



# Teamcenter Enterprise Product Configuration

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PLM World 2006



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- ▶ Demonstration / .avi



# Why Product Configuration?

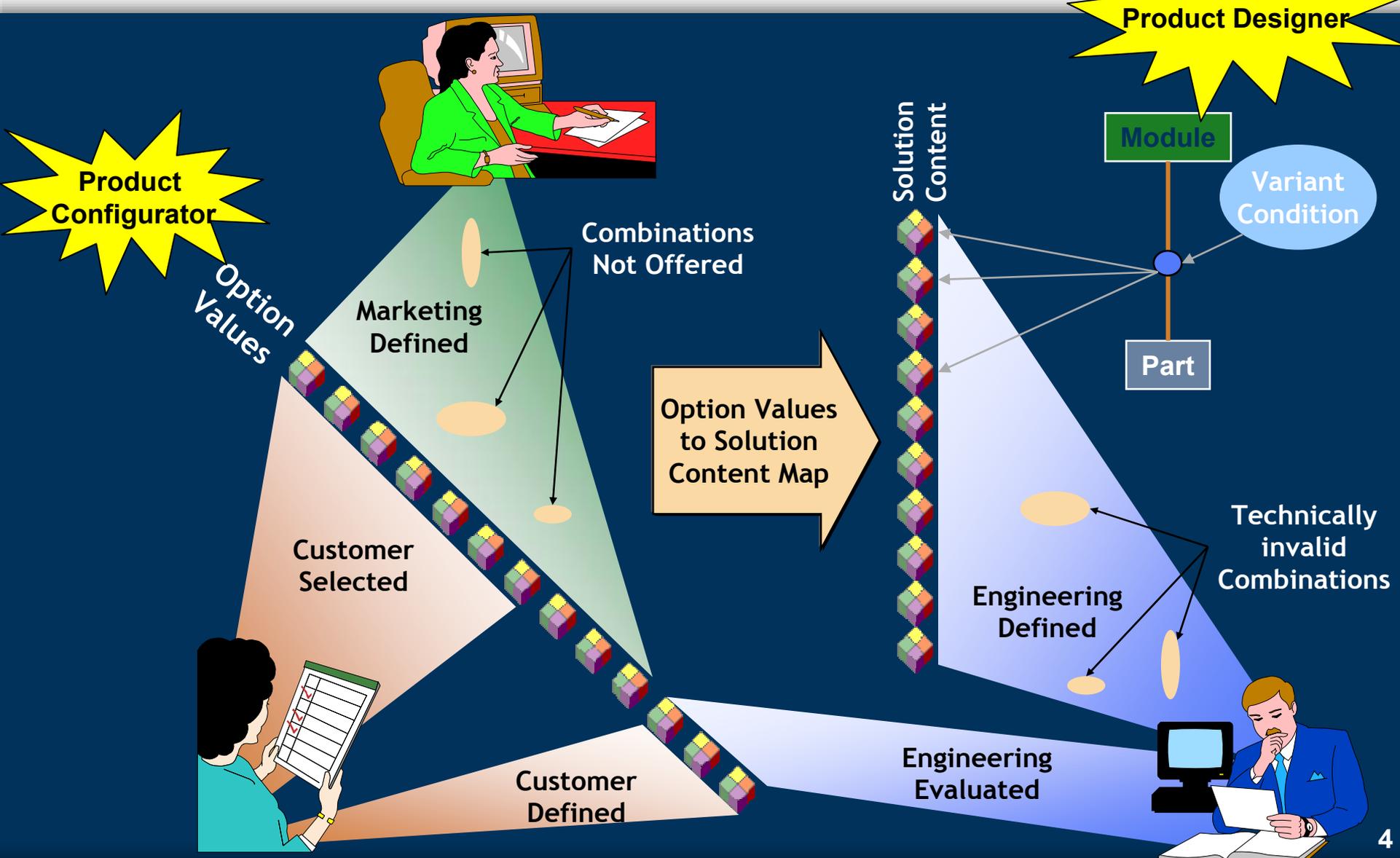


- ▶ Customers today are continually demanding more product variability; traditional BOM management prohibits meeting these challenges
- ▶ Product Configuration in PLM allows you to manage families of products instead of discrete variants. This enables you to:
  - ▶ Offer more product variety to meet a broad range of customer requirements without driving up costs
  - ▶ Increase re-use of design solutions
  - ▶ Improve Bill of Material accuracy
  - ▶ Reduce cycle times
  - ▶ Accelerate time to market
  - ▶ Manage all product data in a Single source
  - ▶ Support Sales and Marketing Analysis





