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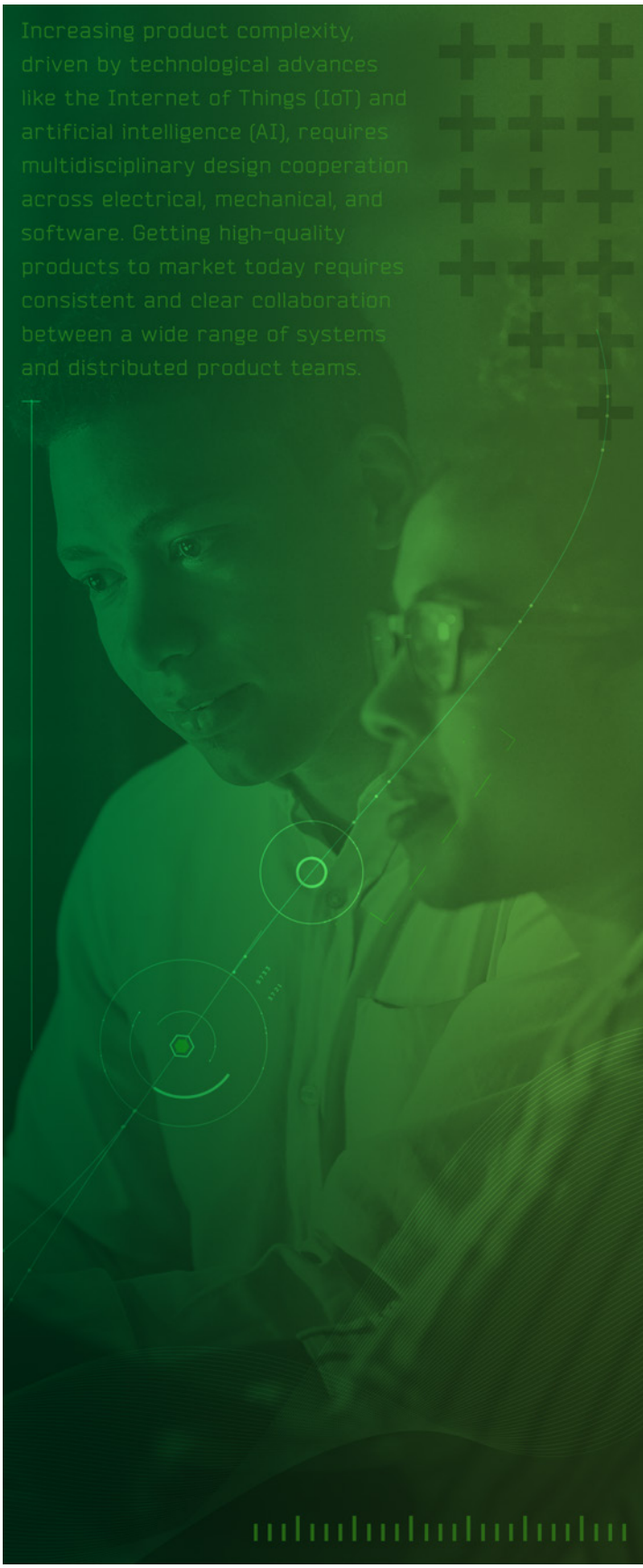
Today's Product Innovators Need Intelligent BOM Management

WHITE PAPER



IMPACT OF COMPLEX PRODUCTS AND SUPPLY CHAINS

The rapid evolution of technology and outsourced manufacturing has created new opportunities, but also new challenges and risks. One doesn't have to look very far to see how poor product design and development processes can impact companies and their customers. Global companies like Samsung and Apple have had their share of product failures. The launch of Samsung's foldable phone is just one example where the product launch was delayed by months due to design flaws.[1] Getting their product to market quickly, but before it was ready, proved to be an "embarrassing" moment for Samsung.[2]

Increasing product complexity, driven by technological advances like the Internet of Things (IoT) and artificial intelligence (AI), requires multidisciplinary design cooperation across electrical, mechanical, and software. Getting high-quality products to market today requires consistent and clear collaboration between a wide range of systems and distributed product teams.

