



Ontology and Rules provide Mass Customization of Vehicles

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Chuck Rehberg, CTO
Trigent Software
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overcoming limits

Background

- A Fortune 250 Company offers mass customization of a wide variety of Trucks and Buses



Background

- Mass Customization of Trucks and Busses
 - Customers describe the desired vehicle by selecting the base model and a wide range of attributes (e.g. vehicle length) and features (e.g. number of exits)
- Combinatorics of parts and assemblies
 - More than 480,000 combinations of parts, assemblies, and locations for a given vehicle
 - Each vehicle off the assembly line can be one-of-a-kind.

The Configuration Challenge

- Given an order that may never have been previously built, identify the best set of parts, assemblies and component locations for the vehicle (the Vehicle Configuration)
- Different parts and assemblies will be available at different plants at different times. So, need to select a configuration that can be built at a plant prior to the promised delivery date.

Solution Ontology

- Ontology defined both bottom-up and top-down
 - Bottom-up:
 - Allow design engineers to specify which combinations of parts and assemblies satisfy given models, attributes and features; Identify generalizations based on common usage.
 - Identifies what has been designed to work together
 - Top-down:
 - Provide Ontology for vehicle system and subsystem down to components and assemblies; ensures complete vehicle design and sphere-of-influence checks (some standards apply: ATA classification codes)

Solution Rules Engine

- Domain-specific UI
 - Engineers identify specific combinations in terms of both abstractions and instances
 - Rules are generated; They are not directly written by the engineers
 - Engineers work only in terms of their domain Ontology
- Employ a fast Rules Engine
 - Over 600K rules with avg. 24 condition elements
 - Truck configured in under 10 seconds on my laptop
 - Worlds fastest most scalable rules engine – recently patented (2008) – Not based on RETE; Much better memory profile

Benefit

- Ontology allows quick and reliable specification of new variations
- Rules are specified in terms of the Ontology (incl. features and attributes)
- Changes in Ontology and Changes in Rules can take effect immediately (or at designated times and plants)
 - Allows flexible change in suppliers and parts
 - New models and variations reuse previously proven engineering work

Summary

- Ontology-driven engineering is in mission-critical use today in large corporations
- Rules-based technologies exists today to flexibly and rapidly leverage Ontologies to meet business goals
- In many industries there are significant opportunities is mass customization and the “long tail”. The efficient management of knowledge assets is key to unlocking those opportunities.