# Product Configuration User Roles





# U-Decide Bicycles

## Example: Configuring a Bike

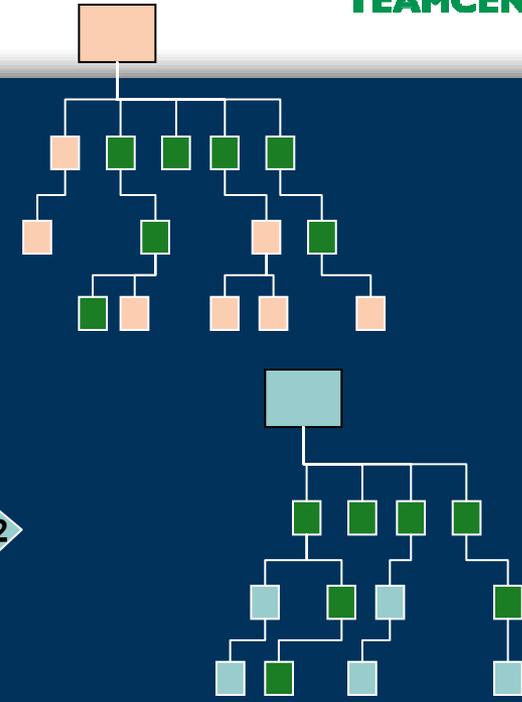
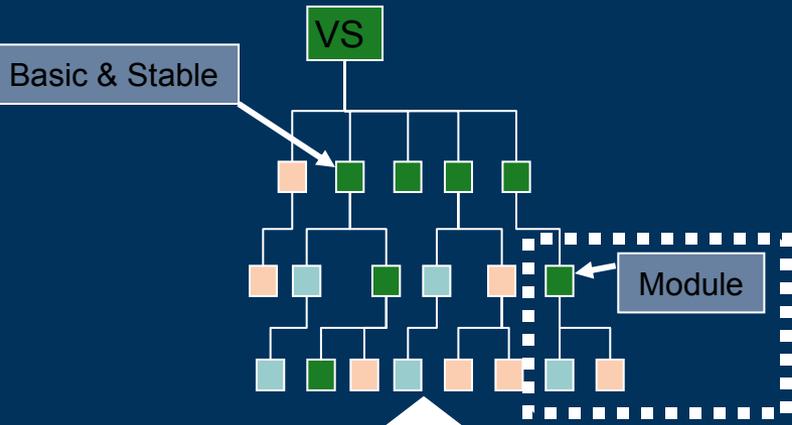




# Product Configuration Basics



## Variable Structure – All Parts Necessary to Build a Range of Products



### Apply Context

### Bicycle Selected Option Set (SOS)

Frame Color	<i>Pearl Blue</i>
Pedals	<i>Sport</i>
Seat	<i>Max Flite</i>
Wheels	<i>Dura Ace Tubeless</i>
Crankset	<i>Hollowtech II</i>

## How Does the System Know What Parts to Include?



LOAD if Pedal = Racing

LOAD if Pedal = Sport



# Product Configuration Overall Flow



Teamcenter Enterprise

Product Configurator Focus

Product Configurator Administration

- Define:
- Product Line Breakdowns
  - Marketing Decomposition
  - Options Families (Features)
  - Option Values
  - Product Model Mapping
  - Related Constraints, Defaults, Derived Values

Product Configurator Configuration

Make / Save Configuration Selections

- Define:
- Product Decomposition
  - Design Solutions
  - Variant Conditions
  - Technical Options & Constraints

Product Designer Administration

Apply Configuration Selections to Derive Product Variant / BOM

Instantiate Product Variant (generate/re-use Variant Items)

Product Designer Configuration

Product Designer Focus



# Product Model



- ▶ A **Product Model** is a market offered product line
  - ▶ Each model is typically targeted at a particular market segment and different models may be offered from year to year or according to geographic region
- ▶ Selection of a Product Model is the first decision a consumer must make
  - ▶ The configuration choices that are offered will be dependent on the model that has been specified
- ▶ Option rules can all be qualified to apply in the context of certain product models only

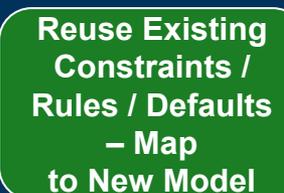
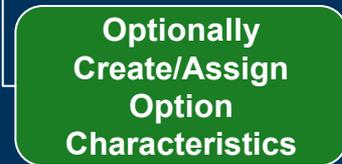
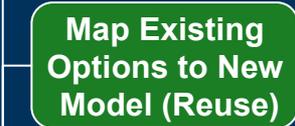
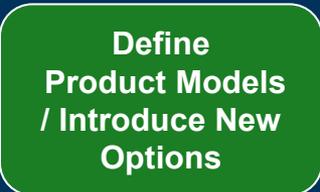
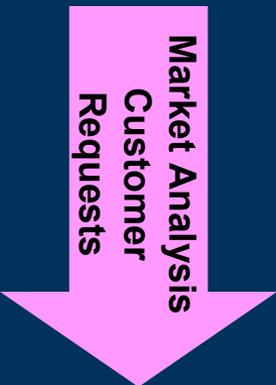
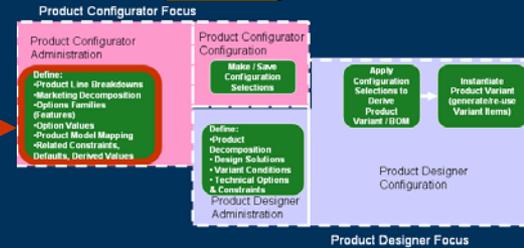




