



# Today's Product Innovators Need Intelligent BOM Management



# 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. In 2016, Samsung's Galaxy Note 7 battery issues caused not only explosions and recalls, but also damage to the Samsung brand.<sup>1</sup> Revealingly, Underwriters Laboratories concluded that both design and manufacturing issues contributed to the battery problems – with design issues linked to two key supply chain partners.<sup>2</sup>

The convergence of mechanical, electrical, and software design in the Internet of Things (IoT)<sup>3</sup> era is forcing multi-disciplinary design cooperation. Getting high quality products to market today requires consistent and clear collaboration between a wide range of systems and distributed product teams.

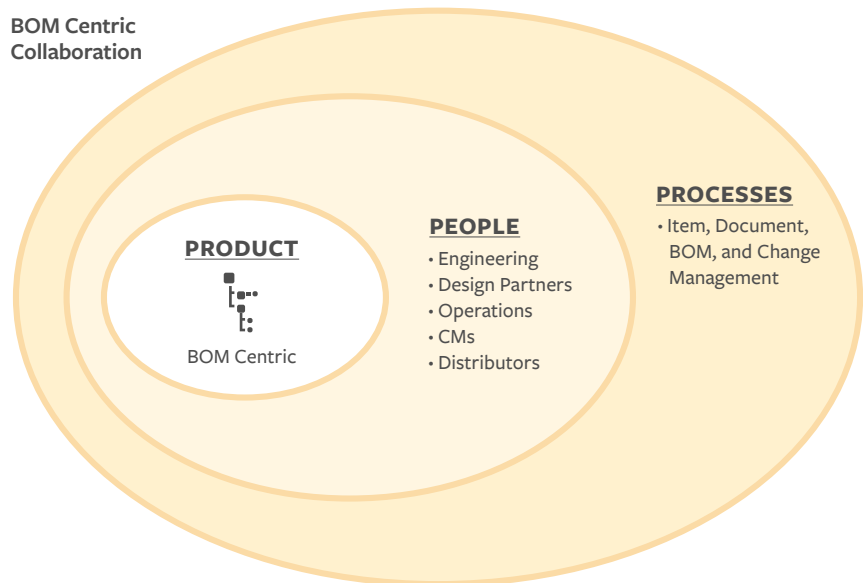
Companies demand tighter control of their intellectual property (IP), which is often managed in a [bill of materials](#) (BOM). BOMs define everything necessary to manufacture products and comprise the core building blocks of the [product record](#). However, too often BOMs are managed across multiple 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.

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.

Product innovators must turn to more intelligent BOM solutions 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. These teams are only as effective as their weakest link in the supply chain, and some partners may not have sophisticated infrastructure or large teams to help design, source, build, and ship products. With a BOM centric solution, all teams and tiers of the global supply chain can easily access information and collaborate anytime and anywhere.

**Product innovators must turn to more intelligent BOM solutions to eliminate obstacles and deliver superior products.**



**These are the 5 key requirements that intelligent BOM management solutions should address to streamline product development:**

1. Centralize control of the BOM, product record, and change processes
2. Provide secure access and accountability for internal and external teams
3. Deliver comprehensive BOM management capabilities
4. Improve collaboration with formal and informal communication
5. Perform proactive health and risk assessments on BOM Components

## The Evolution of BOM Management

Before examining these 5 key requirements, it's worth understanding how BOM management has evolved and what outdated options you might see in your search for a solution.

## BOM Management Comes of Age

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, and to make bulk changes across all where-used assemblies, improved redlining tools)
- Greater accuracy with structured assembly relationships
- Better visibility with reporting for single, multi-level, 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
<b>Tabulated BOMs on Drawings</b>	<ul style="list-style-type: none"> <li>• Depicted BOMs (parts list) shown directly on drawing</li> </ul>	<ul style="list-style-type: none"> <li>• Not intelligent (raster image)</li> </ul>
<b>Spreadsheets</b>	<ul style="list-style-type: none"> <li>• Introduced parent/child structure and basic relationship</li> </ul>	<ul style="list-style-type: none"> <li>• Disconnected from drawings, change orders</li> <li>• Difficult to control changes and track usage</li> </ul>
<b>Relational Databases</b>	<ul style="list-style-type: none"> <li>• Provided ability to classify and data (e.g., item master, approved manufacturer's data could be associated with BOM structure data)</li> <li>• Created ability to manage multi-level BOM relationship and search for where-used assemblies</li> </ul>	<ul style="list-style-type: none"> <li>• Early databases required IT/technical resources and were "home-grown" solutions</li> <li>• Separated from systems and processes that managed change orders, drawings, files, and other documentation</li> </ul>

