Another aspect of the process to consider when assessing the complexity of your product development process is how frequently and how complex are the simulations conducted to predict product performance.

Analyses of mechanical, electrical, software and systems can be a powerful way to reduce development delays and improve product performance. Keep in mind, though, that the data generated by running such simulations can be complex. It needs to be connected to the design data originally used to build the simulation model; otherwise, the context of the result is lost. Managing these types of results requires more specialized data management capabilities.

Not every organization conducts many analyses, if any at all. Products that function in simple operating environments likely won't need extensive analyses. There are even cases where it is just simpler to over-engineer some components or use prototyping and testing methods to prove out performance. In these cases, data management capabilities for simulations are not needed.

THE MISNOMER OF COMPANY SIZE

Again, the size of your company isn't a factor when it comes to determining how best to manage product data. Some small companies might receive design data in multiple CAD formats; manage electrical, software and system data, and track analyses across many domains. Even though these companies are small, they still need a broad and capable data management solution.

On the other hand, a large company might only work with design data from a single CAD application, outsource and black box electrical and software development and only run an occasional simulation. That company, even though large, does not need to burden product development with an unneeded PDM, PLM or ALM solution.

NO DATA MANAGEMENT IS A POOR OPTION

It's very important to note that just because a PDM, PLM or ALM solution isn't the right fit for a company, that doesn't mean they need *no data management capability*. CAD files, even if they're all of a type, need to be easily understood, and readily accessible for design collaboration and the engineering change processes.

There are legitimate challenges to managing CAD data, whether it was created on one CAD application or across many applications. CAD applications, by their very nature, produce many complex and interrelated files such as parts used in an assembly and a drawing. Product design configurations are created and stored among a variety of files and versions, making it difficult to keep track of the specific design configurations delivered to a customer.

The range of design versions spread over files makes it hard for engineers to quickly find the information they need, especially if they're tracking a design that has evolved from previous designs or from one development project to another. The number of files also makes it hard for those seeking to determine which assembly, for example, uses a particular component.

CAD management isn't easy, no matter your company's size or the products it makes.

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TECHNOLOGIES FOR DATA MANAGEMENT

For companies with simple product development processes, there have been few real options for data management solutions. This section will take a close look at four options for controlling, sharing and protecting product development data which includes desktops and laptops, shared drives, PDM, PLM and ALM solutions as well as a new option: CAD enhanced cloud-sharing services.

DESKTOPS AND LAPTOPS

An option for managing data is also the most widespread one: desktops and laptops. Because engineers use CAD and simulation software that often are installed on an operating system, the files created with the software can be stored and managed on the operating system. Now, anybody who manages correspondence by searching past emails by keyword can attest to the lure of using the operating system for file management. Because the files reside on the computer, they're readily accessible and somewhat searchable. Also, they can be organized according to a system of an engineer's own choosing or creation.

There are, however, flaws. As anyone who has lost or cannot find a vital email through the usual search methods can attest, the operating system has big drawbacks when used to store important information. The system has no built-in means to track or to intelligently search for the types of artifacts used in product development, making it hard, if not impossible, for engineers to find files. Even an engineer who follows his or her own organizing system to file designs and design artifacts can easily misplace or delete a file. And, of course, any other engineer who needs to find those designs on the operating system would not be able to

figure out the organizational method and would most likely be locked from the files altogether. Another issue lies in the fact that designers can't easily share their work. If they do pass files by email or a similar means, they often do so by violating IT protocols meant to avoid a security breach. Additionally, all product information could be lost should the operating system crash.

The bottom line: artifacts, whether they've been deleted, lost to a crash, or whether they simply can't be found when searched for, are lost, usually forever.

SHARED DRIVES

A more advanced option than desktops and laptops exists in the form of shared networked drives. Shared or networked drives reside on the same network as desktops and laptops and are widely accessible within the company. Essentially, the drives act as a common hard disk for the networked computers. This option offers a slight advantage because they allow multiple engineers to store and share their information easily.

Other than the small advantage of the shared system, engineers who rely on shared or networked drives to manage product data face the same management issues seen by those who manage files on their operating systems. Engineers cannot use intelligent searches to find information and cannot be assured they're looking at the correct design configuration. Furthermore, they have no means to manage files, to tag them for searches, or to manage design configurations. Like laptops and desktops, files stored there can easily be misplaced, lost, or deleted.