# Product Configurator Administration Activity Diagram



We are **HERE**



\* All rules, defaults, constraints, packages can apply for one or more product models



# U-Decide Bicycles Market / Customer Input



## ▶ Customers are saying:

### ▶ “I need help!”

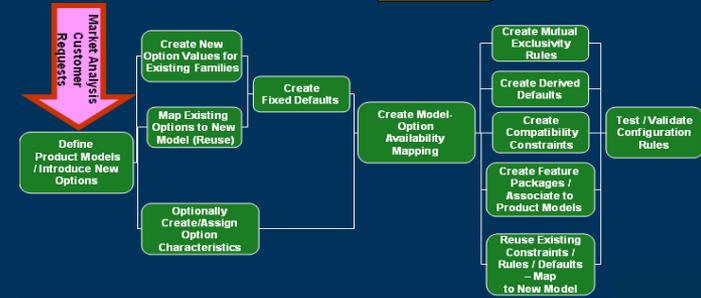
- ▶ Problem: “When I order my bike, I am asked what Frame Size I want. How should I know?”
- ▶ Solution: U-Decide needs to ask customers questions they know how to answer and translate these inputs into the right size frame

### “Provide more women-focused features”

- ▶ Problem: Women represent a large part of the customer base but are dissatisfied with the number of features marketed toward them
- ▶ Solution: U-Decide should introduce more female targeted features

## ▶ General Market Considerations:

- ▶ Demand: Keep up with the latest technology
- ▶ Solution: Allow customers to get what’s new and hot from U Decide





# U-Decide Bicycles

## Incorporate Market / Customer Input



- 1) Let Customer Easily Configure Right Size Frame
- 2) Offer More Choices for Women

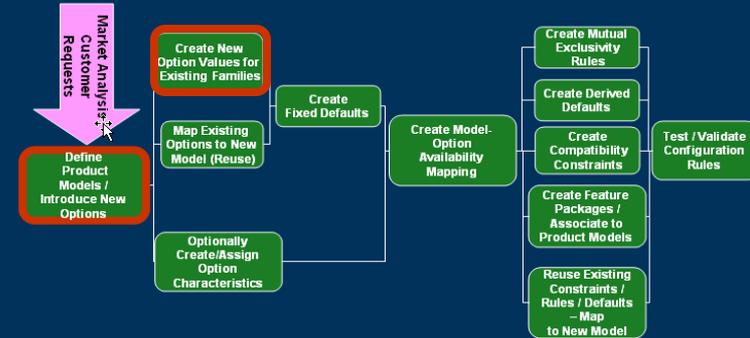
Before: User had to select proper frame size directly  
 Limited smaller frame sizes available

	Mountain Bike	Road Bike	Hybrid Bike
<b>Frame Size</b>	XS - 15 in / 38 cm	XS - 20 in / 52 cm	XS - 15 in / 38 cm
	S - 17 in / 43 cm	S - 21 in / 54 cm	S - 17 in / 43 cm
	M - 19 in / 48 cm	M - 22 in / 56 cm	M - 19 in / 48 cm
	L - 21 in / 53 cm	L - 23 in / 58 cm	L - 21 in / 53 cm
	XL - 23 in / 58 cm	XL - 24 in / 60 cm	XL - 23 in / 58 cm
	P - 13 in / 33 cm	P - 19 in / 48 cm	P - 13 in / 33 cm

Option Families

- New: 1) Let user input their inseam length  
 2) Offer smaller frame sizes for petite women

28 in / 71 cm
29 in / 73 cm
<b>Inseam Length</b>
30 in / 75 cm
31 in / 78 cm
32 in / 80 cm
33 in / 82 cm
34 in / 85 cm
35 in / 88 cm
36 in / 90 cm
37 in / 93 cm



Later we will see how proper Frame Size gets derived from the Rider's Inseam Length!

Option Values



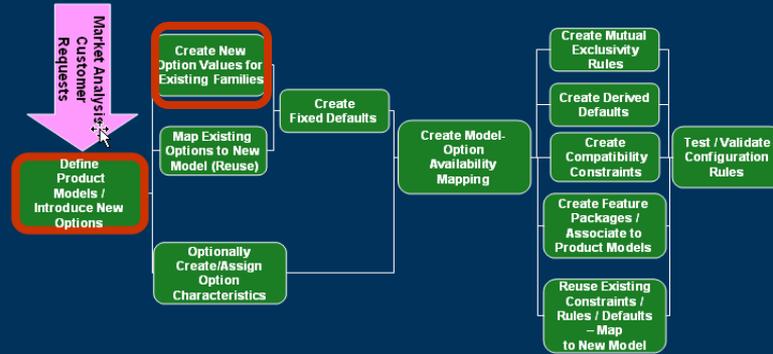


# U-Decide Bicycles

## Incorporate Market / Customer Input



- ▶ Option Families can be **Marketing** significant or not. Only Marketing Families will be displayed to the user during configuration
- ▶ Option Values within an Option Family may be defined as **Mutually Exclusive** to each other
  - ▶ E.g. Any Bike can only ever have 1 saddle
  - ▶ E.g. Customer may order multiple accessories for each bike
- ▶ Option Values can be grouped and offered together as a **Feature Package**, potentially at a discounted price
- ▶ Option Families and Values can be **Global**, i.e. defined and configured independently of product structure
- ▶ Option Families and Values can be Configuration Managed and may have attached Documentation



Searfas Tri-W Saddle - Women's



Engineered specifically for triathlon competition this Searfas saddle is equal to the demands of the high-performance athlete.