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## Early BOM Management Solutions (cont'd)

Solutions	Benefits	Weaknesses
<b>Computer-aided Design (CAD)</b>	<ul style="list-style-type: none"> <li>• Increased productivity and quality of mechanical or electrical designs (vs. manual hand drawn designs)</li> <li>• Provide ability to generate BOM and export for use in downstream systems</li> </ul>	<ul style="list-style-type: none"> <li>• Disconnected design systems (e.g., eCAD, mCAD, and software)</li> </ul>
<b>Product Data Management (PDM)</b>	<ul style="list-style-type: none"> <li>• Simplified engineering design team collaboration when working simultaneously on the same designs</li> </ul>	<ul style="list-style-type: none"> <li>• Failed to introduce any real BOM related advantages beyond what CAD solution offered</li> <li>• 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)</li> </ul>
<b>Material Requirements Planning (MRP/ERP)</b>	<ul style="list-style-type: none"> <li>• Improved and helped automate production planning, procurement, and manufacturing processes</li> <li>• Included ability to manage BOM record more effectively</li> </ul>	<ul style="list-style-type: none"> <li>• Focused on latest release BOM used for production and planning, not on all pre-production revisions in design and development</li> <li>• Did not address supply chain collaboration</li> </ul>

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.

## CAD Centric vs. Product Centric PLM

Some early PLM solutions were developed by CAD / PDM solution vendors. They created PLM capabilities that were CAD centric and typically overlapped with their design tool capabilities.

They tried to incorporate the CAD work-in-process (WIP) design management issues from PDM into PLM, which created greater complexity managing native design files in two different systems of record. This approach often resulted in longer implementations, significant custom development, and sometimes the inability to deliver broader PLM functionality for teams outside of engineering. These CAD centric vendors also created issues when customers chose to use design tools not developed by the CAD or PDM vendor.

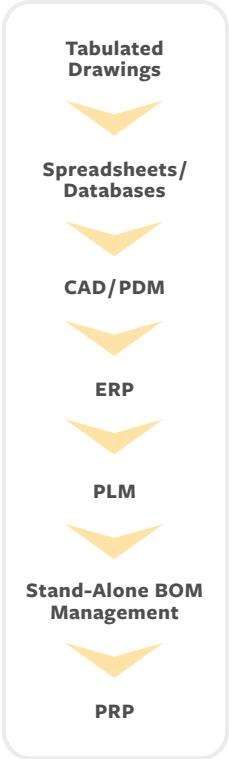
On the other hand, product centric Product Lifecycle Management (PLM) solutions were built from the ground up with an agnostic and more complementary approach to working with design tools. These PLM solutions moved beyond a narrow focus on engineering design team and WIP management issues to address broader product

development processes that impacted the entire product team (e.g., engineering, quality, purchasing, manufacturing, and supply chain partners). However, product centric PLM solutions did not have the added complexity of managing multiple, proprietary CAD file formats where competing CAD vendors were often reluctant to share their IP and integration frameworks.

Product centric PLM solutions were better suited to aggregate product information, BOMs, and associated files from the customer’s mechanical, electrical, and software design tools of choice. Instead of managing CAD and WIP management in both PDM and PLM, this new approach allowed engineering teams to continue developing native designs in CAD and PDM, while enabling the transfer of parts, BOMs, and viewable design files into PLM when it was time to review the design with the rest of the product team that would help deliver the product to market.