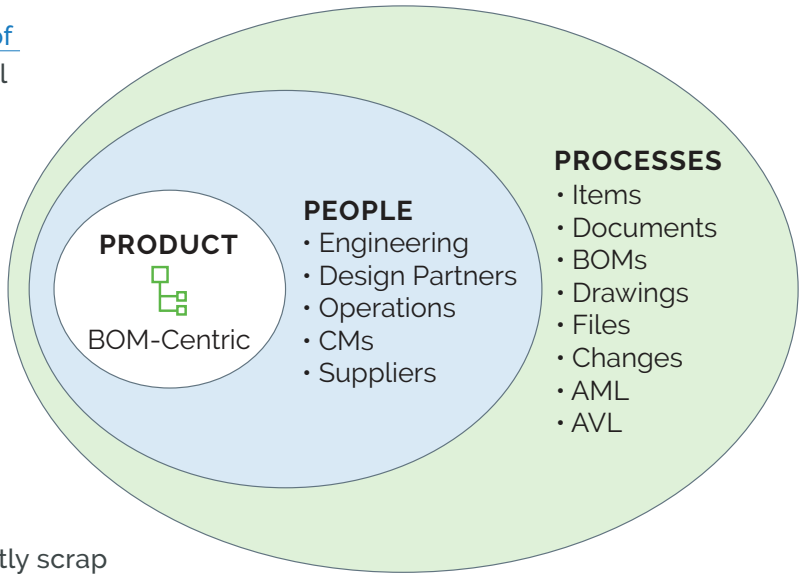
> Product innovators must turn to more intelligent BOM solutions that centralize control of the entire product record and BOM to eliminate obstacles and deliver superior products.

IN-CONTEXT COLLABORATION

Collaboration across teams and partners is the standard objective for every product company but achieving this goal can be challenging. Contract manufacturing partners (CMs) and their distributed supply chains must work in concert with the product company early and throughout the entire product lifecycle. To gain and retain a competitive advantage, everyone responsible for delivering a part of the product must work off the same page. This means having a single, secure place for all things product-related. A centrally controlled BOM with a complete product record can be the difference between leading the market and going out of business.

Companies demand tighter control of their intellectual property (IP), which is often managed in a bill of materials (BOM). BOMs contain all the components necessary to make a finished product and comprise the core building blocks of the product record. However, too often BOMs are managed across multiple systems by engineering and manufacturing teams. This leads to disconnected development processes frequently resulting in product launch delays, quality issues, manufacturing mistakes, and costly scrap and rework to correct product issues.

BOM-Centric Collaboration



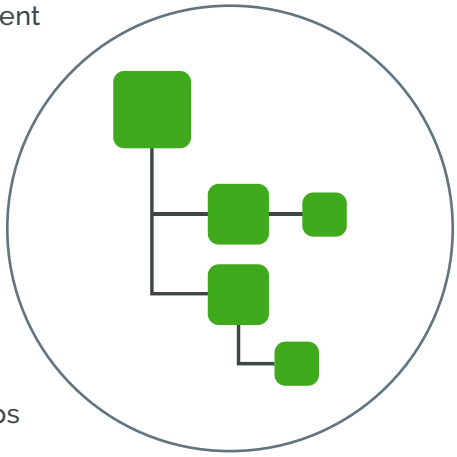
Product innovators must turn to more intelligent BOM solutions that centralize control of the entire product record and BOM to eliminate obstacles and deliver superior products.

Real-time collaboration is enhanced with cloud-based solutions that enable dispersed product teams to communicate throughout the entire product development process.

With an intelligent BOM management solution, all teams and tiers of the global supply chain can easily access information and collaborate anytime and anywhere.

THE EVOLUTION OF BOM MANAGEMENT

Before examining these five key requirements, it's worth understanding how BOM management has evolved and what outdated options you might see in your search for a solution.



Over the past few decades, we have seen BOM management evolve from manual or unintelligent records to more structured and intelligent ones. As technological advances were introduced with software applications and relational databases, the ability to manage complex BOMs improved to yield these key benefits:

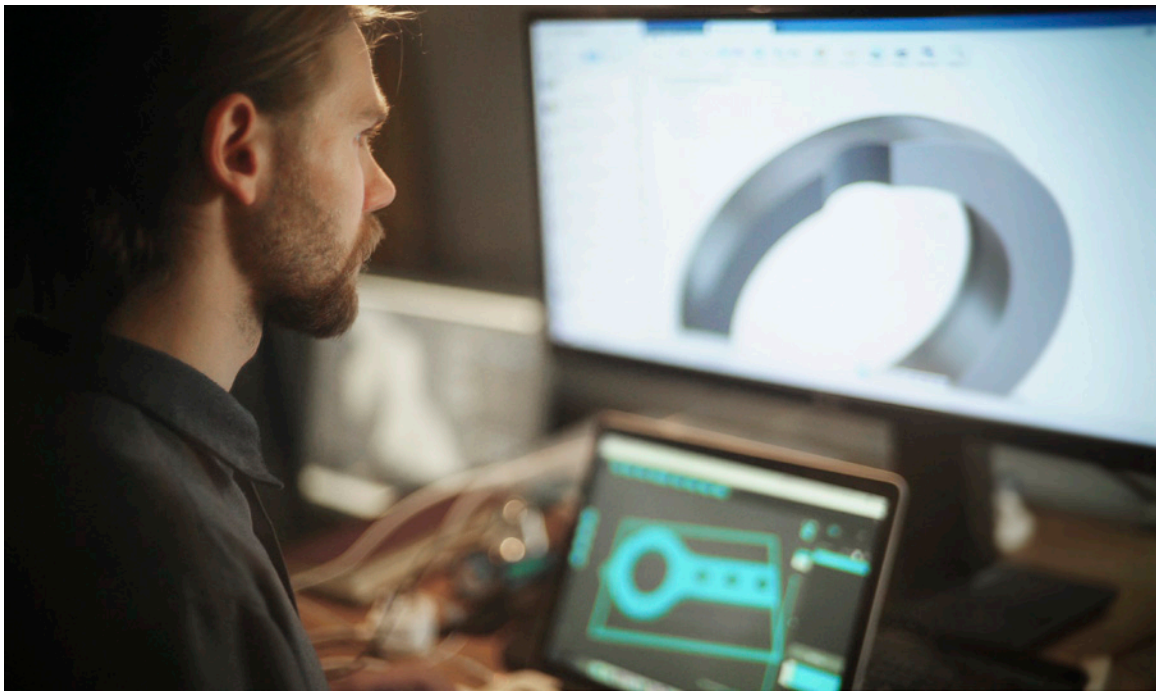
- Faster product release cycles with easier creation and changes (e.g., the ability to import from other systems, the ability to make bulk changes across all where-used assemblies, improved redlining tools)
- Greater accuracy with structured assembly relationships
- Better visibility with reporting for single, multilevel, where-used, and consolidated (flattened) BOMs
- Improved search to find components, subassemblies, and top assemblies

While each advancement introduced more effective ways to create, change, and release BOMs, most failed to deliver benefits to the entire product team from early design through production. Here are some key benefits and weaknesses to consider.

EARLY BOM MANAGEMENT SOLUTIONS

Solutions	Benefits	Weaknesses
Tabulated BOMs on Drawings	• Depicted BOMs (parts list) shown directly on drawing	• Not intelligent (raster image)
Spreadsheets	• Introduced parent/child structure and basic relationship	• Disconnected from drawings, change orders • Difficult to control changes and track usage
Relational Databases	• Provided ability to classify and data (e.g., item master, approved manufacturer's data could be associated with BOM structure data) • Created ability to manage multilevel BOM relationship and search for where-used assemblies	• Early databases required IT/ technical resources and were "home-grown" solutions • Separated from systems and processes that managed change orders, drawings, files, and other documentation
Computer-Aided Design (CAD)	• Increased productivity and quality of mechanical or electrical designs (vs. manual, hand-drawn designs) • Provided ability to generate BOM and export for use in downstream systems	• Disconnected design systems (e.g., EDA, mCAD, software)
Product Data Management (PDM)	• Simplified engineering design team collaboration when working simultaneously on the same designs	• Failed to introduce any real BOM-related advantages beyond what CAD solution offered • PDM solutions typically addressed only one CAD tool and didn't provide comprehensive way to manage ALL aspects of design (e.g., electrical, mechanical, software)
Enterprise Requirements Planning (ERP)	• Improved and helped automate production planning, procurement, and manufacturing processes • Included ability to manage BOM record more effectively	• Focused on latest-release BOM used for production and planning, not on all pre-production revisions in design and development • Did not address supply chain collaboration

As these solutions were introduced, many companies leveraged more than one, resulting in disparate systems across the enterprise. This led to a patchwork of systems in which impacted teams had difficulty identifying the right revision or product design.