- Designed for women, with a slightly wide back to accommodate wider pelvic bone and a slightly shorter nose
- Protective side bumpers aid during setup and transition
- Extra-long nose with gel insert increases cyclist's ability to locate the ideal comfort zone; nose is extra wide for added comfort
- Extra-long rails for additional fore/aft adjustment
- Waterproof synthetic microfiber cover dries quickly

Imported.



### Specification Description

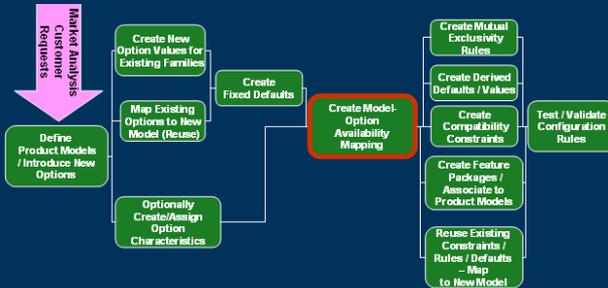
Specification	Description
Weight	270 grams
Material	Synthetic cover/gel/titanium alloy rails
Dimensions	10.7 x 5.5 inches

Saddle  
(Option Family)

Searfas Tri-W  
Women's Saddle  
(Option Value)



# Model-Option Availability Mapping

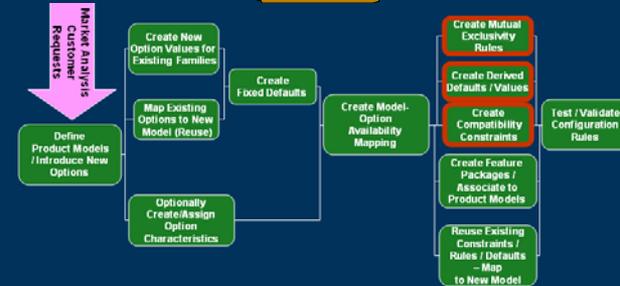


- ▶ Option Families and Values can be reused across Product Models
- ▶ The Model-Option Availability Mapping allows scoping a subset of Option Values within a Family to each Product Model
- ▶ Only mapped values will ever be displayed to a customer who is configuring a bike

Option Family	Option Value	Product Model			
		Entry Level	Performance Mountain	Performance Road	Performance Hybrid
Frame Color	Patriot Blue	X	X		X
	Tangerine	X		X	X
	Flame		X		
	Ocean Spray			X	X
	Stone	X	X	X	
	Kiwi		X	X	X
Planned Terrain	Paved Only(On-Road)	X			
	Off-Road Only	X			
	Varied	X			
Bike Type	Mountain	X			
	Road	X			
	Hybrid	X			
Rider Inseam	28 in / 71 cm	X	X	X	X
	29 in / 73 cm	X	X	X	X
	30 in / 75 cm	X	X	X	X
	31 in / 78 cm	X	X	X	X
	32 in / 80 cm	X	X	X	X
	33 in / 82 cm	X	X	X	X
	34 in / 85 cm	X	X	X	X
	35 in / 88 cm	X	X	X	X
	36 in / 90 cm	X	X	X	X
	37 in / 93 cm			X	
Frame Size	13 in / 33 cm		X		X
	15 in / 38 cm	X	X		X
	17 in / 43 cm	X	X	X	X
	19 in / 48 cm	X	X	X	X
	21 in / 53 cm	X	X	X	X
	23 in / 58 cm	X		X	X
	24 in / 60 cm	X		X	X
Saddle	Simplicity Comfort	X	X	X	X
	Pro-Gel		X	X	X
	Titanium Pro-Gel		X	X	X
	Racing V Kevlar		X	X	X
	Tri-W Women's Triathlon		X	X	X
	Memoflex Pro-Gel Women's		X	X	X
Accessories	16oz Plastic Water Bottle Frame Mounted	X	X	X	X
	24oz Plastic Water Bottle Frame Mounted	X	X	X	X
	24oz Lexas Water Bottle Frame Mounted	X	X	X	X
	Front Cargo Rack			X	
	Rear Cargo Rack	X		X	
	Rear Sport Rack		X	X	X
	Headlight	X		X	
	Taillight	X		X	
	Digital Speedometer/ Odometer	X	X	X	X
Tire Type	Tubeless		X	X	X
	Traditional	X	X	X	X
Wheels	Shimano Mtn WH-M965		X		X
	Shimano Mtn WH-M765		X		X
	Shimano Mtn WH-M565	X	X		X
	Shimano Road WH-R550	X		X	
	Shimano Road Dura-Ace Tubular WH-7801			X	
	Shimano Road Dura-Ace Clincher WH-7801			X	
	Shimano Road WH-7801-SL			X	



