CIMdata



Configure-to-Order: Efficiently Meeting Diverse Customer Requirements

Delivering Complex Products Faster and Accurately

Sponsored by Aras

Contents

- Key Takeaways
- Introduction
- Configure-to-Order Elements
- A Product Innovation Platform
- Aras Innovator, A Product Innovation Platform 1/2
- Aras Innovator, A Product Innovation Platform 2/2
- Aras Variant Management 1/3
- Aras Variant Management 2/3
- Aras Variant Management 3/3
- Applying Configurator Technology 1/3
- Applying Configurator Technology 2/3
- Applying Configurator Technology 3/3
- Conclusion
- About Aras



Key Takeaways

- Configure-to-Order (CTO) is a product and sales strategy used to efficiently define and manage customer demand through the use of product variants.
- In most CTO environments, Engineer-to-Order (ETO) is still needed as an option for complex customer needs and to support continuous innovation.
- A modular design strategy, flexible product architecture, and a PLM platform with a strong, flexible configurator are foundational elements needed to successfully define and deliver CTO products.
- Aras' approach to product variability enables a common variability definition that can be used across the lifecycle from sales to product development to manufacturing, and finally to service thereby ensuring consistency while leveraging a low-code approach for maximum product configurability.
- The Aras Innovator platform provides the technology stack needed to effectively develop and produce configurable products in support of Make-to-Stock (MTS), ETO, CTO, and combined CTO/ETO hybrid business and product line strategies.



Introduction

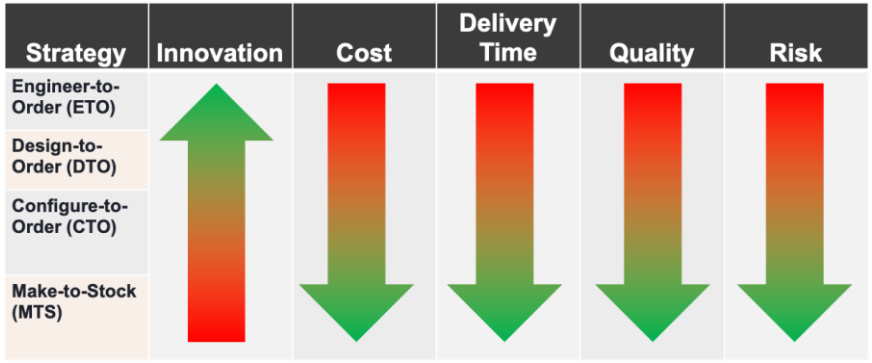
Once an idea becomes a product, companies often create variants to expand market acceptance. Variation points, like size, color, or performance, must resonate with customers. Properly designed product platforms require minimal additional engineering and capital to expand the market, boosting revenue and profits. Manufacturing and service can also optimize processes using these variations.

Transforming an idea into a product for unique customer needs often requires extra engineering, known as an Engineer-to-Order (ETO) strategy. This is costly and time-consuming, adding complexity to manufacturing and service.

Configure-to-Order (CTO) uses modular design, allowing standard parts or modules to be assembled to meet customer needs. Each module is independently designed, developed, and tested before integration.

Make-to-Stock (MTS) produces goods based on anticipated demand, allowing quick distribution but less customization.

These strategies can be profitable and are not mutually exclusive. Companies often start with ETO, then expand to CTO as they understand their markets better, and finally adopt MTS as demand becomes predictable. They can also offer all three approaches within a single product family.



Configurators Affect Critical Business KPIs for Different Business Strategies

Improving business performance involves evolving ETO products to CTO by adding configurable elements over time. The key strategy is to understand the product architecture and only allow variability where it adds value to the customer and is profitable. This approach ensures that the variability introduced is both beneficial to the customer and profitable for the company.

