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Desktop Engineering®

MAKING THE CASE

FOR RESILIENT PLM

Your product lifecycle management (PLM) must be scalable, flexible, and upgradable to handle increasingly complex product design.

The screenshot displays a PLM software interface. On the left, a 3D CAD model of a device is shown with three callouts: 'Remove' pointing to a yellow hex nut, and two 'Replace' callouts pointing to fans. On the right, a discussion panel shows a conversation between Aaron Lee, Mike Miller, and Terry Adams regarding fan replacement options. Below the model is a table with columns: Name, Type, Quantity, State, Unit, Reference Designator, Changes, and Demo Prop.

Name	Type	Quantity	State	Unit	Reference Designator	Changes	Demo Prop
MK7 Thermal Core	Component	2	Released	EA			
Cartridge Heater 40W 24V Right An...	Component	2	Released	EA			
Type K Thermocouple	Component	2	Released	EA			
Wire-Filament Extruder Guide	Component	1	Released	EA			
Nylon Spacer with Flange	Component	1	Released	EA			
Mini Nozzle 0.4mm	Component	2	Released	EA			

A SPECIAL SUPPLEMENT IN PARTNERSHIP WITH



ARE YOU READY?

Disruptive changes to product design require a resilient approach to product lifecycle management.

It was only a decade or so ago that sensors and embedded software were mere supporting characters in product development, mostly associated with highly engineered products like aircraft and automobiles. Today, these technologies take center stage in products of all types, raising the bar for product lifecycle management (PLM) platforms and calling into question whether existing systems have the staying power to meet the requirements of tomorrow's engineering practices.

The fast emerging Internet of Things (IoT) is bringing wholesale changes to how products are conceived, architected and built. In a world where intelligent, connected devices will be the norm, even a simple household appliance like a blender becomes an intricate exercise in design complexity involving onboard electronics and communications technologies. Creating these connected products is pushing PLM beyond its traditional role of managing CAD files and orchestrating mechanical design processes.

Prognosticators say the IoT is poised to radically transform everything from our cars to our homes, and even the manufacturing floor. Over 40 billion active connected devices are forecast by 2020, according to ABI Research, paving the way for consumers to adopt connected products in droves, including smart thermostats, security systems and household appliances. Research by the Acuity Group found that more than two thirds of consumers plan to buy connected technology for their homes by 2019, drawn in by the promise of new value-added services, greater convenience and higher efficiency.

Outside of the home, the IoT aims to be a dominant

force on the road. The number of connected cars is poised to multiply more than sixfold from 2013 to 2020, reaching 152 million vehicles, estimates IHS Automotive. On the manufacturing front, IoT is expected to be a similar game changer with predictions for the Industrial Internet to potentially add an astounding \$10 trillion to \$15 trillion to global gross domestic product over the next 20 years, according to General Electric, which is investing \$1 billion to develop Industrial Internet technology and applications.

It isn't just the IoT rewriting the rules of the product development and adding to overall product complexity. Development cycles are continuously shrinking, on-demand product customization is on the rise, and global supply chains and manufacturing technologies like 3D printing are ushering in fresh opportunities — as well as new challenges — requiring engineering organizations to move to systems and processes that will allow them to adapt quickly to the accelerating pace of change.

Enterprise PLM systems put in place to tackle yesterday's product development and innovation challenges may not have the chops to handle this growing complexity, nor the flexibility to adjust quickly in a volatile business climate. It takes a certain class of PLM to be able



The Increasing Complexity of the Product Design Universe

As the physical and digital worlds increasingly overlap, thanks in part to the connected billions of products making up the Internet of Things, resilient product lifecycle management is critical.

to keep step with fast changing business requirements while recalibrating to support modern technology advances.

Future-Proof Your PLM Investment

To support the fluidity of technology and business, PLM solutions need to be able to easily adapt to the shifting landscape without holding companies hostage or requiring them to start over from scratch. Like enterprise resource planning (ERP) software and other major corporate systems, PLM can be one of the more costly and labor-intensive enterprise endeavors, in some cases taking years to deploy and requiring millions of dollars.

A RESILIENT PLM SOLUTION OPENLY ACCOMMODATES WHATEVER COMES DOWN THE PIKE WITH MINIMAL DISRUPTION AND WITHOUT REQUIRING ORGANIZATIONS TO HAVE A CRYSTAL BALL ABOUT WHAT LIES AHEAD FOR EMERGING TECHNOLOGIES OR FUTURE BUSINESS REQUIREMENTS.