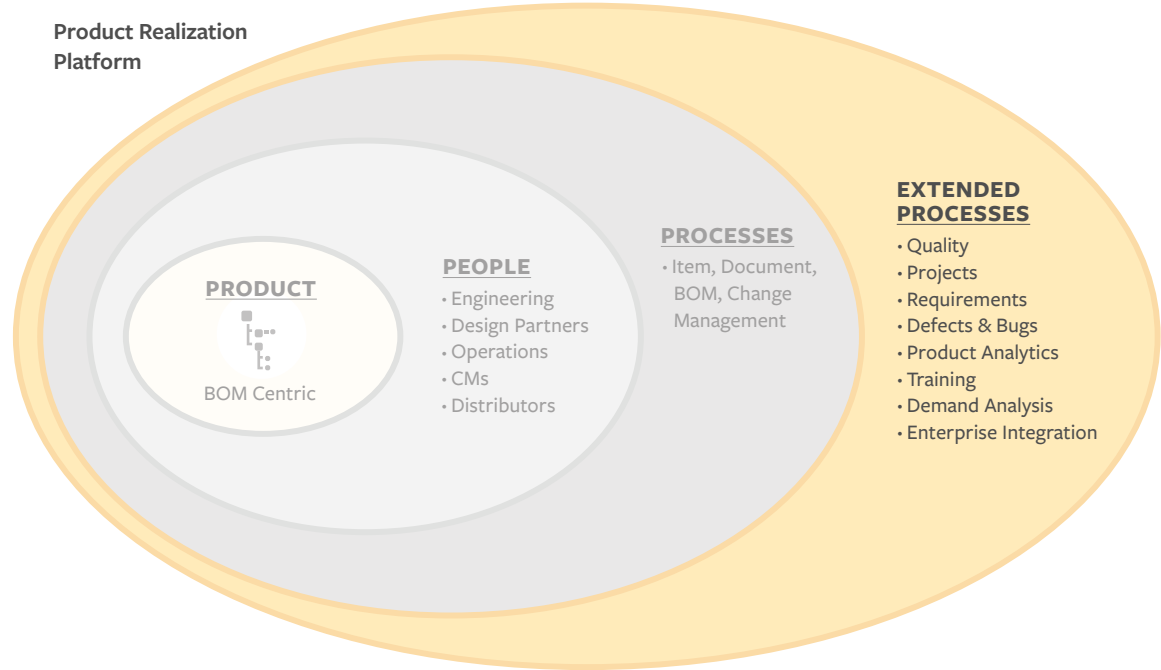
Since CAD centric PLM systems were more complicated to use and difficult to implement, it created a window of opportunity for new software startups to provide more simplistic standalone BOM management solutions. At first, these standalone systems appeared to offer a simpler and more appealing way to manage BOMs, but they did not provide much beyond basic BOM functionality. They also lacked critical connections to people and systems across the supply chain. And instead of creating a single system to manage product information, they added to the number of systems required to manage the entire product record and BOM throughout the entire product development process.

BOM System Evolution



## Product Development Platform Extends Traditional PLM Borders

Arena Solutions began by providing the ability to create, change, and release products, which is the core of any good PLM. 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 PRP solution includes more extended product processes than any other cloud-based PLM solution on the market.



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

- Quality and corrective action preventive action (CAPA) processes
- Project management information
- Product requirements, hardware defects, and bug tracking
- Component lifecycle and compliance information
- Product demand analysis
- Product analytics
- Employee training records
- Supply chain partners
- Enterprise integrations (e.g., CAD, ERP, Quality Inspection, SSO)

Arena PRP has extended the traditional borders of PLM to deliver a true single source solution where all teams can collaborate.

## Contrasting BOM Management Solutions

		Core BOM Definition	Structured Relationship	Pre & Post Production Revisions	Control Files & Documents	Engineering Change Processes	Supply Chain Collaboration	Sourcing & Compliance	Integration to Design & Manufacturing	Extended Processes
Solutions	Spreadsheets	●	●	●						
	CAD	●	●	●	◐					
	PDM	●		●	◐	◐			◐	
	ERP	●	●	◐				◐		
	Standalone BOM	●	●	●	?	?	?		?	
	PLM	●	●	●	●	●	?	?	?	?
	PRP	●	●	●	●	●	●	●	●	●

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

## 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 streamlined engineering change, project management, quality, employee training, and other product processes
- Share BOM information easily between design and manufacturing systems
- Protect IP with data encryption, secure user authentication, and configurable access user controls
- Gain visibility to product process trends and metrics to make more informed business decisions
- Consolidate multiple systems to avoid duplication and replication of like information
- Enable web-based access 24/7 anywhere around the world

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 key 5 key factors necessary for more intelligent BOM management.

## The 5 Key Factors to More Intelligent BOM Management

Selecting the right solution will enable you to improve your NPI 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 5 key functional areas to consider when creating a more intelligent way to manage your BOMs.