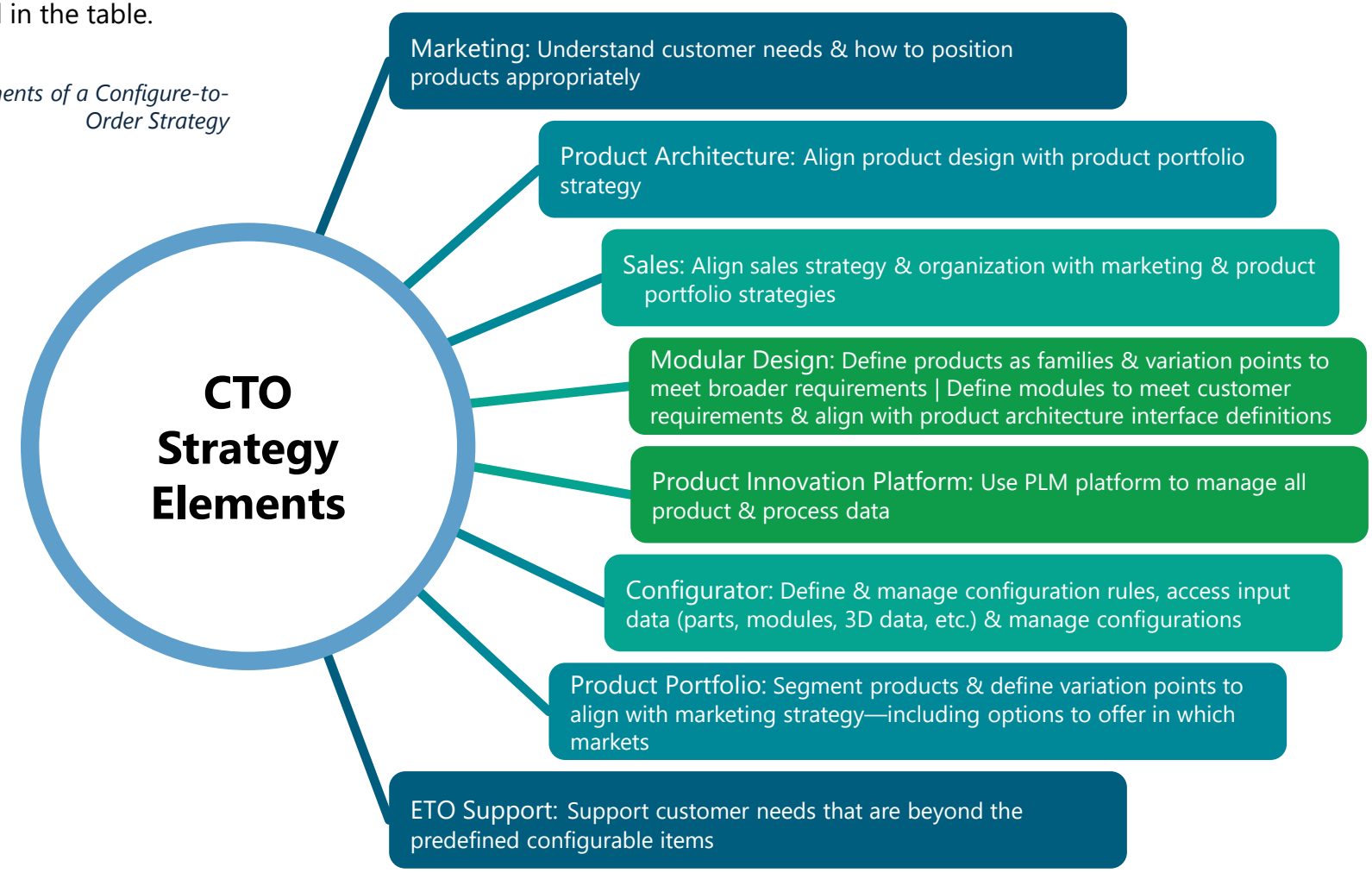
Transforming from ETO to CTO takes time, but CTO to MTS can be quick once demand is clear. The most efficient way to develop a CTO product is through modular design with well-defined variation points and stable interfaces.

A hybrid ETO/CTO process can be beneficial, with ETO at the module level allowing incremental product variants. ETO can create new modules or core elements, while reusing existing ones is common.

Configure-to-Order Elements

Adopting a Configure-To-Order business strategy is not as simple as licensing a configurator application or module. Structuring a product so it can be effectively configured, produced, delivered, and serviced while generating the market share and expected profit targets requires people, processes, technology, and data to be aligned. Key strategy issues include those defined in the table.

Elements of a Configure-to-Order Strategy



A Product Innovation Platform

A product innovation platform is defined by five strategic imperatives and seven strategic characteristics shown below. They were published in a CIMdata Position Paper that defines what a Product Innovation Platform is and why it is important.