As a result, organizations aren't inclined to replace a PLM system once it's up and running. More than likely, they will be tempted to make do with functionality limitations and outdated business processes rather than go through the pain and expense of a full-scale migration to a more advanced PLM platform. In fact, according to a recent report by PLM industry analysts CIMdata, PLM systems are updated on average only every six years and, for a third of companies, every 10 years.

However, sticking with yesterday's PLM status quo is not a recipe for success when developing tomorrow's next-generation products. The best way to future-proof your R&D efforts is to choose a resilient PLM platform that serves as a solid foundation to continuously evolve with the times. A resilient PLM solution provides the best

COMPLEXITY BY THE NUMBERS

48%

The percentage the average product lifecycle was shortened between 1997 and 2012

8 billion

The number of connected devices to ship in 2020

> \$1 trillion

The IoT (Internet of Things) market opportunity in 2020

2X

The amount product complexity increased between 1997 and 2012

40-80 billion

The number of connected products in the field by 2020 with the potential to collect data

100 million

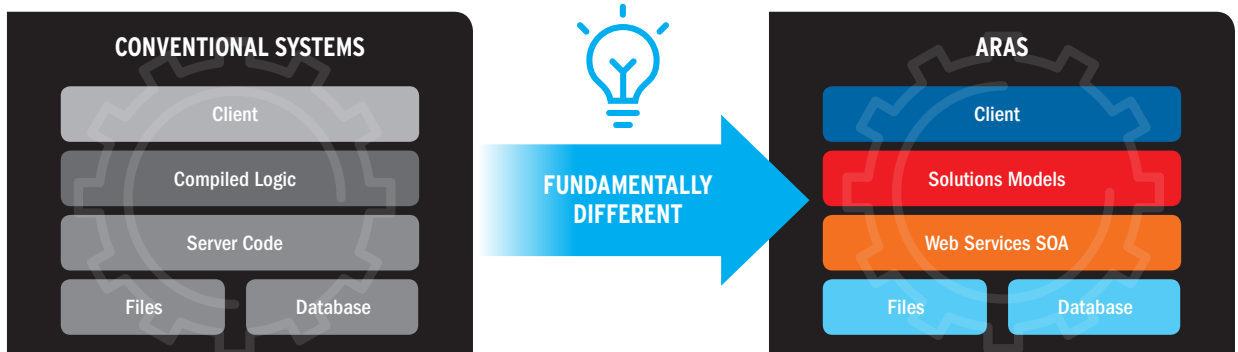
The lines of code in a luxury car

chance of accommodating a 10-year-plus corporate time horizon where market conditions constantly change, product complexity continues to sky rocket, and global competition further intensifies.

A PLM platform built for resiliency ensures that the business can respond regardless of critical shifts like changing business models, entering new markets, or acquiring other companies. For example, the adaptability in a resilient PLM solution makes the process changes necessary for systems-driven product development possible without lots of custom programming or new modules to buy. Bringing together

THE RESILIENT APPROACH

Aras Innovator isn't locked into yesterday's best practices thanks to its model-based approach and Service-Oriented Architecture.



RESILIENT PLM DEFINED

engineers around the world from the mechanical, electronics, and software disciplines to develop IoT-enabled products is exactly the type of process transformation that resilient PLM is designed for.

A resilient PLM solution doesn't box a company out of the latest technologies, empowering organizations to take advantage of new software releases and readily adopt new infrastructure such as upgrades to the latest database or operating system when it makes sense while making sure PLM customizations are carried forward without being re-implemented. A resilient PLM solution openly accommodates whatever comes down the pike with minimal disruption and without requiring organizations to have a crystal ball about what lies ahead for emerging technologies or future business requirements.

Aras Innovator PLM has been architected from the ground up with resiliency in mind. The purpose is to give companies the scalability and flexibility required while ensuring upgradability even when applications are heavily customized. The underlying Aras PLM platform technology makes this possible. The combination of Aras Innovator's unique model-based approach and Service-Oriented Architecture (SOA) in the platform ensures flexibility and scalable performance whether running PLM applications out-of-the-box or highly customized.

This model-based SOA in the Aras Innovator platform is fundamentally different than traditional PLM systems. Instead of the limitations imposed by a conventional hard-coded schema and business logic, the Aras technology makes application customization much faster, easier and more sustainable. This is especially important in light of findings from Gartner Research that show more than half the total cost of ownership over a five-year period for a conventional enterprise application like PLM is spent on consultants and internal resources charged with maintaining and updating the system. Aras gives companies the flexibility to quickly adapt PLM processes to gain competitive advantage without worrying about upgradeability so they achieve greater ROI on their PLM investment.