ADDRESSING BROADER PRODUCT DEVELOPMENT PROCESSES

Product lifecycle management (PLM) solutions have evolved to address the limitations of traditional BOM management solutions. Some early PLM solutions were developed by CAD- or PDM-centric solution providers. These solutions created PLM capabilities that were more focused on the CAD model and file management issues required for engineering design teams, rather than the rest of the product team (e.g., quality, procurement, manufacturing, suppliers).

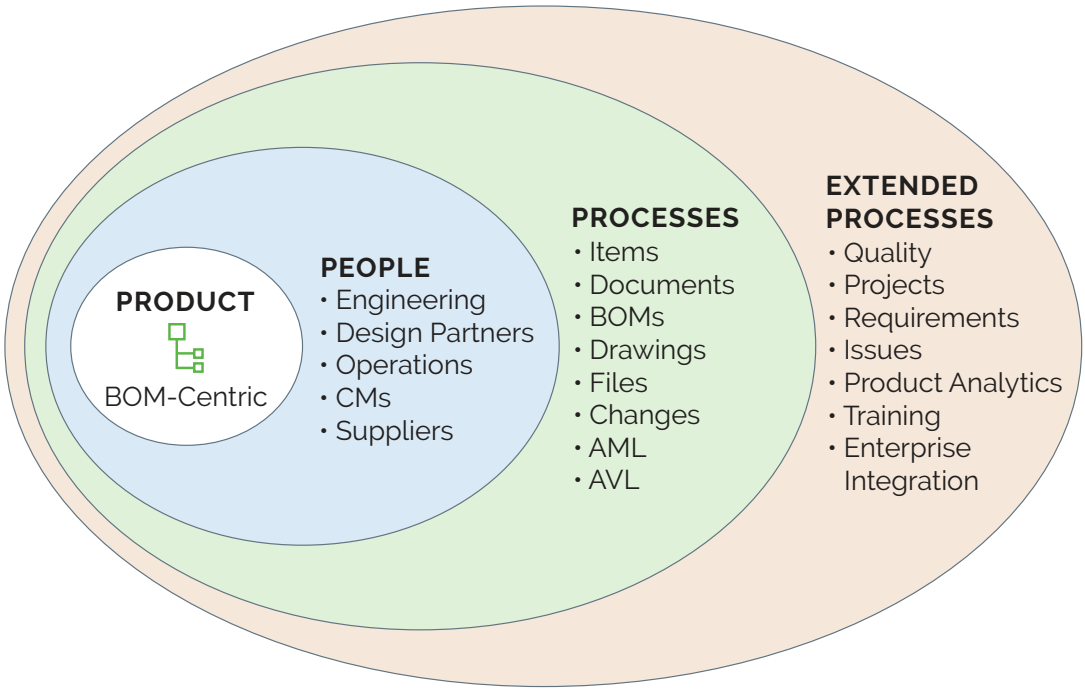
Cloud PLM software solutions evolved to provide necessary advancements to bring the complete product record together and share it with dispersed teams. These solutions were built from the ground up with an agnostic, and more complementary, approach to working with any CAD or PDM tools. This enabled the next wave of PLM solutions to move beyond focusing only on a single engineering design team's needs or their work-in-process (WIP) management processes within a single group (e.g., mechanical, electrical, software).

Today's product development platforms eliminate new product development and introduction (NPDI) barriers by managing the entire product record. Arena's cloud-based product development platform includes PLM and quality management system (QMS) solutions built on the foundational product record, BOM, and extended processes.

EXTENDING TRADITIONAL PLM BOUNDARIES

Arena Solutions began by providing the ability to create, change, and release products, which is the core of any good PLM system. As customers' manufacturing models became more distributed and complex, broader product process support was added to ensure products could be designed, manufactured, and shipped on time and without incident. Today, Arena's product development platform includes both PLM and QMS with more extended product processes than any other cloud-based solution on the market to provide a single source of truth for the connected product and quality record.

Product Development Platform



These extended product processes include management of the core product record with connections to:

- Closed-loop quality management processes
- Project management information
- Product requirements and issue management
- Component lifecycle and compliance information
- Product analytics
- Employee training records
- Supply chain partners
- Enterprise integrations (e.g., CAD, ERP, CRM, SSO)

Arena has extended the traditional borders of PLM to deliver a true single-source solution where all teams can collaborate more effectively and in real time.