Strategic Imperatives—Critical, high-priority set of objectives that an organization must achieve to maintain or enhance its competitive position and ensure long-term success:

- Connection—how easily others can plug into the platform to share & transact
- Gravity—how well the platform attracts participants, both producers and consumers
- Flow—how well the platform fosters the exchange and co-creation of value
- Openness—how easily the platform can be extended and enhanced
- End-to-end lifecycle support—its ability to support the complete product lifecycle

Strategic Characteristics—Features, capabilities, or attributes that are pivotal for achieving long-term business goals, ensuring competitiveness, and enabling organizational transformation, i.e., the strategic imperatives

- Sustainability
- Data management and ability to find data
- Configuration and traceability
- Process and knowledge management
- Upgradeability
- Enterprise infrastructure utilization
- Availability and stability

The Need for a Product Innovation Platform…

A CTO product line requires a product innovation platform to define a foundation upon which configuration rules, parts, and related information critical to CTO (and ETO) products can be created and maintained. Aras provides this in their PLM solution.

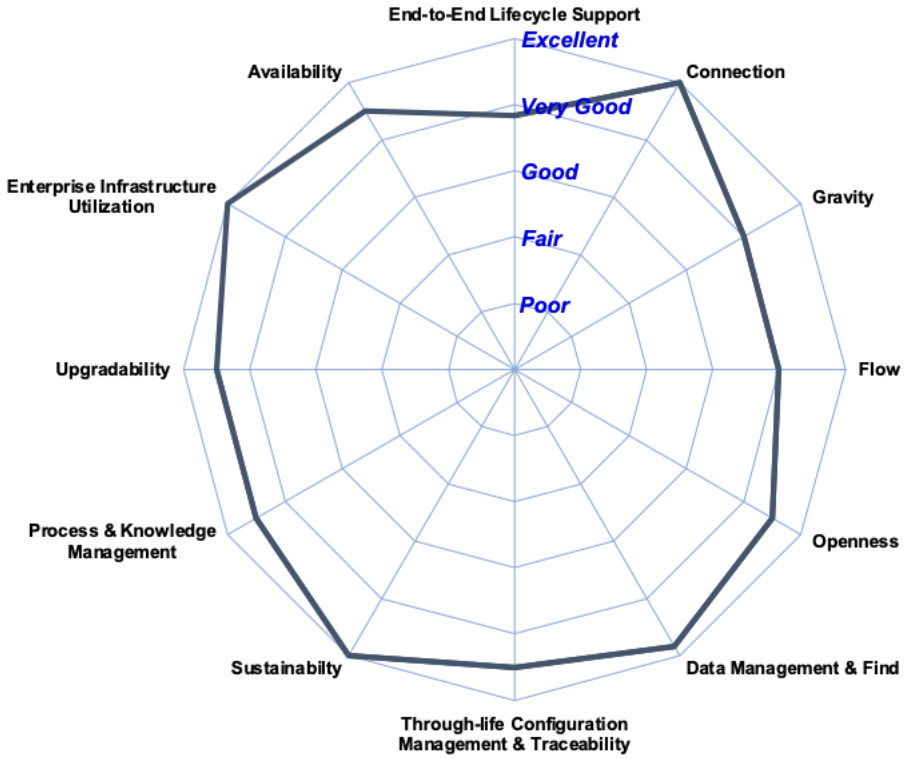
Aras Innovator, A Product Innovation Platform 1/2

Capabilities & Benefits

CIMdata assessed Aras Innovator against the CIMdata's Product Innovation Platform description and found it to be a credible, robust implementation of the definition. For more information on the assessment see CIMdata's Product Innovation Platform Assessment.

Key capabilities built into Aras Innovator that support this assessment include:

- Low code—Aras' low code capability is core to how the solution is built and configured. It has been there from the product's inception and is well proven.
- Flexible data model—The Aras Innovator data model is configured using its low code capability and is well known for its adaptability.
- Upgrades—For over 20 years, Aras has offered free upgrades to subscribers, regardless of how much configuration they've done. This is possible thanks to their flexible data model and low-code approach. While this feature is less unique in SaaS (since competitors also offer upgrades with SaaS), moving to SaaS often limits customization and requires removing or recreating customizations from on-premises implementations. However, Aras allows the same level of configurability for both cloud and on-premises deployments. Their extensive experience with upgrades ensures that customers can trust their upgrades will work smoothly.