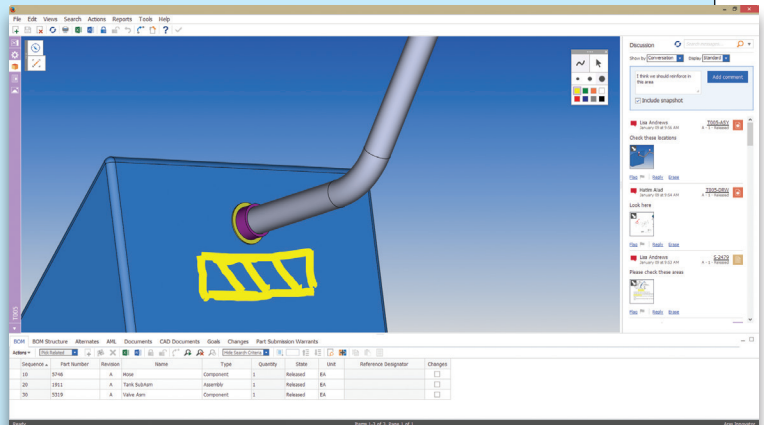
Aras Innovator's resilient approach to PLM reduces the complexity of maintaining and evolving the PLM backbone. With Aras Innovator, PLM becomes a sustainable investment that evolves with the business and that grows with a company over time.



With business shifting at an unprecedented pace, the PLM system deployed to meet today's business requirements is likely not equipped to meet tomorrow's.

Think of resilient PLM as an insurance policy for change. Instead of locking companies into yesterday's "best practices" forever forward, a PLM platform architected for resiliency can easily adapt to changing business requirements while giving companies the ability to upgrade to the next software version and infrastructure enhancements with minimal disruption and without a significant burden on end users or IT.

A truly resilient PLM solution should have the legs to last 10 years or more — a critical requirement considering the investment — without holding companies back or losing an edge in innovation. A resilient PLM system doesn't hold



Aras Innovator 11 takes a different approach to visual collaboration by adding discussion threads with embedded viewables and markups making cross-functional communication easier than ever before.

product data hostage or dependent on exotic, proprietary technologies. Rather, a resilient PLM platform supports open standards, ensuring that it can evolve with changing technologies even when it's unclear exactly what those new technologies will be.

A resilient PLM application needs to be easily adaptable because let's face it: Business needs and company processes will surely change over the next 10 years, and the core enterprise PLM system needs to be able to follow suit. If it can't, the PLM system becomes irrelevant, locking in the enterprise and stifling competitiveness.

If your PLM platform can't readily adapt to evolving business requirements, easily be upgraded even when it's been customized, or is a roadblock to adopting modern IT technologies, it's fair to say it's hit a wall. That's as good a time as any to rethink PLM strategies and consider resilient PLM.

