

RuleStream Standards-Based Engineering for Custom Manufacturing

CIMdata Commentary

One of the driving pressures on businesses today is the need to deliver more “personalized” products to their customers. Customers are demanding that the product(s) they purchase be tailored to their specific needs. This includes functional capabilities, operational characteristics, and even look and feel (style). The growth of Engineer-to-Order (ETO) products and manufacturing is a reflection of this trend.

Delivering individualized products in a cost-effective, timely manner requires that manufacturers be better able to leverage previous designs, capture more knowledge about their products and how they were designed and built, and be able to impart that knowledge effectively to all employees, especially new hires that have no corporate history. For example, ETO manufacturers typically have complex products that must be closely aligned with detailed customer specifications while simultaneously taking into account engineering standards, supply chain capabilities, and manufacturing constraints.

While every organization produces data and information about its products, transforming that data into an accessible knowledge base is difficult. In product development, understanding how a product is intended to function and how to apply that understanding to create an appropriate product is knowledge; and capturing, managing, and reusing that knowledge effectively is a competitive advantage. The models and drawings of the product are a part of the information that defines a product, but they don't convey how or why someone created the product in a specific way or what standards or regulations must be applied to the product.

For many years, people involved in product design have tried to capture the knowledge that is an inherent part of all design activities. The goals are to be able to:

- reduce the amount of time from receipt of order to product delivery.
- preserve and leverage the organization's intellectual property.
- re-use knowledge from previous design efforts to shorten the time and cost required to execute custom complex designs.
- reduce design errors.
- improve the quality of designs and increase innovation.
- respond more quickly and more accurately to requests for quotations.
- increase win rate of RFPs.
- ensure adherence to internal, industry, and regulatory standards.

All of these goals have a positive impact on the business by reducing costs and allowing companies to better and more quickly satisfy their customers' requirements.

Capturing product knowledge in a manner that enables sharing and reuse of that knowledge has proven to be very difficult. Companies have struggled to capture and manage design knowledge as engineers have used many (home-grown) tools such as workbooks, configurators, and spreadsheets to document their designs and design decisions and for quotation and manufacturing processes. Early attempts at building home-grown systems to capture and reuse knowledge failed because they were too limited technically, required

users to be able to develop computer codes (or programs) to embody knowledge rules and actions, and did not integrate with common product design tools such as CAD, CAE, and PDM systems.

Configurator approaches worked well for low-complexity products, but were unsuitable for medium/high complexity products. Many sales configurators were unable to do order/requisition engineering because they lacked integration with engineering tools needed to create drawings. However, work in this area has continued, and today companies such as RuleStream are delivering solutions that we call Standards-Based Engineering (SBE). In the context of SBE, rules are a series of behaviors that can be executed to modify the product definition based on specific requirements and constraints. Rules may act on design models (both 2D and 3D geometry) or other aspects of the design such as material, temperature, flexibility, corrosion resistance, surface finish, ship date, cost, or weight. SBE solutions for manufacturers have the following characteristics:

- Rules are managed in defined public contexts (i.e., they are available to all designers); they are also versioned and secured.
- They can be used within the user's normal design, analysis, and management solutions.
- They capture design rules both automatically and by user definition.
- They allow rules to be customized and adapted.
- They provide a user interface that integrates systems, rules, models, and data that are relevant to accomplishing a specific task at a specific time.
- They employ a "bottoms-up" methodology for rule authoring so rules can be shared between product models, reducing the number of rules needed.

SBE provides a bridge between past product development efforts and future designs. It helps companies capture their intellectual value-added from product development and provides that knowledge to product designers. This means that new designs can be accomplished more quickly, since designers can work faster without having to worry that they are re-inventing items that have been designed previously.

RuleStream's SBE solution embodies a number of characteristics that distinguish it from earlier knowledge-based design approaches. These include having a database that contains the definitions of the rules and the how the rules are to be applied. RuleStream's method of creating rules and capturing knowledge allows different groups within the organization to enter their rules within the common database. This allows new rules to reference existing rules and their parameters and results, avoiding duplication, and helping to enforce a standard rule set and nomenclature across the organization.