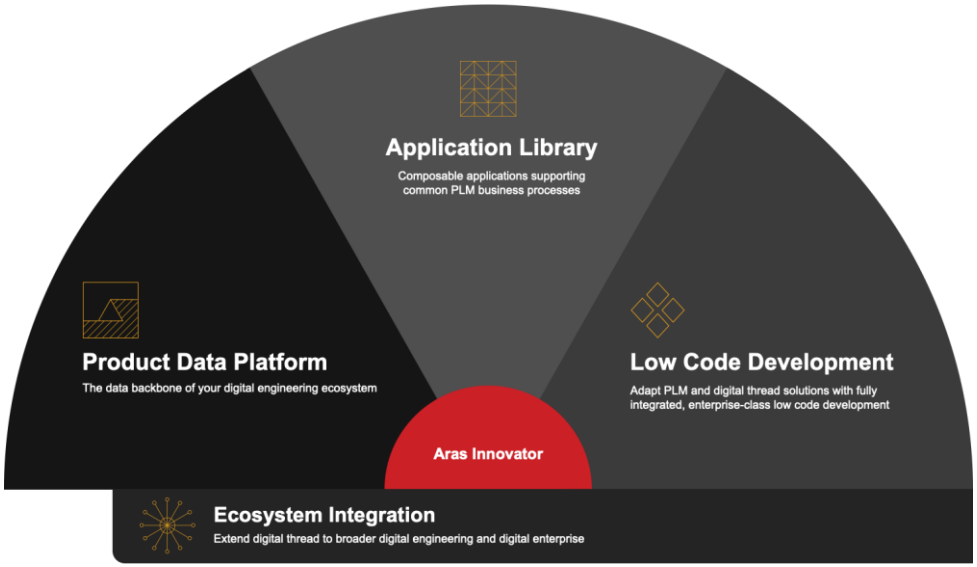
CIMdata's Assessment of Aras Innovator Against the Product Innovation Platform Definition

Aras Innovator, A Product Innovation Platform 2/2

Key capabilities continued:

- Federated Data—Aras Innovator supports federated data which enables more robust digital thread implementations. With federated data, data remains in its source repository and is referenced by the destination repository. Depending on security, Aras Innovator is able to write to federated data fields providing added data flexibility, ultimately implemented as a logical single source of truth with a consistent user experience.
- Visualization—If CAD data is associated to the configured structure, the Aras 3D viewer can show the configuration graphically and capture markups and comments.
- Integrations—Aras encourages integrations as the trusted data hub by providing flexible data modeling along with RESTful APIs and a rich connector ecosystem for secure data exchange with encryption at-rest and in-transit. Aras also offers numerous integrations with enterprise and authoring applications, especially CAD applications. Many independent software vendors (ISVs) provide integrations for all common CAD solutions. Additionally, Aras' subsidiary, XPLM, offers a wide range of integrations for MCAD, ECAD, ERP, PLM, and MBSE solutions.

Aras Innovator platform and applications such as Product Engineering, Manufacturing Process Planning, Variant Management, Technical Documentation, Requirements Engineering, and more are included as part of the cloud-based SaaS deployment or on-premises. Using Aras' low-code approach, variant management can be applied to BOMs and structures anywhere within the product lifecycle. The solutions are the same and any on-premises configuration can be moved to SaaS without losing any capability. Beyond that, Aras still offers the easily configured, Community Edition download that can be used in production without support for up to fifty named users.



A Platform for PLM & Digital Thread

Aras Variant Management 1/3

Aras Innovator, which has been built as a PLM platform from its very early days, has allowed Aras to develop it differently from traditional enterprise applications. Aras develops foundational modular platform services that support various capabilities. These services can be used individually or combined with others. Building on these platform services—such as configuration, security, and workflow—Aras creates applications and solutions. By designing the platform as a set of modular services, Aras ensures flexibility for building diverse applications.