### 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:

<p><b>Requirements</b></p>	<ul style="list-style-type: none"> <li>• Aggregate BOM and product record (e.g., electrical/mechanical/software design, drawings, and specifications)</li> <li>• Enable easy import/integration from design systems and manufacturing systems</li> <li>• Automate review and release for change processes including ECRs, ECOs, and Deviations</li> </ul>
<p><b>Benefits</b></p>	<ul style="list-style-type: none"> <li>• Eliminates multiple systems and duplicate data entry</li> <li>• Improves accuracy and reduces errors</li> <li>• Ensures every aspect of the product is controlled and documented, in context, to each revision</li> <li>• Simplifies and speeds time to resolution when manufacturing mistakes or quality issues arise</li> </ul>
<p><b>Actions</b></p>	<ul style="list-style-type: none"> <li>• Review how many systems are used to create, change, and manage product/BOMs</li> <li>• Determine if all design teams if they have early, easy, and continual access to related product designs</li> <li>• Understand if speed trumps adequate controls and quality in the race to get products released</li> </ul>

**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?

<b>Requirements</b>	<ul style="list-style-type: none"> <li>• Provide secure access and user authentication</li> <li>• Enable access based to BOMs/product based on appropriate licensing and user roles</li> <li>• Ensure protection and accountability</li> </ul>
<b>Benefits</b>	<ul style="list-style-type: none"> <li>• Requires all users to have specific logins that provide right level of access</li> <li>• Ensures IP is not shared unnecessarily and is protected based on user responsibilities/roles</li> <li>• Provides accountability for actions via historical tracking of key actions</li> </ul>
<b>Actions</b>	<ul style="list-style-type: none"> <li>• Ask vendors if they have tailored and appropriately priced licensing for different users</li> <li>• Determine whether subsets of product information and BOMs can be shared with one or more partners to avoid giving unnecessary access to IP</li> <li>• Review the solution’s ability to track key actions and make all teams accountable to perform</li> </ul>

### 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 your entire teams’ requirements 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.

<b>Requirements</b>	<p><b>Managing Key BOM Descriptors/Attributes</b></p> <ul style="list-style-type: none"> <li>• Component item numbers, names, categories, lifecycle phases, quantities, reference designators, and other user definable attributes (e.g., BOM notes)</li> <li>• Key component attributes inherited automatically from part/item records</li> <li>• Cross-reference links to drawings, documents, specifications, files &amp; other records</li> <li>• Part and assembly thumbnails showing snapshot of attached files</li> <li>• Designation of alternate or substitute parts</li> </ul>
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<p><b>Requirements</b></p>	<p><b>Multiple Views of BOMs (Function Specific)</b></p> <ul style="list-style-type: none"> <li>• Flattened BOM (consolidated view of a multi-level BOM with a single roll-up of each item)</li> <li>• Indented BOMs (display unlimited multi-level explosions or views)</li> <li>• Sourcing BOMs</li> <li>• Costed BOMs with roll ups</li> <li>• Compliance information for BOMs (e.g., RoHS, REACH, WEEE, Conflict Minerals)</li> </ul> <p><b>BOM Reports, Search, and Comparisons</b></p> <ul style="list-style-type: none"> <li>• Easy to compare redlines highlighting what changed between revisions</li> <li>• Where-used searches or links to traverse up the product structure and show all using assemblies</li> <li>• History to determine what changed</li> </ul> <p><b>Accelerated BOM Change Process</b></p> <ul style="list-style-type: none"> <li>• Ability to import/export BOMs</li> <li>• Flexibility to subject to revision control OR not (for pre-production releases)</li> <li>• Bulk replacement of parts used across multiple assemblies</li> <li>• Intelligent verification for reference designators confirming quantities match</li> <li>• Capability to package up entire BOM and all associated content in a build package for partners</li> </ul>
<p><b>Benefits</b></p>	<ul style="list-style-type: none"> <li>• Speeds the time to introduce new products</li> <li>• Eliminates unnecessary errors and costly quality issues</li> <li>• Enhances teams' ability to research BOM history</li> <li>• Provides insights and visibility (e.g., costing, compliance, sourcing)</li> </ul>
<p><b>Actions</b></p>	<ul style="list-style-type: none"> <li>• Ask to review key functionality in product demos for creating, changing (redlining), and releasing BOMs</li> <li>• Determine if the BOM functionality is intuitive so that teams will adopt</li> <li>• Review options for importing, exporting, integrating and connecting to other systems to share information with design and manufacturing systems and external partners</li> <li>• Ask for references from customers at companies with similar design and manufacturing systems</li> </ul>

#### 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 methods of collaborating 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 NPI processes.