When it comes to protecting product development data, shared-file security is marginally better than for file storage on laptops or desktops, though data isn't encrypted. Rather, engineering organizations that use this file-storage method simply define who has rights to the files. Obviously, users need not adhere to these rules, making security breaches a potential issue.


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PDM, PLM AND ALM SOLUTIONS

The most capable option for managing product development data comes in the form of PDM, PLM and ALM solutions. Before diving into the advantages and disadvantages of each, a few definitions are needed.

- **Product Data Management (PDM)** systems are used to manage artifacts that describe, define and simulate mechanical and electrical product hardware.

- **Product Lifecycle Management (PLM)** systems are used to facilitate and automate the development of products, particularly focusing on hardware aspects, through design and manufacturing.

- **Application Lifecycle Management (ALM)** systems are used to facilitate and automate the development software that is embedded within products.

Each of these software systems offer powerful capabilities in their own right. In fact, they address a number of drawbacks seen when shared-drives and operating systems are used to manage files. Engineers can manage their own design work seamlessly, find other designs using a variety of methods and keep track of the most current versions of designs. These solutions manage CAD files in almost every format. They possess capabilities to track and manage the models and results of simulations. Electronics designs and software code can be kept under control by utilizing a wide range of tools, even in collaborative environments across many suppliers. These systems can even automate and control complicated processes with routing and sign-offs.
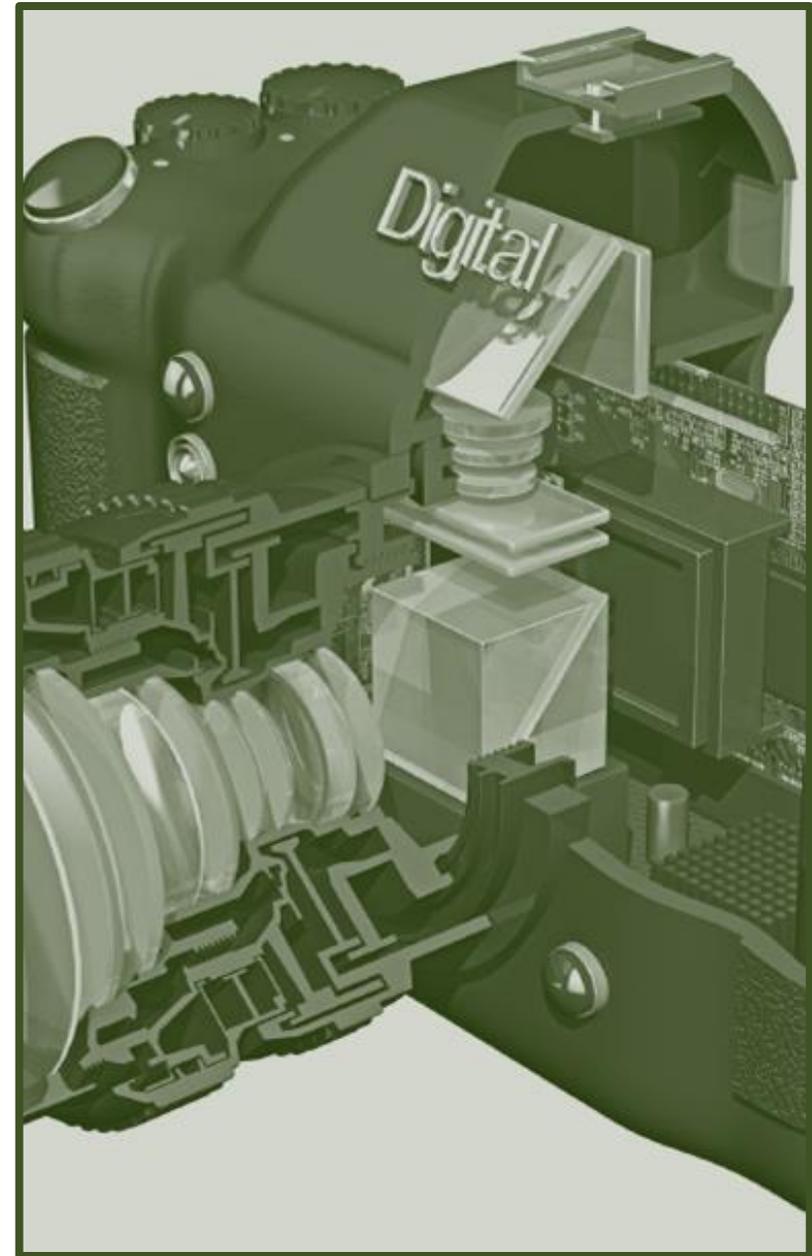
Make no mistake: these tools are powerful and scalable. Very large and very small companies can use these solutions because their capabilities span such a wide range of needs. Yet, it is critical to understand the lower boundaries of these solutions, the point at which they do not offer more value than the effort required to set up and maintain them. The challenge of such systems lies in multiple issues.