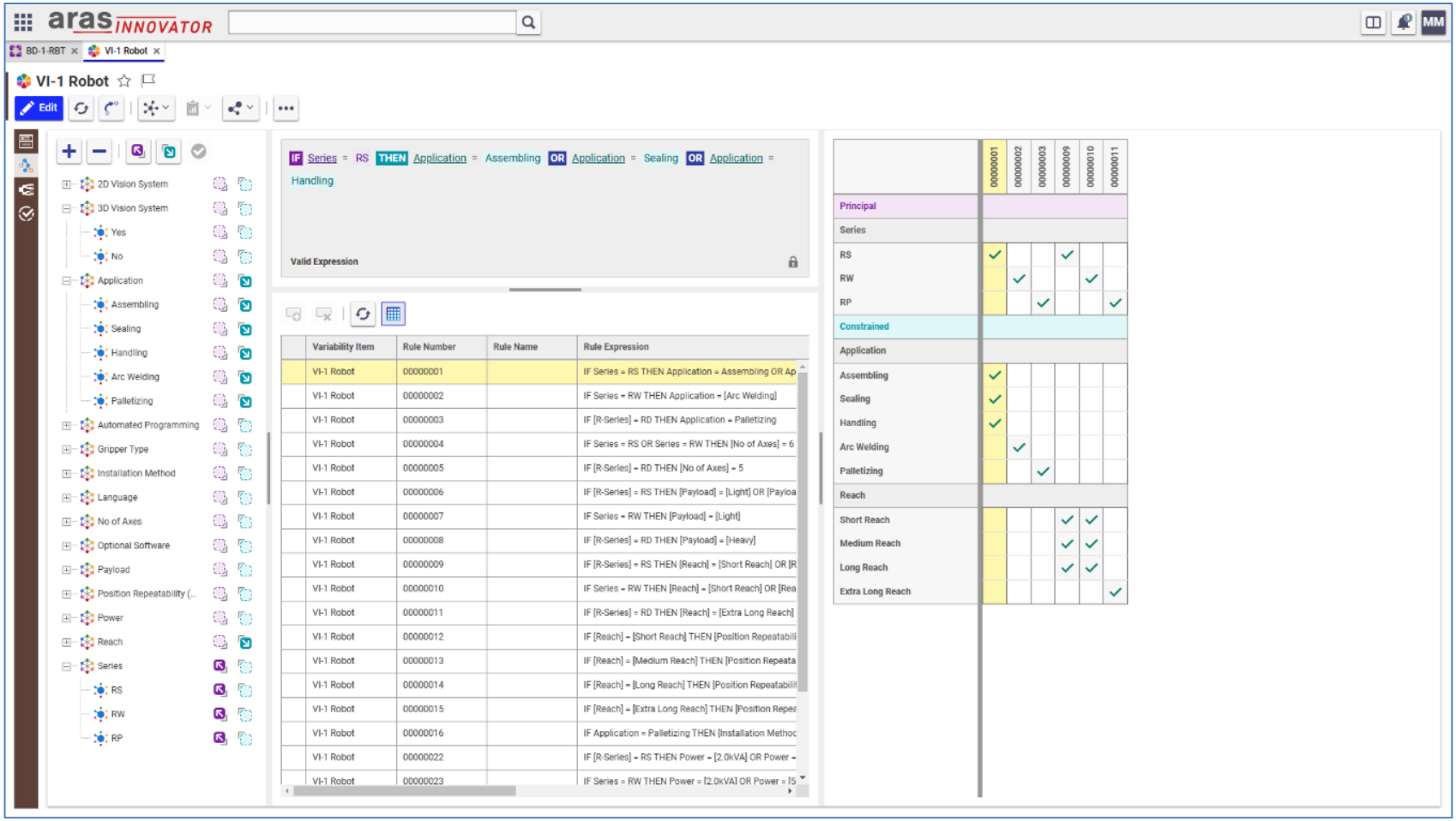
Aras introduced its built-in Configurator Services in 2018, ensuring independence and full control by eliminating reliance on third-party configurator providers. The Scope Object Model and Configurator API methods enable Aras to develop the Variant Management application while also empowering customers to create their own configurator applications if needed.

Aras's vision for managing product variation provides variability by using features, options, and variability rules. By treating variability definition as its own entity, Aras ensures consistent variability management throughout the product lifecycle, reducing—or even eliminating—configuration conflicts. This approach enables the configuration of structures across the lifecycle—such as engineering product structures, technical documentation, and manufacturing process plans—using a shared variability definition and consistently applying variability rules across all data structures. Additionally, the consistency of this variability definition is maintained through a standardized rule format, ensuring clarity and preventing any chance of misinterpretation. Aras Variant Management enables users to create and manage variability rules using both IntelliSense-guided text editors and table-based rule editors.

Aras Variant Management 2/3

Product variability definitions can be managed as a structure of variability by breaking it down into manageable segments, thus enhancing usability and manageability. This approach enables the application of relevant variability scopes at various levels of the product definition.