READY FOR THE FUTURE

CASE STUDIES

aras
INNOVATOR®

Replacing a legacy system

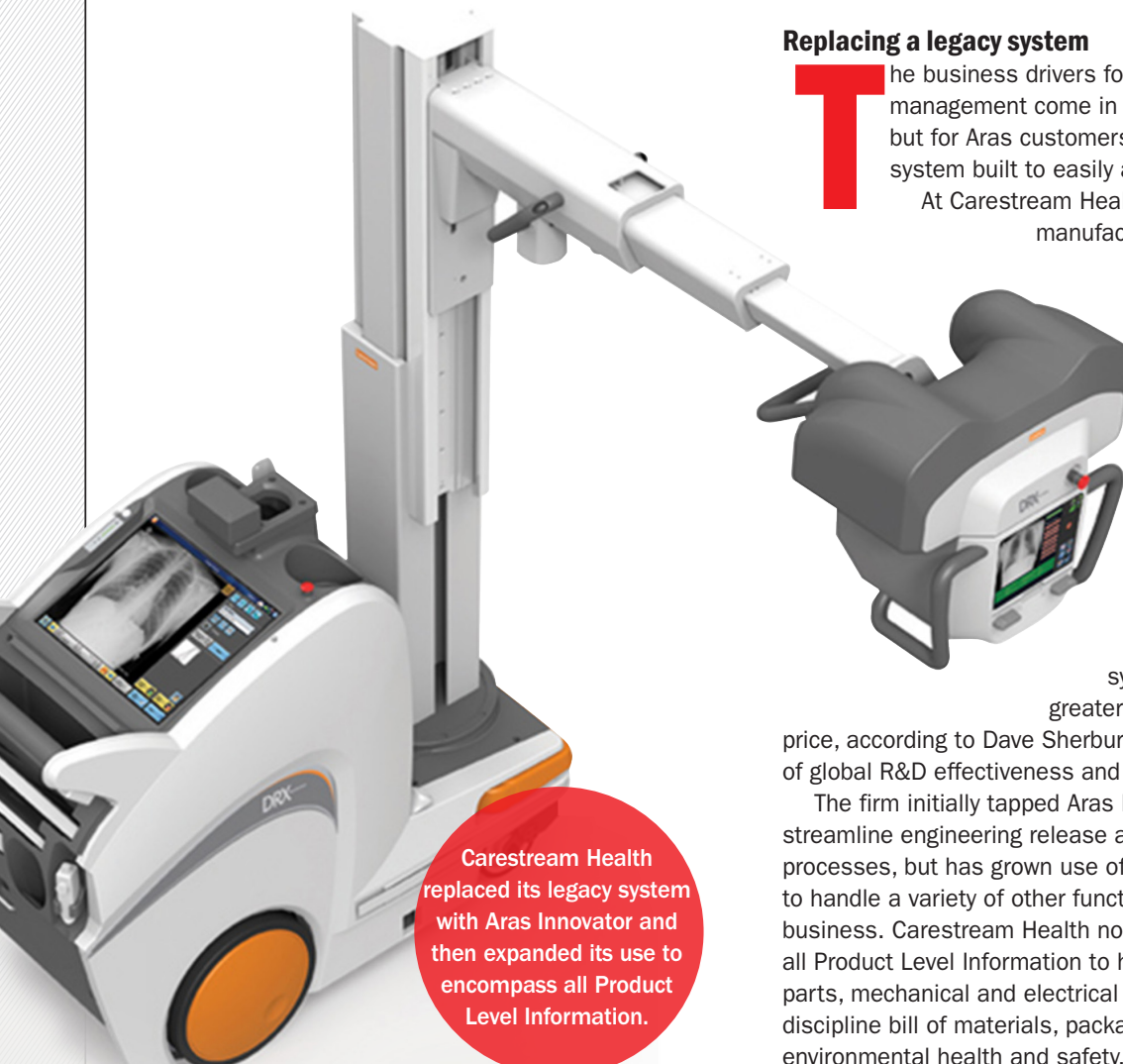
The business drivers for product lifecycle management come in many shapes and sizes, but for Aras customers, it boils down to having a system built to easily accommodate change.

At Carestream Health, an international manufacturer of medical &

dental healthcare imaging equipment and non-destructive testing film, growing pains related to globalization precipitated a need to replace a legacy system that couldn't keep pace with the evolving needs of the business. The company needed a PLM system that could offer

greater flexibility at a competitive price, according to Dave Sherburne, Carestream's director of global R&D effectiveness and engineering IT.

The firm initially tapped Aras Innovator to help streamline engineering release and change order processes, but has grown use of the system over time to handle a variety of other functions across the global business. Carestream Health now uses Aras Innovator for all Product Level Information to help manage commercial parts, mechanical and electrical CAD releases, cross-discipline bill of materials, packaged parts, defects, and environmental health and safety, among other processes.



Carestream Health replaced its legacy system with Aras Innovator and then expanded its use to encompass all Product Level Information.

The only constant is change. Learn how three very different companies are prepared to manage those changes with Aras Innovator.



MEILLER has reduced its PLM infrastructure maintenance costs and complexity while gaining the ability to customize its PLM solution.

Improving R&D performance

F.X. MEILLER Co., a global provider of heavy duty trucking systems, turned to Aras Innovator because it wanted to improve R&D performance, reduce development costs and migrate away from a legacy PLM system. After evaluating the alternatives, the firm chose Aras because of its modern architecture and its superior performance during benchmark scalability testing. Aras also offered greater functionality with a much smaller footprint, which resulted in significant cost savings for the company, officials said.

One of the biggest benefits of Aras' approach is the integrated modelling environment, which lets the company handle a large portion of the project work themselves without expensive consulting fees. Since implementing the system, MEILLER has reduced its PLM infrastructure maintenance costs and complexity while gaining the ability to make modifications and customizations to the PLM solution on its own. This has enabled the firm to extend PLM processes and gain greater agility in the marketplace, the officials said.