# Define Marketing Constraints and Derived Defaults



- An **Option Default** allows you to specify a default option value (could be conditional on other values that have been selected)

Example: Based on Terrain Type, a default Bike Type will be set. This can be overridden by the customer if desired

On-Road =



		Bike Type		
		Mountain	Road	Hybrid
Planned Terrain	Paved Only(On-Road)		X	
	Off-Road Only	X		
	Varied			X

Off-Road =



- An Option **Compatibility Constraint** allows you to explicitly specify that certain combinations of option values are not allowed

Example: If customer chooses to override the U-Decide default above, we still want to make sure they don't buy a road bike for off-road use

		Bike Type		
		Mountain	Road	Hybrid
Planned Terrain	Paved Only(On-Road)			
	Off-Road Only		X	
	Varied		X	





# Test Marketing Rules / Save Configuration (Selected Option Set)



- ▶ Even if the underlying Parts Solutions / Product Structure do not even yet exist, you can exercise the marketing rules, options, constraints and configure a **Valid Complete Selected Option Set**
- ▶ Marketing User / Sales Engineer / End Customer can always configure by Product Model and never see or access any parts or product structure

*INSERT CONFIGURATION WIZARD SCREEN CLIP*



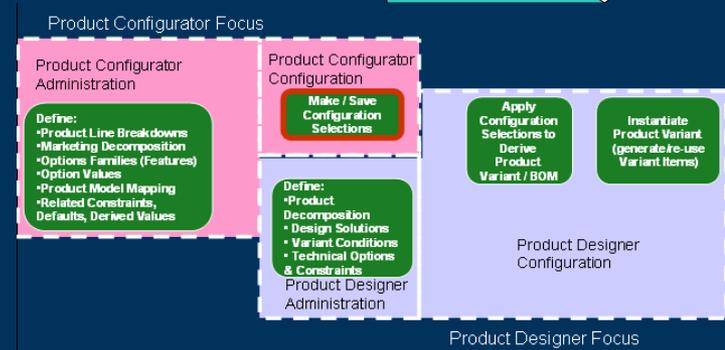
# Configuration Validation



- ▶ As the user makes selections, the system validates:
  - ▶ Is the configuration **Complete**? (all Mandatory Options have a selection)
  - ▶ Is the configuration **Consistent**? (no Incompatible selections have been made)
- ▶ If the Selected Option Set is Incomplete or Inconsistent, there are different levels of feedback the user can request:
  - ▶ **Warnings/ Information** – a list of all issues and causes are displayed; the user can correct them at any time
  - ▶ **Errors** – the user must correct all problems before continuing with the configuration
- ▶ During the configuration process, the user is led through the choices they need to make. A **Dynamic Constraint Evaluation** mode displays the effect previous selections have on the compatibility of future selections. Incompatible choices are not displayed to the user



# Product Configurator Configuration Activity Diagram



**If Dynamic constraint enabled, rules are evaluated as user selections are made and valid choices updated real-time**

Select Product Model to Configure

Choose Dynamic or On-Demand Constraint Evaluation \*

Select Warning Mode, Error Mode, or No Check \*

These decisions may or may not be up to the user depending on user role (i.e. internal, customer, sales engineer)

Optionally Select Feature Packages

Select Options

Validate Selections for Completeness

Validate Selections for Consistency (only needed if dynamic mode not enabled)