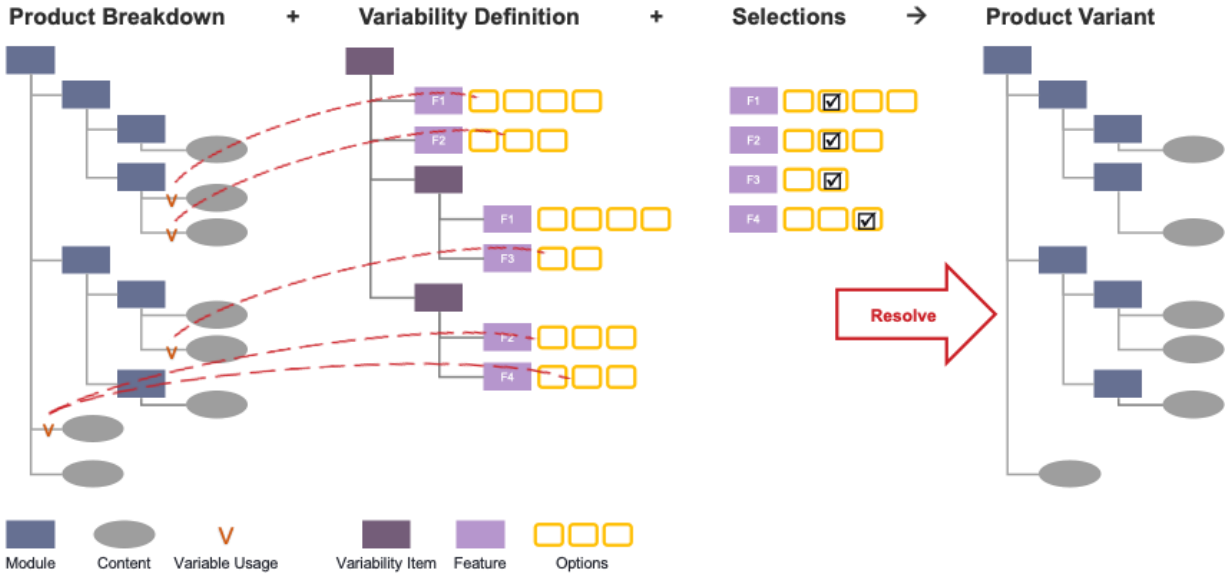
Managing Variability Rules in Variant Management



Aras Variant Management 3/3

Another core foundation of the Aras Variant Management application is the management of the product platform through a content structure. This structure consolidates information for multiple product variants, eliminating the need to duplicate BOMs. It encompasses both product commonality and variant-specific content, with the latter tagged based on its valid usage conditions. This approach enables the dynamic generation of any valid product variant by simply specifying a selected set of features or options. Both usage conditions and selection sets are directly driven by the variability definition providing advanced product line management capabilities to the users.

Since the Aras Variant Management constructs are implemented using Aras technology; versioning, workflows, effectivity, change management, and other solution building blocks can be applied to provide configuration control and traceability. This is a big deal in regulated industries.