MiTek Corp., comprised of 13 specialized audio companies, needed a PLM platform that could help

"WE HAVE CAPABILITIES WE'VE NEVER HAD BEFORE AND OUR USERS HAVE EMBRACED ARAS IN A BIG WAY. ARAS HAS GIVEN US THE STRATEGIC ADVANTAGE WE WERE AFTER." GARY KLOSARK

unify and automate processes across its three research and development divisions. The combination of Aras Innovator's customizability, open source solutions, and its Microsoft look and feel has allowed MiTek to evolve the PLM solution over the years without the on-going support of the vendor or consultants, making the solution extendable and affordable over time. More than two-thirds of MiTek employees now use Aras, and R&D engineers designated as process owners across all divisions are creating their own applications, forms, workflows and lifecycles. "We expected the typical PLM system and that's not Aras," said Kevin Friske, database administrator for the firm. "They don't do things like everyone else."

New Level of Granularity

It's Aras Innovator's mark of differentiation that has helped Kolcraft Enterprises, a maker of children's products and juvenile furniture, increase its competitive edge by optimizing quality, time and cost throughout its product lifecycle, said Gary Klosark, the firm's director of information technology. With Aras, Kolcraft has achieved a whole new level of granularity in its PLM processes as well as configuration management and control, enabling it to manage its business in ways not possible previously, Klosark said.

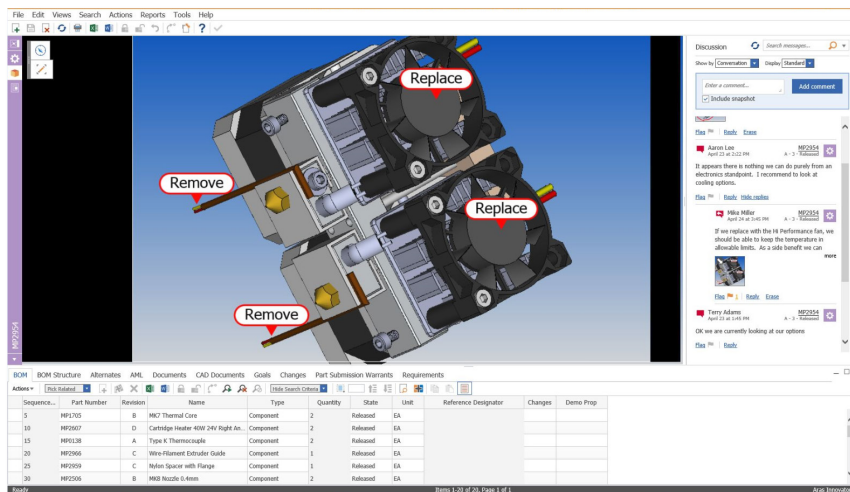
"We're already seeing the benefits of the Aras PLM system at Kolcraft and we're just getting started," he adds. "We have capabilities we've never had before and our users have embraced Aras in a big way. Aras has given us the strategic advantage we were after."

ARAS' UNIQUE ARCHITECTURE

It's one thing to talk about resiliency and quite another for a product lifecycle management platform to feature an architectural design that ensures it has staying power now and into the future.

Conventional PLM systems, which rely on hard-coded schema and business logic, historically run into roadblocks when business requirements change or new technologies enter the scene. The lack of flexibility means that despite pouring millions of dollars and dozens of man-years into a deployment, traditional PLM can be limiting, forcing customers to adopt the vendor's idea of best practices and keeping their business processes that way forever in lieu of adapting to the way that particular customer actually conducts business today and innovating as opportunities emerge. The alternative route with conventional PLM systems is for companies to do a lot of complex programming to customize, but this approach is time consuming and expensive — not to mention, putting the entire system at risk of requiring a re-implementation when updates become available. Aras Innovator calls on a number of unique attributes that differentiate it from the competition, helping customers avoid these roadblocks and safeguarding their long-term investment in PLM processes.

SCALABLE: Aras Innovator is designed from the ground up to be highly scalable. The underlying PLM platform technology, called a model-based service oriented architecture (model-based SOA), is a pure web architecture which employs a scale-out and scale-up approach. Applications run on scale-out web servers while CAD models, drawings, documents, and other file types are stored in scale-out vault servers with replication. The database is only used for meta-data which is ideal for a relational database server



Aras Innovator provides Visual Collaboration, a fast, simple way to collaborate securely across disciplines, locations and organizations.

and leads to excellent scale-up capabilities. These characteristics enable scalable performance whether running out-of-the-box or highly customized PLM applications.