CONTRASTING BOM MANAGEMENT SOLUTIONS

All of the solutions noted here can manage BOMs to some degree. However, most of these solutions predate the current realities that require dispersed teams to work together 24/7. So, the real question is: Can these systems address the way supply chains interact today?

Understanding the progression of BOM management options provides insight into what is required in today's modern product development environment and what you should demand of your system. If your current system doesn't address one or more of these requirements, then you need to know the five key factors necessary for more intelligent BOM management.

Solutions	Core BOM Definition	Structured Relationship	Pre & Post Production Revisions	Control Files & Documents	Electronic Routings and Approvals for ECO Processes	Supply Chain Collaboration	Sourcing & Compliance	Automated BOM Integration of Entire BOM to Manufacturing Systems	Extended Processes
Spreadsheets (and Stand-Alone BOM Tools)	●	●	●	●	●	●	●	●	●
CAD	●	●	●	◒	●	●	◒	●	●
PDM	●	●	●	◒	◒	●	◒	◒	●
ERP	●	●	◒	●	●	●	◒	●	●
On-Premises PLM	●	●	●	●	●	◒	◒	◒	◒
Arena Product Development Platform (PLM/QMS)	●	●	●	●	●	●	●	●	●

THE 5 KEY FACTORS TO DRIVE INTELLIGENT BOM MANAGEMENT

Selecting the right solution will enable you to improve your new product introduction process to drive down costs, improve reliability, and improve profit margins. It will also help you scale as demand increases and your company expands. Here are the five key functional areas to consider when creating a more intelligent way to manage your BOMs.

Quick Assessment

Does your existing system or set of solutions cover these key requirements?

- ☑ Aggregate electrical, mechanical, software, files, and documentation into a single system and complete BOM
- ☑ Create, change, and track revisions before and after production release
- ☑ Collaborate with partners for design, component sourcing, field services, and/or manufacturing
- ☑ Connect BOM to streamline engineering change, project management, quality, and other product processes
- ☑ Give visibility to product process trends and metrics to make more informed business decisions
- ☑ Integrate with upstream and downstream systems (CAD, ERP, CRM)

1. **Centralize Control of the BOM, Product Record, and Change Processes**

   Because design and manufacturing teams use many different systems unique to their job roles, it's important to have an agnostic approach to aggregate the entire product record into a single system for simplified collaboration. Having a centralized BOM provides better control while streamlining connections between product information and people to accelerate development processes. And cloud solutions make it easy to access information, no matter where your teams are located.

   Centralized control involves more than having a single system to store product information. It creates the necessary backbone for effective product development by helping connect all related product and process information. It helps with change processes (e.g., change requests, change orders, deviations) by linking key product record information. And it eliminates confusion by ensuring teams have a single place to create and change all aspects of the product design. Consider the following requirements when evaluating your needs:

Requirements	• Aggregate BOM and product record (e.g., electrical/mechanical/software design, drawings, specifications) • Enable easy import/integration from design systems and manufacturing systems • Automate review and release for change processes including ECRs, ECOs, and deviations
Benefits	• Eliminates multiple systems and duplicate data entry • Improves accuracy and reduces errors • Ensures every aspect of the product is controlled and documented, in context, to each revision • Simplifies and speeds time to resolution when manufacturing mistakes or quality issues arise
Actions	• Review how many systems are used to create, change, and manage product/BOMs • Determine if all design teams have early, easy, and continual access to related product designs • Understand if speed trumps adequate controls and quality in the race to get products released

2. Provide Secure Access and Accountability for Internal and External Teams

It seems like common sense, but you may be surprised to discover some solution providers have yet to create simple, secure ways to access and share product information between internal and external teams. Many providers continue to rely on outdated methods of collaboration that will not scale with highly dispersed teams. As such, some vendors claim to be "supply chain enabled," but evaluating their offerings in detail reveals a limited and risky approach to sharing product information with large, complex supply chains.

When evaluating how systems provide access and accountability, determine if the vendor offers only a "one-size-fits-all" license for different types of users. Or, do they provide "right-sized" licensing for internal and external team members based on their unique roles and responsibilities?

Does the solution provide a secure method for external partners to access only the specific components of the BOM they need to source or build? And finally, does the solution provide an audit trail of key actions to eliminate "finger-pointing" and increase accountability between internal and external teams?