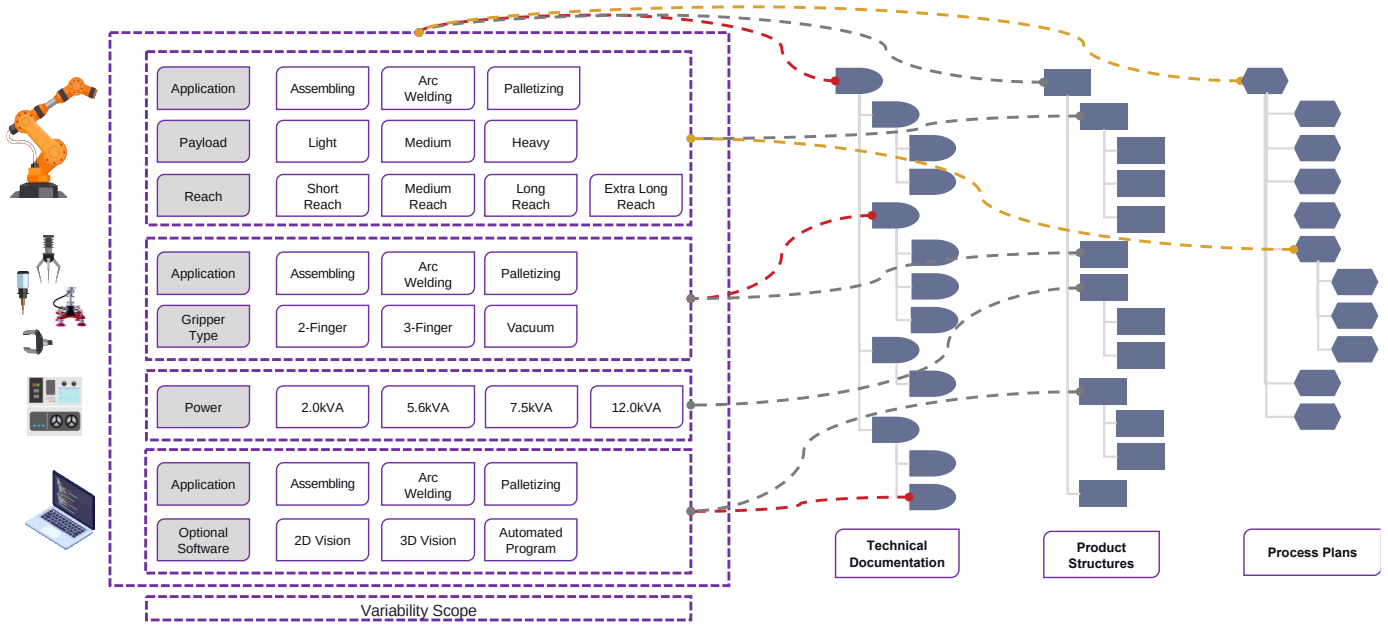


Aras Variant Management Executing a Configure-to-Order Process

Applying Configurator Technology 1/3

In addition to the typical configurator use cases of presenting product options to a customer facing UI, and transforming a 150% product BOM to an eBOM, a configurable Product Breakdown Structure containing all permissible configurable components, assemblies, and other assets needed to build product variants is utilized. In its simplest form, options and variants capabilities are used to generate variants directly within a product breakdown structure. As the number of features, options, rules, and dependencies grows, so does complexity.

The Aras Variant Management application streamlines and automates the process by defining and consuming rules to generate any given allowed product variant from the product breakdown structure by selecting allowed variant option combinations. The Aras Variant Management application and Aras configurator platform services support different configurator use cases, including applying a common variability definition and rule set to data structures such as requirements, technical documents, EBOM, MBOM, and manufacturing process plans.



Hierarchical Configuration Structure and Relationships to Product Structures

Applying Configurator Technology 2/3

CTO Digital Thread

The Aras configurator application and related services enable Aras Innovator to support different configurator use cases, including applying a common variability definition and rule set to transformation structures such as requirements, tech docs, EBOM, manufacturing process plans, and spare parts lists.

Connecting configurable structures across the lifecycle enables automation of the creation of the digital thread such that when fully developed a complete traceable digital thread for a variant can be developed from configurator input. While not trivial to develop, the benefits are large.

CPQ

A high value use case desired by many businesses is Configure, Price, Quote (CPQ). Building a solution to support CPQ is a complex endeavor. A robust, scalable, and maintainable solution requires integration with the digital thread to ensure the solution always has access to current configuration options and pricing data. Aras integrates well with CPQ solutions or can provide a mechanism to build CPQ capabilities if the customer requires.

Hierarchical CTO Support

Beyond CPQ, and configurators in general, Aras can support hierarchical and hybrid configurations. In a hierarchical configuration each module within a product can have its own structure and configuration rules enabling parallelized or distributed product configuration development.

Hybrid CTO/ETO Process

When a customer or prospect requires a variant not supported within the CTO solution there are three choices. First, do nothing, and hope the customer will make do with what is offered. Second, adjust the variant definition so a new configuration of existing parts or modules satisfies the customer's requirements. Finally, if the first two options are unacceptable, engineering will need to be done.

In the most advanced configurator implementations, the lack of an option that meets customer CTO requirements is transformed into an ETO opportunity by providing a mechanism to capture customer input for their special needs. In these cases, the CTO application can be used to trigger an ETO process. Ideally the ETO is restricted to the existing variation points and results in new configurator features or options.