Product design parameters and calculations are stored in the RuleStream database. Because these rules are in a managed environment and interact with one another as they are entered and updated, designs can be quickly validated to ensure that the proposed design meets customer-specific requirements as well as basic structural quality standards. RuleStream's tight integrations to many key 3D CAD systems drives product knowledge directly into the 3D CAD too and the dynamic, bi-directional integration keeps an accurate and dynamic 3D model constantly in front of engineers so they can quickly and easily visualize the feasibility of a new design before it is committed to production. These 3D CAD integrations also allow RuleStream to generate new native drawings on the fly. RuleStream also provides end users the ability to manipulate products using a 2D layout tool—either Microsoft Visio® or a native 2D interactor. RuleStream's solution also provides a built-in rule history and traceability functionality, which gives insight and information on old formulas and equations, as well as when and why they were changed and by whom.

RuleStream can also generate a variety of order engineering outputs, making it effective for order/requisition engineering. These outputs include, but aren't limited to 2D, 3D, routings, tooling, eCAD feeds, CAE, and more. The following figures illustrate product application of RuleStream's SBE solution.

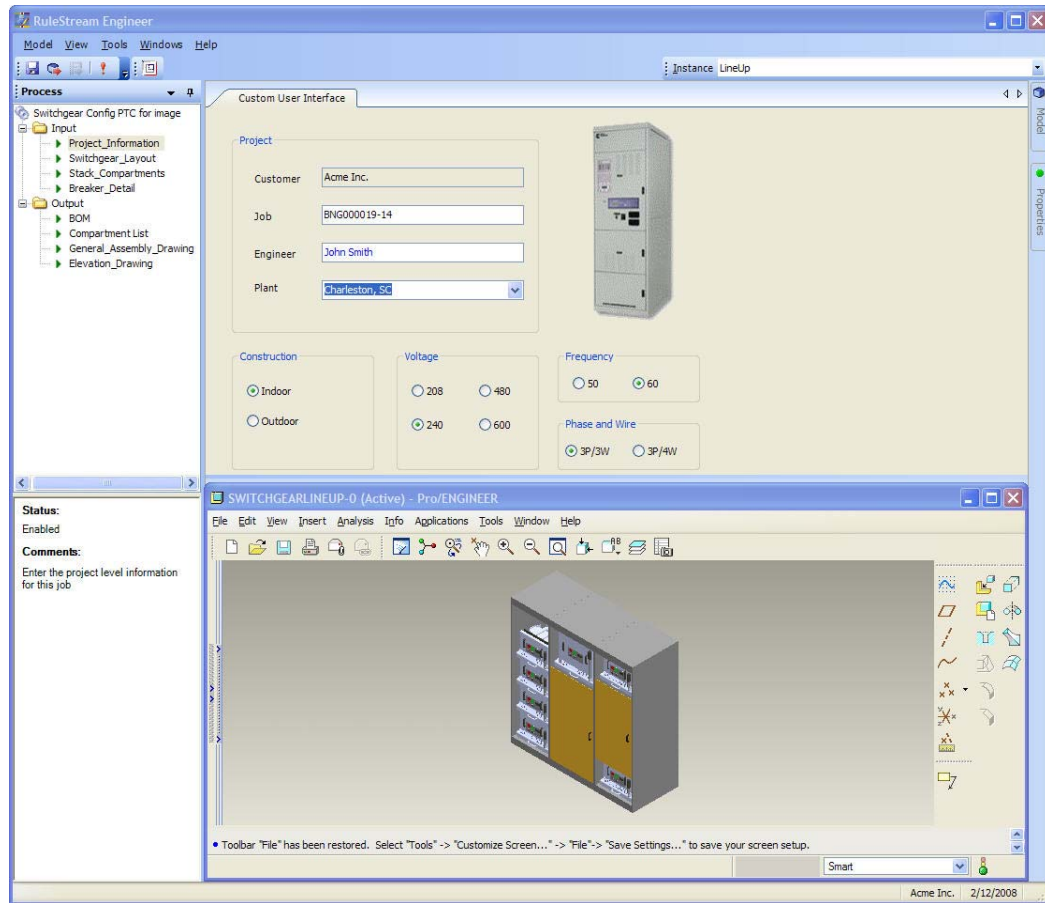


Figure 1—Using RuleStream to Automatically Create a 3D Model

Once the functional product requirements have been entered, RuleStream allows engineering work products (such as CAD models and drawings) to be automatically generated according to design and manufacturing rules.