1. **Installation and Maintenance:** These systems require professional deployment and service. IT personnel must roll out the system with a specific sequence. They must also build out and maintain the underlying database over time.

2. **Changing Users' Processes:** CAD users need to check files in and out of these systems, meaning they have to change the way they work. Furthermore, while on a tight schedule, they avoid using the system; instead keep in-process files on their desktops. This raises security concerns and voids the value of the system.

3. **Adding Process Complexity:** Let's face it. In companies with simple product development processes, it is sometimes far simpler to walk a form across a hall instead of submitting a digital process.

For companies with complex product development processes, these systems are invaluable. But for those with simple ones, they only add to management overhead while delivering too little value. They simply aren't the right fit for certain companies.

CAD ENHANCED CLOUD-BASED SHARING SERVICES

The latest solution is actually a combination of two technologies: a CAD application and a cloud-based file sharing service. Each of these technologies offer different capabilities that, when combined, provide data management functionality that is the right fit for companies with simple product development processes.

The foundation of this solution starts with a cloud-based file sharing service, which offers the following capabilities.

- **Cloud Backup:** The capability to 'backup' files by storing them in the cloud to protect against data loss.

- **Broader Access:** The capability for anyone at any time to access files stored in the cloud. Files can be accessed from multiple technical centers within the same company, for example, or by individual designers who can call up files on their laptops and devices while traveling.

- **Sharing with External Parties:** The capability for users to quickly and easily share selected files with external collaborators, including suppliers, partners and customers.

Note that such cloud-based file sharing services do not offer a complete feasible solution alone. Instead, these capabilities are provided by the CAD application, which includes:

- **Viewing Relationships:** The ability to view the relationships between files, such as those that exist between drawings of parts, assemblies composed of multiple components, subassemblies and more.

- **Where-Used Reports:** The ability to run a 'where-used' report that lists the other CAD models where a specific component is used.

- **Bill of Materials:** The ability to generate a Bill of Materials (BOM) from a CAD assembly of components.

These abilities, and much more, are included in more advanced PDM, PLM and ALM systems. However, this solution offers numerous advantages over them, including:

- **No Deployment, No Maintenance:** Other than setting up the cloud-based file sharing service and CAD application, there is no other software to install. It requires no additional IT support, making it easy to get running.

- **No Change to Processes:** At the end of the day, engineers using this solution do not need to change how they work with their data. They still just save files.

Ultimately, for companies running simple sorts of product development processes, this solution offers the right set of capabilities they need to manage their data.

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SUMMARY AND CONCLUSION

Data is the lifeblood of product development. As such, *all* companies need to have some means to manage, share and protect their data. Yet, finding the right data management solution has been difficult for many companies.

PRODUCT DEVELOPMENT COMPLEXITY MATTERS

Expert guidance often portrays the selection of a data management solution as a simple choice. If your company is large, then you need a full-blown PLM system. If your company is small, then you need the simplified scaled down version of PDM. But in reality, the right system depends on the complexity of your product development process, not the size of your company.

GAUGING PRODUCT DEVELOPMENT COMPLEXITY

When determining your product development complexity, and thus the type of solution needed, keep the following in mind:

- Multi-CAD data in the supply chain
- Electronics and software development
- Volume and complexity of analyses

Companies that must manage any of these issues have moderately complex product development processes, and as a result, need a more advanced data management solution. Organizations that deal with none of these issues, however, have simple product development processes. They can afford to consider simpler data management options.

OPTIONS FOR DATA MANAGEMENT SOLUTIONS

There is a range of different options for managing product development data. However, many of them have significant drawbacks for companies running simple processes.

- **Laptops, Desktops and Shared Drives** all lack the ability to understand CAD data. Manually organizing and managing these files undermines the productivity of engineers.

- **PDM, PLM and ALM systems** provide powerful capabilities, but demand IT professionals for deployment and maintenance.

- **CAD-Enhanced Cloud Sharing Services** provides the fundamental capabilities engineers need without the overhead of software systems.

FINAL TAKEAWAYS

Most companies have become resigned to choosing between a few data management options that are poor fits. Now, however, there are more options, especially for the companies that run simple product development processes.

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