FLEXIBLE: Compared to conventional compiled code-based systems, which might require weeks or months to make changes, Aras Innovator allows companies to make real-time modifications to business rules, forms, workflows and even the data model without any kind of complex programming. A browser-based graphical, drag-and-drop solution studio makes it easy to customize the out-of-the-box applications and even create new solutions. Behind the scenes, XML templates which describe the PLM applications are simply being modified. Aras uses application modeling instead of coding and compiling which makes customizing much, much faster and the customizations can be maintained when upgrades occur which is the basis of resilient applications.

ADAPTABLE: Again, here's where Aras Innovator's model-based SOA approach pays off because the platform virtual-

IS YOUR CURRENT PLM SYSTEM UP TO THE TASK?

Is your organization planning to do any of the following in the next 10 years? If so, your product lifecycle management system might hit a wall if it lacks resilience.

- Add or modify hardware to support end-user growth?
- Change or modify vault file storage?
- Add more sites to the network?
- Add new functionality, departments and workflows to an existing PLM system?
- Go through an acquisition or merger?
- Change or add an enterprise resource planning system, CAD program, or another major tool set?

izes well, partitions easily, and provides solution portability. Because solutions are portable, it's easy to move and merge Aras applications, transferring solutions between dev/test/production or sharing process improvements between different divisions of a business. The software doesn't skimp on flexibility when it comes to deployment options either: Companies can choose from on-premise, on-cloud and hybrid approaches for deployment, and Aras can be easily integrated with other enterprise systems like ERP. This flexibility means companies can move and migrate on their own schedule to control their own destiny.

UPGRADABLE: Regardless of the amount of tailoring an Aras Innovator enterprise application has undergone, upgrades are straightforward and easy. The entire system definition is described in the model's XML template. The SOA web services, which define the behaviors and actions available to the model, are compiled code. The combination of the model-based approach with the SOA results in a complete separation of system description and underlying technology. Upgrades to new releases of the underlying Aras Innovator SOA technology are straightforward. In fact Aras performs upgrades for subscribers at no additional cost.

ECONOMICAL: Together the scalable, adaptable, flexible, and upgradable combination of Aras Innovator make PLM more sustainable, which leads to a lower cost of ownership. With a full range of out-of-the-box PLM solutions that make customization faster and easier, expensive consulting is cut. In addition, the software's annual subscription eliminates PLM license fees and covers all upgrade costs, including upgrade services for customizations. This ensures that companies don't incur multiple payments to maintain their PLM environment, and that's what resilient PLM is all about.

SCALABILITY SPOTLIGHT



With product development requirements in a constant state of flux, it's incumbent on core enterprise systems like product lifecycle management (PLM) to be able to easily adapt to changing requirements without taking a nosedive in performance.

With support for open Web standards and a modern web platform, Aras Innovator was designed from the ground up for scalability, even if it is highly customized by the end user. Through its scale-out and scale-up approach, Aras Innovator can satisfy global engineering organizations of any size and scope, ensuring that the same PLM platform has staying power and performance whether there are several hundred users or several hundred thousand.

To verify scalability, Aras, Microsoft and HP undertook several rounds of benchmarks, which were conducted by Logic 20/20, an independent

business consultancy. Using tests designed to mimic real-world usage scenarios and data structures, Aras Innovator running on Microsoft SQL Server 2014 Enterprise Edition was able to scale to 1 million named users with 250,000 concurrent users while maintaining optimal performance. Running on a standard Hewlett Packard ProLiant DL980G7 server with 40

cores and a pair of HP ioDrive2 Duo I/O Accelerators, Aras Innovator clocked in with an average response time of 0.069 seconds for a range of operations with 250,000 concurrent users.

Logic 20/20's testing also found that average CPU utilization during testing was consistently below 10% and never higher than 20%. Based on its results, Logic 20/20 concluded that the combination of Aras Innovator 10 and SQL Server 2014 Enterprise Edition scales nearly linearly with hardware upgrades and that the PLM platform is not constrained by its architecture. Rather, the burden of work falls on the hardware, allowing global organizations to accommodate changing workloads simply by scaling up or scaling out accordingly.

"You need to be sure that whatever PLM software you choose today will work when you have more users and greater workloads," notes Peter Schroer, Aras president. "You need to make sure you don't get stuck because your PLM platform won't grow as big as you need it to."