Requirements	• Provide secure access and user authentication • Enable access to BOMs/product based on appropriate licensing and user roles • Ensure protection and accountability
Benefits	• Requires all users to have specific logins that provide right level of access • Ensures IP is not shared unnecessarily and is protected based on user responsibilities/roles • Provides accountability for actions via historical tracking of key actions
Actions	• Ask vendors if they have tailored and appropriately priced licensing for different users • Determine whether subsets of product information and BOMs can be shared with one or more partners to avoid giving unnecessary access to IP • Review the solution's ability to track key actions and make all teams accountable to perform

3. Deliver Comprehensive BOM Management Capabilities

Intelligent BOM management systems should provide comprehensive capabilities to create, import, change, share, compare, and approve BOMs throughout the entire product lifecycle. Before selecting a BOM management system, you should gather and evaluate the requirements of all your teams to ensure cross-functional collaboration can be achieved. Be careful not to evaluate BOM solutions against only one team's needs in managing design. It is important that electrical, mechanical, and software design teams have an agnostic approach to aggregate and share their related designs in a single system easily.

Requirements	**Managing Key BOM Descriptors/Attributes** • Component item numbers, names, categories, lifecycle phases, quantities, reference designators, and other user-definable attributes (e.g., BOM notes) • Key component attributes inherited automatically from part/item records • Cross-reference links to drawings, documents, specifications, files, and other records • Part and assembly thumbnails showing a snapshot of attached files • Designation of alternate or substitute parts **Multiple Views of BOMs** (Function Specific) • Flattened BOM (consolidated view of a multilevel BOM with a single roll-up of each item) • Indented BOMs (display unlimited multilevel explosions or views) • Sourcing BOMs • Costed BOMs with roll-ups • Compliance information for BOMs (e.g., RoHS, REACH, WEEE, conflict minerals) **BOM Reports, Search, and Comparisons** • Easy-to-compare redlines highlighting what changed between revisions • Where-used searches or links to traverse up the product structure and show all using assemblies • History to determine what changed **Accelerated BOM Change Process** • Flexibility to subject to revision control OR not (for pre-production releases) • Bulk replacement of parts used across multiple assemblies • Intelligent verification for reference designators confirming quantities match • Capability to package up entire BOM and all associated content in a build package for partners **Accurately Pass Information and Connect Systems** • Use import/export tools for BOMs • Leverage automated integration options for CAD, CRM, and ERP • Provide single sign-on (SSO)
Benefits	• Speeds the time to introduce new products • Eliminates unnecessary errors and costly quality issues • Enhances ability of teams to research BOM history • Provides insights and visibility (e.g., costing, compliance, sourcing)
Actions	• Ask to review key functionality in product demos for creating, changing (redlining), and releasing BOMs • Determine if the BOM functionality is intuitive so that teams will adopt • Review options for importing, exporting, integrating, and connecting to other systems to share information with design and manufacturing systems and external partners • Ask for references from customers at companies with similar design and manufacturing systems

4. Improve Collaboration With Formal and Informal Communication

Most vendors provide formal, revision-controlled options to collaborate around the product record. However, there are times when less formal and more flexible collaboration methods are needed. The ability to provide input around items, assemblies, BOMs, and other product information outside formal change and product processes enhances product development and ultimately accelerates NPDI processes.

Requirements	• Facilitate easy transfer of data between design and manufacturing systems • Provide intuitive web-based applications to accommodate less sophisticated partner environments • Provide formal and informal methods of collaboration • Share controlled build packages with in-context collaboration without accessing live system data • Enable licensed access for internal/external teams with formal approval and sign-off capabilities • Allow licensed access for internal/external teams with informal collaboration outside formal review process
Benefits	• Increases system adoption and removes training obstacles • Speeds product development cycles and time to market • Reduces time to identify product issues • Reduces cost and complexity to share information with multitiered supply chains • Removes confusing methods of collaboration via disconnected email, vaults, and other systems
Actions	• Determine if the solution can provide build packages for product data (e.g., BOMs, parts, documents, drawings) • Ask the vendor if they support informal ways to collaborate outside the formal change process

5. Perform Proactive Health and Risk Assessments on BOM Components

Complex product companies and their supply chain partners need to eliminate risks for sourcing market-available and compliant components. The ability to identify and source parts that meet environmental compliance is critical to reduce product costs and get products delivered on time and on budget. Providing component lifecycle and compliance information to the right people throughout the supply chain is critical to ensure quality, reduce costs, and avoid unnecessary shipping delays.