Optionally Perform Characteristic Rollup on Selected Options

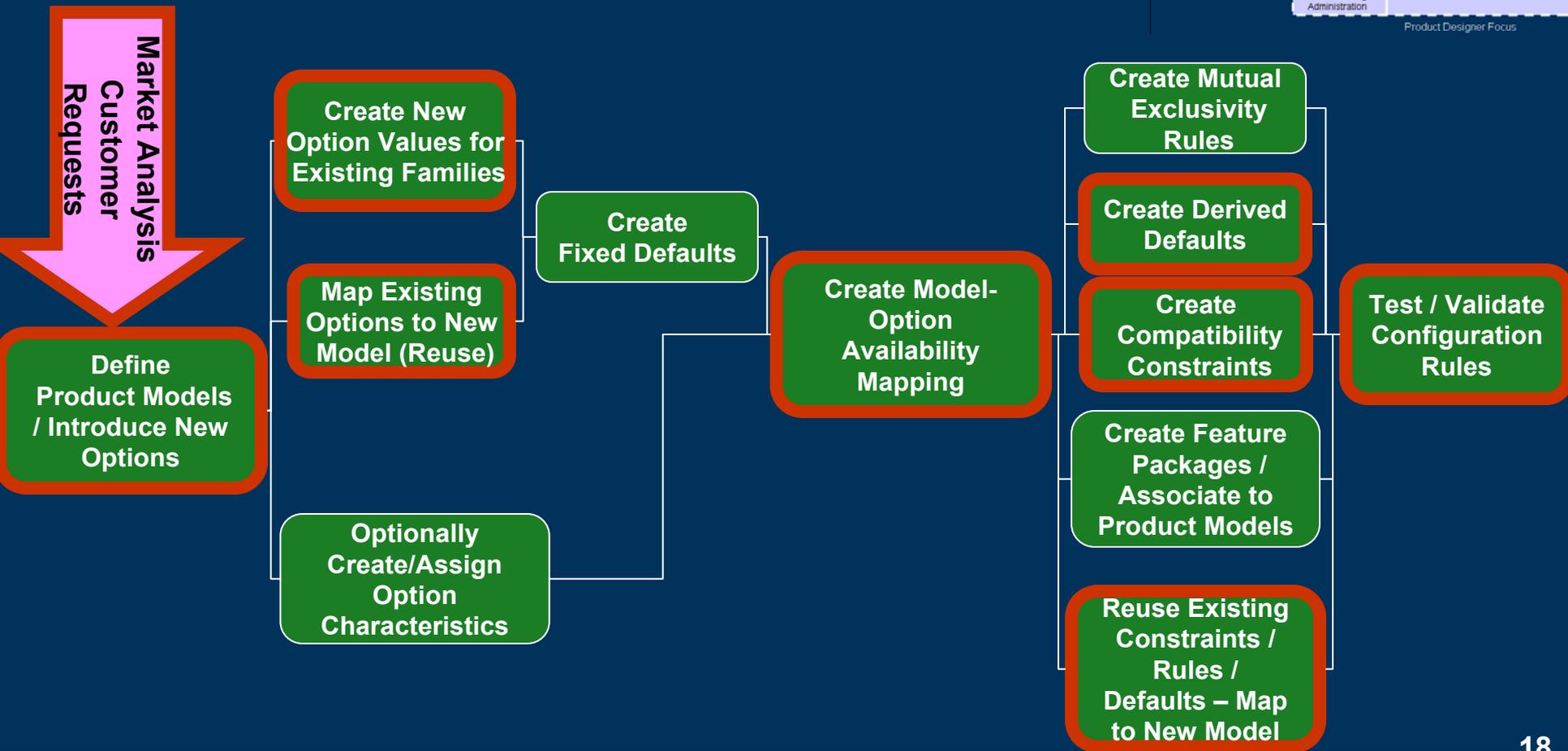
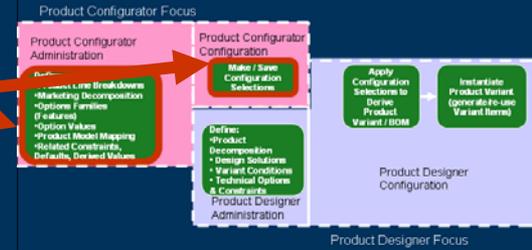
Save Selections (SOS)



# Product Configurator COMPLETE



We have **COMPLETED**



\* All rules, defaults, constraints, packages can apply for one or more product models



# Product Configuration Overall Flow



## Product Configurator Focus

### Product Configurator Administration

#### Define:

- Product Line Breakdowns
- Marketing Decomposition
- Options Families (Features)
- Option Values
- Product Model Mapping
- Related Constraints, Defaults, Derived Values

### Product Configurator Configuration

Make / Save Configuration Selections

#### Define:

- Product Decomposition
- Design Solutions
- Variant Conditions
- Technical Options & Constraints

Product Designer Administration

Apply Configuration Selections to Derive Product Variant / BOM

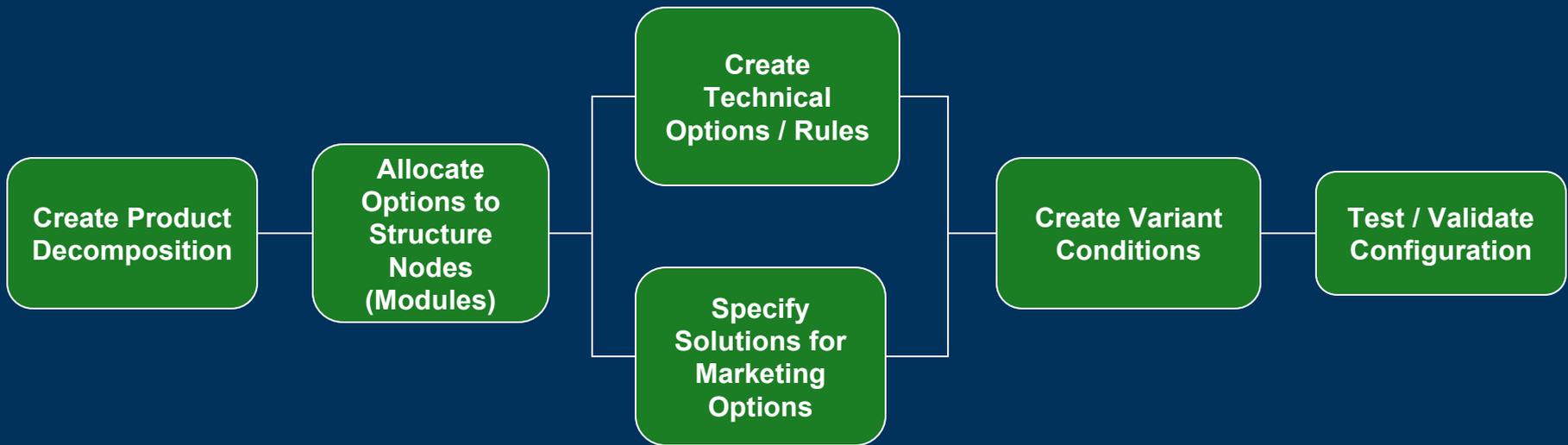
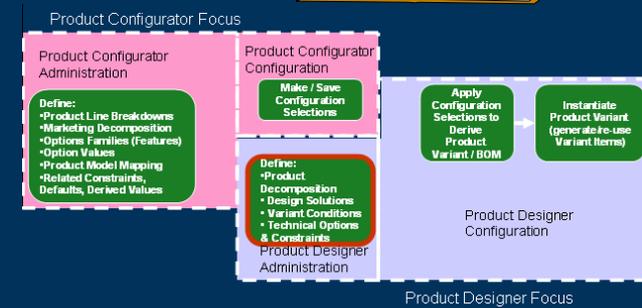
Instantiate Product Variant (generate/re-use Variant Items)

