Teamcenter Variability Backbone
Product Configurator & Rulestream

Juergen Bauer - Teamcenter Product Management
Managing Product Variability

1. Why Product Configuration
2. Variability Solutions
3. Variant Matrix
4. Rulestream
5. What is the Teamcenter Configurator
6. What’s new …
The Business Problem: Managing Product Complexity

Product complexity is increasing

Customers demand greater individual choice

Offer variety without driving up costs

Many contributors to product definition

Complex network of features and constraints intertwined with product content

Increased demand to visualize, validate and perform impact analysis for any (and across many) configurations
### Variability Management product overview

#### Standard products
- **Configure-to-Stock (CTS)**
  - Pre-defined set of variants managed downstream as individual products
  - Manual BOM edits allowed for individual variants (Configuration results like BOM, BOP...)

#### Configure-to-order
- **Configure-to-Order (CTO)**
  - Option/feature management & part usage
  - Rule authoring focused on logical part inclusion/exclusion rules
  - Typically focused on BOM and BOP configuration
  - CAD used for validation of complex configuration results
  - Primary drivers of complexity include BOM solve performance (can be 10K+ orders/day) and managing large volumes of part usage rules
  - Change and Effectivity management

#### High complexity Configure-to-order
- **Rulestream**
  - Engineering calculations and content generation (new part creation)
  - Rule authoring focused on calculations and driving authoring tools for content generation (BOM and all related content)
  - Bi-directional CAX integrations are critical
  - Bi-directional CAX integrations are critical
  - Capture and execution of complex engineering/design calculations and integrations (client and server) to authoring tools

#### Engineer-to-order
- **Engineer-to-Order (ETO)**
  - Pre-defined set of variants managed downstream as individual products
  - Manual BOM edits allowed for individual variants (Configuration results like BOM, BOP...)

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Siemens PLM Software
Variability Management product overview

Standard products

Variants
Matrix

Individual Variants

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<td>Rulestream</td>
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Variant Matrix BOM Manager: Concept (AWC 4.1/4.2)

100% Active workspace based.
→ Quantity controls how many parts used in which variant

Matrix BOM content presentation view

All SKUs related to the Product Line are presented, based on the input configuration criteria

Product Line components are presented in rows & Product variants in columns
Variant Matrix
Product Demo

Launch Product Line in Variant Matrix and view Variant BOMs

Add new Parts to Product Line & update existing variant BOMs

Create a New Product Variant & create Variant BOM

Product Availability:

- First Release – Dec 2018
- Completion Release – Spring 2019
Variability Management product overview

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- **Top-Level 150% CTO Configuration**
- **Rulestream**
- **Top-Level ETO Configuration**
What is Rulestream?

A platform for capturing product-centric knowledge

A set of tools for automating ETO Processes

An environment for creating ETO products on demand
ETO Knowledge Capture

Rulestream ETO
- Rule Execution Engine
- Rules & Facts Repository

Authoring Tools
- CAD, CAM, CAE
- MS Office (Visio, Word, Excel)
- Legacy

Systems of Record
- ERP
- Teamcenter
- CRM
ETO Knowledge Utilization

Customer Requirements

Rulestream ETO
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Systems of Record
- ERP
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- CRM

Bid Package
- Proposals
- Tech Specifications
- Bid Drawings
- 3D Visualizations

Engineering/Mfg. Package
- Detailed 3D models
- Manufacturing Drawings
- Analysis
- EBOMs, MBOMs
- Work Instructions
- Test Procedures
Rulestream Sample User Applications
Internationalization

• Unicode characters may now be used for:
  • Creating Custom UI’s
  • End User (Engineer) data entry
  • Architect data/rules entry

• Engineer, Unattended Engineer, Architect, User Manager
  • Excludes (at this time): model services, thin client, offline sync server, priority scheduler, drawing productivity pack

• Rulestream system interfaces provided in:
  English (default)  Russian
  Chinese  Spanish
  Japanese  Italian
  German

• Resource files available for translating system interfaces to languages that are not provided by Siemens out-of-the-box
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- **Variants**
- **Matrix**
- **Individual Variants**

**Rulestream**

**TC Configurator**

Top-Level 150% CTO Configuration

Top-Level ETO Configuration
Teamcenter Configurator
Data backbone for variability

- Single product configuration backbone to support the entire lifecycle from product planning to execution & service
- Separation of product variability definition from content applications
- Enable visualization of any configuration of a product
- Multi-domain impact analysis
- Fully integrated with PLM change process and effectivity control
Teamcenter Configurator
Repository for product variance planning and execution

Separation of Configuration data from Content

Central repository for Product Architecture, Configuration and Dictionary information

Product Breakdown with Product -Line, -Model, -Variant planning level

Feature “Where Used”
Design impact
Manufacturing impact
Configure based on selected part

Configure-2-order
Drive re-use of configured content

Role based interaction to support engineering evaluation, overlays or order management

Change Control for Phase-in and Phase-out processes of product features

Product Line and Architecture

Product Breakdown

Separation of Configuration data from Content

Central repository for Product Architecture, Configuration and Dictionary information