<p><b>Requirements</b></p>	<ul style="list-style-type: none"> <li>• Facilitate easy transfer of data between design and manufacturing systems</li> <li>• Provide intuitive web-based applications to accommodate less sophisticated partner environments</li> <li>• Provide formal and informal methods of collaboration</li> <li>• Share controlled build packages with in-context collaboration without accessing live system data</li> <li>• Enable licensed access for internal/external teams with formal approval and sign-off capabilities</li> <li>• Allow licensed access for internal/external teams with informal collaboration outside formal review process</li> </ul>
<p><b>Benefits</b></p>	<ul style="list-style-type: none"> <li>• Increases system adoption and removes training obstacles</li> <li>• Speeds product development cycles and time to market</li> <li>• Reduces time to identify product issues</li> <li>• Reduces cost and complexity to share information with multi-tier supply chains</li> <li>• Removes confusing methods of collaboration via disconnected email, vaults, and other systems</li> </ul>
<p><b>Actions</b></p>	<ul style="list-style-type: none"> <li>• Determine if the solution can provide build packages for product data (e.g., BOMs, parts, documents, drawings)</li> <li>• Ask vendor if they support informal ways to collaborate outside the formal change process</li> </ul>

#### 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

Item Number	Mfr. Item Number	Part Description	Market Availability	Status	Risk	Datasheet	RoHS	REACH	Conflict Minerals	PCN
10035 3M	10035 3M	SCC 1000 Open Top Static Shielded Bag Metal-In	5,638	Active	<span style="color: green;">●</span>	✓	✓	✓	✓	✓

<b>Requirements</b>	<ul style="list-style-type: none"> <li>• Provide risk assessment from within your system and BOM view that includes integration to electronic component databases               <ul style="list-style-type: none"> <li>• Access to large component database for global component distributors</li> <li>• High level risk component health indicator</li> <li>• Market availability (e.g., number of parts available by supplier or alternate parts for obsolete components)</li> <li>• Designation of compliance to RoHS, REACH, and conflict minerals along with links to compliance certificates or materials declarations</li> </ul> </li> <li>• Ability to extract component distributor's webpage               <ul style="list-style-type: none"> <li>• Manufacturer's name and part number</li> <li>• Vendor's name and part numbers</li> </ul> </li> </ul>
<b>Benefits</b>	<ul style="list-style-type: none"> <li>• Accelerates the time to find, create, and source parts</li> <li>• Increases accuracy and eliminates manual data entry of component information</li> <li>• Reduces risk purchasing obsolete, non-compliance, or hard to source parts</li> </ul>
<b>Actions</b>	<ul style="list-style-type: none"> <li>• Ask the BOM management vendor if they provide integration to electronics component databases and component distributors</li> <li>• Ensure your BOM solution can easily reference compliance and availability data and display within your BOM solution</li> </ul>

## Proven BOM Management for Product Innovators

Product innovators like GoPro, Teleflex, Nutanix, and Bio-Rad 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 issues:

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

David Sangster is the Senior Vice President of Operations 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.

**“It’s embarrassing to admit, but we had a number of instances where the suppliers built the wrong version of the product. It was ‘rev A’ all right, but the wrong ‘rev A’.”**

– David Sangster  
Senior VP of Operations, Nutanix

Prior to 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’.”

With Arena, Nutanix streamlined their 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”
- ✓ Lower 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)

**NUTANIX™**



There are hundreds of Arena customer success stories just like Nutanix. As you consider your BOM management needs, remember Arena has been helping companies design, produce, and deliver innovative products in the cloud since 2000. We have elevated PLM into a comprehensive product realization platform to help complex product companies accelerate NPD and NPI to deliver high quality products to market fast. So, don’t settle for partial or disconnected BOM solutions when you can use a single solution that connects your products, people, and processes. To learn more about how Arena can help with your BOM management needs, contact us today.

<sup>1</sup> Samsung blames batteries for Galaxy Note 7 fires, <http://money.cnn.com/2017/01/22/technology/samsung-galaxy-note-7-fires-investigation-batteries/>

<sup>2</sup> Samsung details Note 7 battery finding and highlights future safety measures, <https://techcrunch.com/2017/01/22/note-7-3/>

<sup>3</sup> Internet of Things (IoT) definition, [https://en.wikipedia.org/wiki/Internet\\_of\\_things](https://en.wikipedia.org/wiki/Internet_of_things)