BOM Component Sourcing & Risk Assessment

EVERYROAD SALES ITEM	MFR ITEM	LOOKUP CRITERIA	MATCH	MATCHED PART	PART DESC	MARKET AVAILABILITY	STATUS	RISK	DATASHEET	ROHS	REACH	CONFLICT MINERALS	PCN
431-00001 rev 3 LED BLUE CLEAR THIN 0603 SMD	LTST-C191TBKT Lite-On	LTST-C191TBKT Lite-On		LTST-C191TBKT Lite-On Technology	LED Low-Power Uni-Color Blue 468nm 2-Pin Chip LED T/R	1,027,887	Active		Datasheet	RoHS	REACH	Conflict	PCN

Requirements	• Provide risk assessment from within your system and BOM view that includes integration to electronic component databases
	  • Access to large component database for global component distributors
	  • High-level risk component health indicator
	  • Market availability (e.g., number of parts available by supplier or alternate parts for obsolete components)
	  • Designation of compliance to RoHS, REACH, and conflict minerals along with links to compliance certificates or materials declarations
	• Ability to extract component distributor's web page
	  • Manufacturer's name and part number
	  • Vendor's name and part numbers

Benefits	• Accelerates the time to find, create, and source parts • Increases accuracy and eliminates manual data entry of component information • Reduces risk of purchasing obsolete, noncompliant, or hard-to-source parts
Actions	• Ask the BOM management vendor if they provide integration to electronics component databases and component distributors • Ensure your BOM solution can easily reference compliance and availability data and display within your BOM solution

PROVEN BOM MANAGEMENT FOR PRODUCT INNOVATORS

Product innovators like Nutanix, Sonos, Peloton, and Ecobee rely on Arena Solutions to manage their product development processes for their complex products. These companies require access to a central, secure system to collaborate with their internal teams and external partners.

CUSTOMER RESULTS: "ZERO WRONG BOMS"

Nutanix designs and sells an Enterprise Cloud Platform that natively converges compute, virtualization, and storage into a resilient, software-defined solution. Nutanix selected Arena to help address these key areas:

- Revision control
- Inefficiencies with change order management
- Expensive scrap and rework problems based on building products to the wrong revision

David Sangster is the Chief Operating Officer at Nutanix and manages the team responsible for fulfillment, logistics, new product introduction, and launching product into volume production. With dozens of active suppliers, including contract manufacturers, distributors, and key technology partners, David has had to deal with issues that stem from a high frequency of changes.

Before using Arena, Sangster's team was stuck relying on Excel spreadsheets and email to address manufacturing challenges. "It's embarrassing to admit, but we had a number of instances where the suppliers built the wrong version of the product," said Sangster. "It was 'rev A' all right, but the wrong 'rev A'."

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>
> —David Sangster, Chief Operating Officer, Nutanix

Success Story

NUTANIX

With Arena, Nutanix streamlined its design processes, reduced costs, and accelerated time to market.

Streamlined Design Processes

- ☑ Reduced ECO approvals from days to hours
- ☑ Accelerated engineering processes aligned around centralized data
- ☑ Improved collaboration with 50+ supply chain partners

Reduced Costs

- ☑ Reduced scrap and rework with "zero wrong BOMs"
- ☑ Lowered COGS with increased engineering team visibility
- ☑ Increased part re-use and standardization

Accelerated Time to Market

- ☑ Ability to import/export BOMs
- ☑ Flexibility to subject to revision control OR not (for pre-production releases)

CONCLUSION

If you need to work with dispersed teams and suppliers, you need to be confident that everyone is collaborating around the latest BOM revision throughout the entire product lifecycle. There is no need to rely on manual processes or siloed tools that lead to confusion and uncertainty. Arena's Cloud PLM solution offers a more intelligent BOM management approach to help you deliver innovative products fast.

To learn more about how Arena can help with your BOM management needs, visit ArenaSolutions.com.

REFERENCES

1. Samsung's wildly ambitious $2,000 folding phone that was breaking after days of use learn about this saga
2. Samsung Admits To 'Embarrassing' Galaxy Fold Failure

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