Product Designer Configuration

## Product Designer Focus

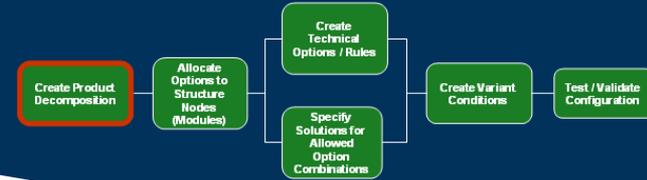
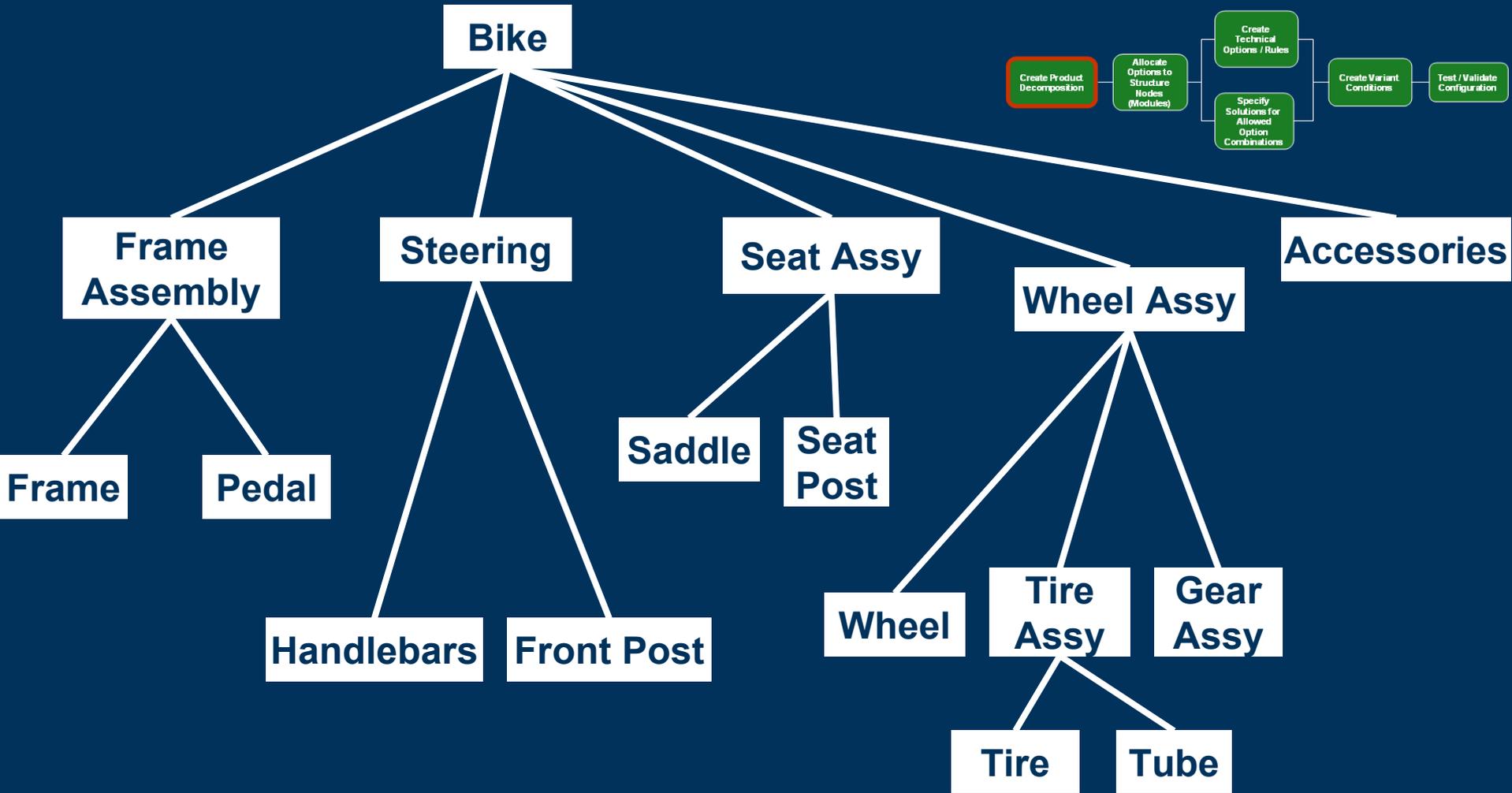