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Variability Planning
Scoping

- Consume sub-set of Features from Dictionary → Product Line → Product Model for scoping and maximum reuse
- Manage product-specific rules and share rules with other products
- Leverage Product Lines and Summary Models and Features to simplify rule maintenance
  - Authoring and Configuration activities leverage this scoping to present only relevant variability to user
Complexity Management
Configurator Context: Rules

- **Complexity Optimization using Rules** such as default, exclusion, feasibility and inclusion

- **Grid-based** rule authoring UI to edit multiple rule types within a single view

- Filter / expand / collapse and improved usability makes it straightforward to manage a heterogeneous rules set, incl. operator support (=<>)

- **Availability Rule**
  - Feature is Available

- **Default Rule**
  - Feature is Default

- **Exclusion Rule**
  - Feature is Excluded

- **Inclusion Rule**
  - Feature is Included

- **Calculation**
  - Include Function to calculate feature
Managing variability on a Hand Drill Product Line

“Consumer”
12V NiCd
Right rotation only
No torque control
Speed On/Off
Standard Chuck

“Semi-Professional”
12V NiMh
Left – Right rotation
Torque control
Speed On/Off
Standard Chuck

“Professional”
18V NiMh
Left – Right rotation
Torque control
Speed Electronic
Professional Chuck
Product Configurator - Core Capabilities
Variability shared across multiple content domains

- Dictionary
  - Company "vehicles"
- Architecture
  - Small Cars
- Product Line
  - Vehicle X
- Model
  - LX
- Rules / Constraints
  - ‘3.0L V6’ only in Region “US”

Configurator Context
- Passenger Cars

Has Variant Configuration Context

SVR
- (saved) Variant Rule

Variable Product
- BOM
- CAD
- Mfg Process

Variable Product Requirements

Package
- Winter Pack
Summary
- All 4 cyl. engines

Feature Family
- Engine
- Region
- Winter Pack
- All 4 cyl. engines

Feature
- 1.8L 4 cyl
- 3.0L V6

Rules / Constraints
- ‘3.0L V6’ only in Region “US”

Variant Condition
- 150% eBOM
- 150% CAD structure

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Saved Variant Rule → Variant Criteria
Enable historical tracking of saved configurations and order details (11.6)

Key Features *
- Support for revision control
- Differentiate between user/system selections.
- Persist what rule date was used
- Persist what effectivity date was applied
- Persist what Revision / Status was used
  - Enhancements beyond current Saved Variant Rule

Tracking “Models/Variants”
- Manage Configurations for tracking Models
- Effect in/out a configuration on a certain date
- Manage tracking model status

Order Management/Solution Variant
- Capture Variant Criteria of an Order
- Coordinate changes to variant criteria with ERP
- Generate Solution Variant for a given variant criteria
- Compare criteria and impact to Solution Variant

Extend to capture content criteria
- Content applications will get extended to consume Variant Criteria alternative to Saved Variant Rule
- Select Variant criteria for content selection
Variant Criteria (TC 11.6)

“lifecycle” your Saved Configurations
Positional Variability (TC 11.6, NX12)
configure specific positions of parts in a product assembly

Ability to modify geometric position of designs in a design assembly

Before: every possible position requires separate BOM line occurrence

Now: Dynamic Variable Positioning
NX Expression based

Positional Variability Use case requires:
- Calculation
- Positioning
- Solution Variant (to save result)
ERP / Order Management Integration Options

Create “Solution Variants” for Product and Assemblies in Teamcenter and these pre-defined send 100% results to ERP

Integrate Teamcenter in your Order Management Process and send 100% results to ERP for every Orders

Synchronize your Configuration knowledge to downstream Configurator in ERP
Solution Variant (Variant Item Replacement)
create, manage and update persistent Item and structure for a defined set of variants

- Persist Configured Variant for an Order
- Manage and Reuse solution variants
- Create multiple level solution variant structure, with minimal user interaction
- Validate and synchronize managed and reuse solution variants
- Update Solution variant or associated criteria
Solution Variant
Product Demo

Product Availability: TC 11.6 - Nov. 2018
Integration Options

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Synchronize your Configuration knowledge to downstream Configurator in ERP
Teamcenter Config. Work with ERP (mBOM in TC)

Product Order

E-BOM (150%)

M-BOM (150%)

BOP (150%)

ERP

Low complex interface share only 100% information

OOTB

Product Order

apply/solve

send

apply

solve
Integration Options

Create “Solution Variants” for Product and Assemblies in Teamcenter and these pre-defined send 100% results to ERP.

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Synchronize your Configuration knowledge to downstream Configurator in ERP.
Teamcenter Config. Work with ERP (mBOM in ERP)

Teamcenter

ERP

E-BOM (150%)

Config. Context

Config.Profile

ERP

Product Order

E-BOM (150%)

M-BOM (150%)

O-BOM (100%)

BOP (150%)

BOP (100%)

OOTB

High complex interface share complex Rule construct

eBOM-mBOM Alignment will lose possibility to Visualize feed digital production

apply/solve

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Thank you.