These computer-based technologies allow complex information to be shared and worked upon by dispersed teams of people. It is impossible to collaborate on information that cannot be found and collaborating on out-of-date or incorrect data can lead to bad decisions, so data management capabilities are necessary. PDM in particular is used to organize and provide broad access to a company's intellectual assets. However, simply organizing data better produces important, but limited value. The concept of Product Lifecycle Management (PLM) embraces the collaborative use of the managed information in an organization's decision-making processes. New collaborative technologies now go beyond asynchronous data sharing to include real-time viewing, discussion, annotation, and modification of all kinds of product information including 3D design models, analysis results, manufacturing processes, documents of all kinds, audio, video, and many, many others—essentially all information required to make product definition decisions.

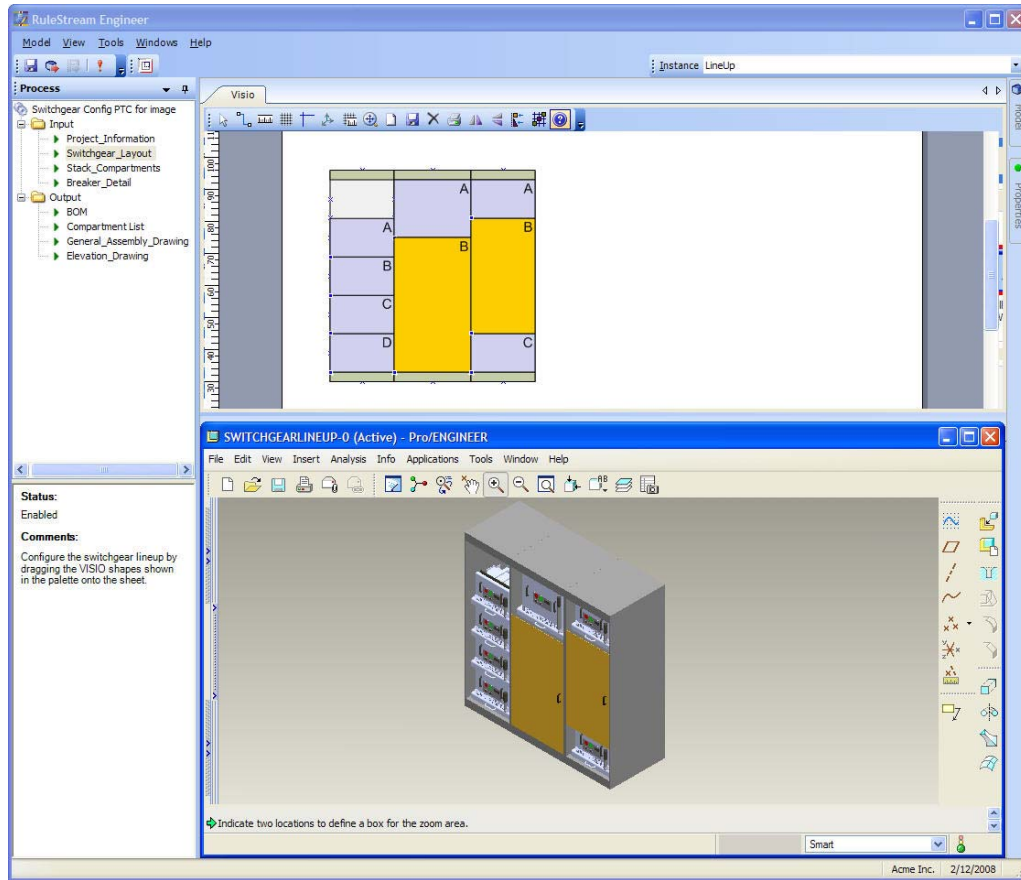


Figure 2—Using RuleStream and Visio to Modify in a 2D View

CIMdata believes that RuleStream’s SBE solution provides a solid offering that should be considered by ETO companies who want to effectively capture and leverage design and product knowledge while responding to customer demands for more highly-tailored products.

About CIMdata

CIMdata, an independent worldwide firm, provides strategic consulting to maximize an enterprise’s ability to design and deliver innovative products and services through the application of Product Lifecycle Management (PLM). CIMdata provides world-class knowledge, expertise, and best-practice methods on PLM. CIMdata also offers research, subscription services, publications, and education through international conferences. Visit <http://www.CIMdata.com> for more information.