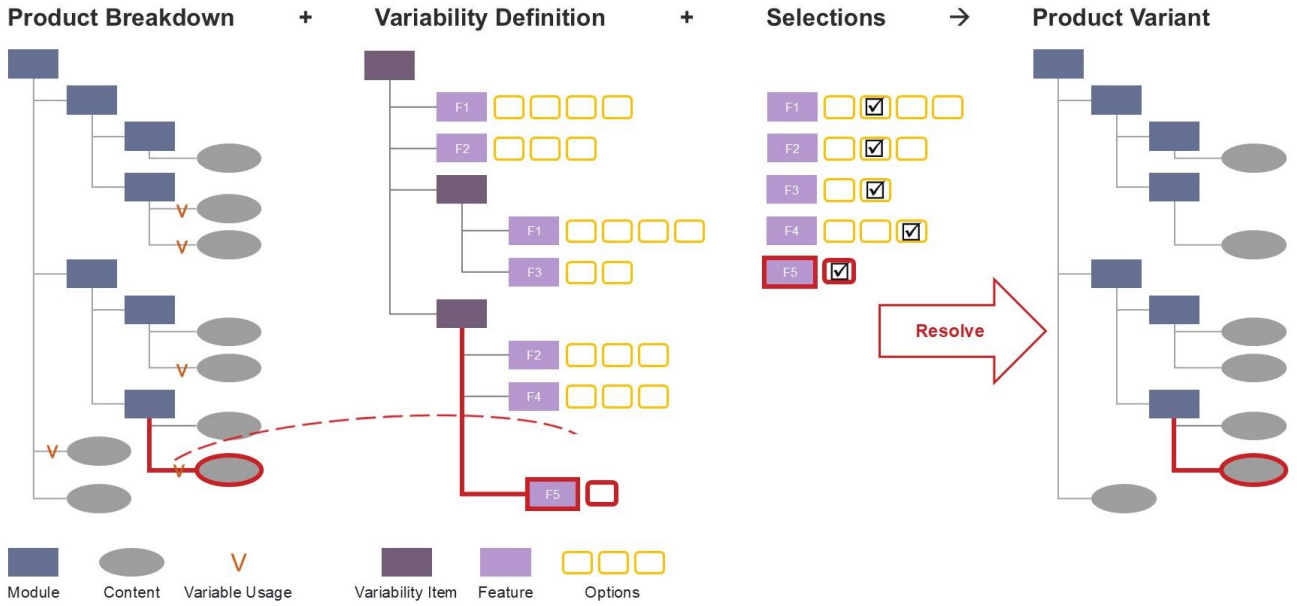
Supporting the hybrid process requires a robust product architecture organizational discipline and feedback loop for continuous improvement, otherwise product and business risks will exceed the value of the additional opportunity.

Applying Configurator Technology 3/3

Aras Configurator Support for Hybrid CTO/ETO

The flexibility of Aras' low code capability enables triggers to be inserted within a configuration application to initiate an ETO process. Since the configurator is built on the Aras platform the ETO data can immediately be consumed into a project plan and workflows and used by other Aras solutions supporting the needed development. All the data and information from the development is captured into a digital thread within the platform so information can be used to create future configurable options, closing the loop.

Aras's best practice approach is to develop every new ETO option as part of the CTO solution rather than creating a one-off option since it will streamline the process in the future and the additional effort is minimal. Doing this ensures that variants developed with the new ETO option will remain traceable to the original product and will not require a new ETO request if the new variant is needed again. The benefit of doing this is that end-to-end traceability is preserved, and the new variant will be reused for future customer orders.



Adding a New Option to Create a New Product Variant

Conclusion

CTO is a strategic product and sales approach that allows businesses to efficiently define and manage how it will meet customer demand for product variants. While CTO is highly effective, ETO remains essential for addressing complex customer needs and fostering new innovation.

To successfully enable CTO, a flexible product architecture, modular design strategy, and a robust PLM platform with strong configurator capabilities are crucial. Aras' approach to product variation and its management ensures a consistent variability definition across the entire product lifecycle—from sales to product development, manufacturing, and service—while leveraging a low-code approach for maximum product configurability.

The Aras Innovator platform, along with its Configurator Services and the Variant Management application, provides the necessary technology stack to develop and manage configurable product definitions. This supports not only ETO and CTO but also hybrid product strategies that combine both approaches. Beyond generating eBOMs, Aras is able to apply variant definitions to any overloaded structure within the platform. Requirements, mBOM, service parts lists, and other structures can leverage common variant definitions ensuring fast, accurate downstream structure definitions with a digital thread. This capability enables support for many design, manufacturing, and service use cases beyond basic product configuration. For example, since CAD data management is supported within the Aras platform, configurator output can include the 3D geometry and drawings that fully represent the variant.

Companies considering a product configurator with advanced product line management capabilities should check out the Variant Management solution within Aras Innovator. The fully-featured solution that meets requirements from basic eBOM configuration through complex hybrid CTO/ETO processes and the application of variability across the digital thread.

About Aras

Aras is a leading provider of product lifecycle management and digital thread solutions. Its technology enables the rapid delivery of flexible solutions built on a powerful digital thread backbone and a low-code development platform. Aras' platform and product lifecycle management applications connect users in all disciplines and functions to critical product data and processes across the lifecycle and throughout the extended supply chain. Visit www.aras.com to learn more and follow us on YouTube, X, Facebook, and LinkedIn.



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