# Product Designer Administration Activity Diagram





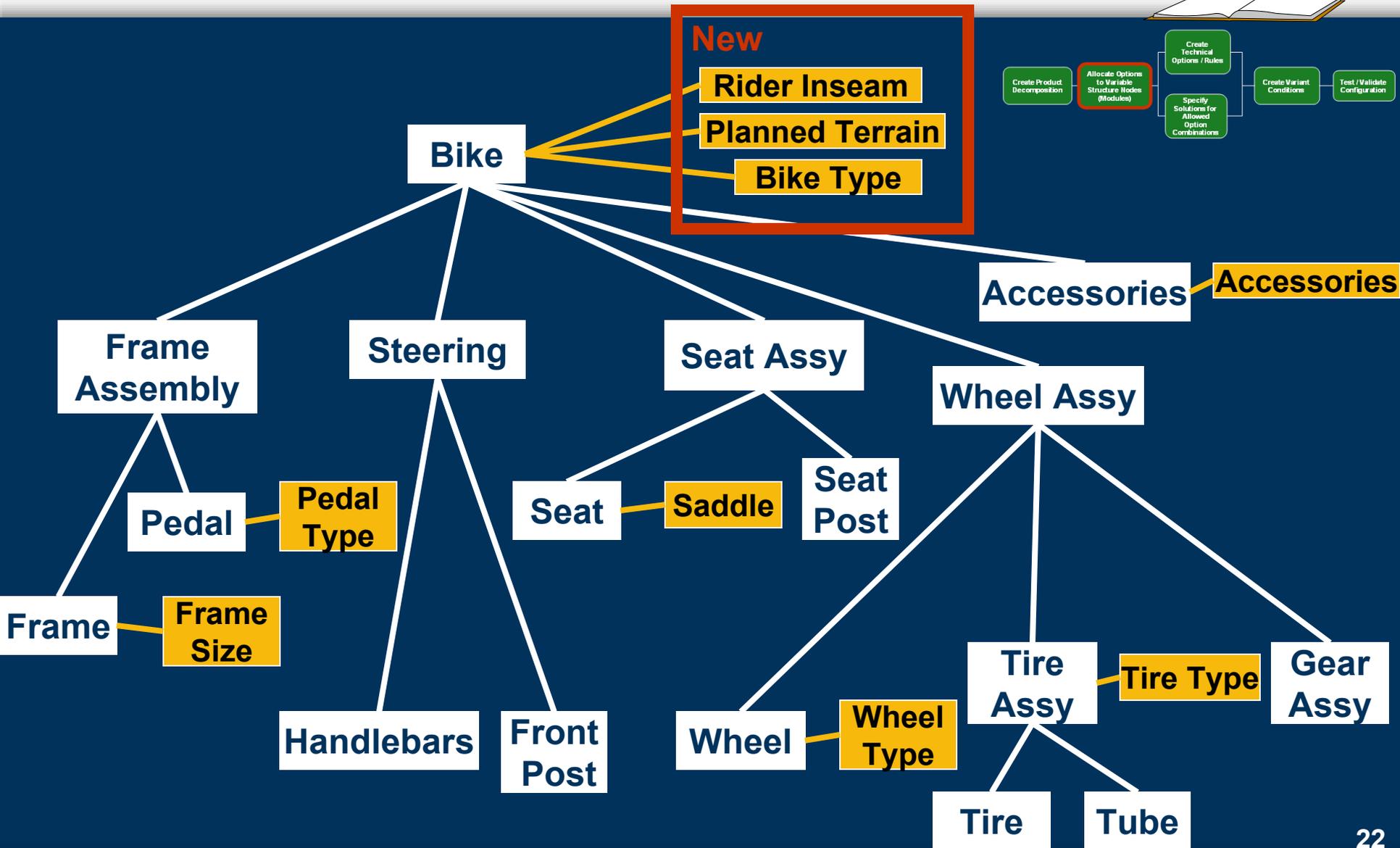
# Bicycle Variable Structure: Create / Update



We aren't making any changes to the generic product definition, so we don't need to make updates at this level



# Bicycle Variable Structure: Associate New Options





# Define Derived Values

## Derive Technical Option Values



- ▶ **Derived Option Values** automatically select an option value if certain other option selections have been made
- ▶ All Variant Expressions can be scoped to one or more Product Models

Product Model = Performance Road

		Frame Size				
		17 in / 43 cm	19 in / 48 cm	21 in / 53 cm	23 in / 58 cm	24 in
Rider Inseam	28 in / 71 cm	X				
	29 in / 73 cm	X				
	30 in / 75 cm		X			
	31 in / 78 cm		X			
	32 in / 80 cm			X		
	33 in / 82 cm			X		
	34 in / 85 cm				X	
	35 in / 88 cm				X	
	36 in / 90 cm					X
	37 in / 93 cm					X

If rider has a 34" inseam and is buying a road bike, they will get the 23" Frame.

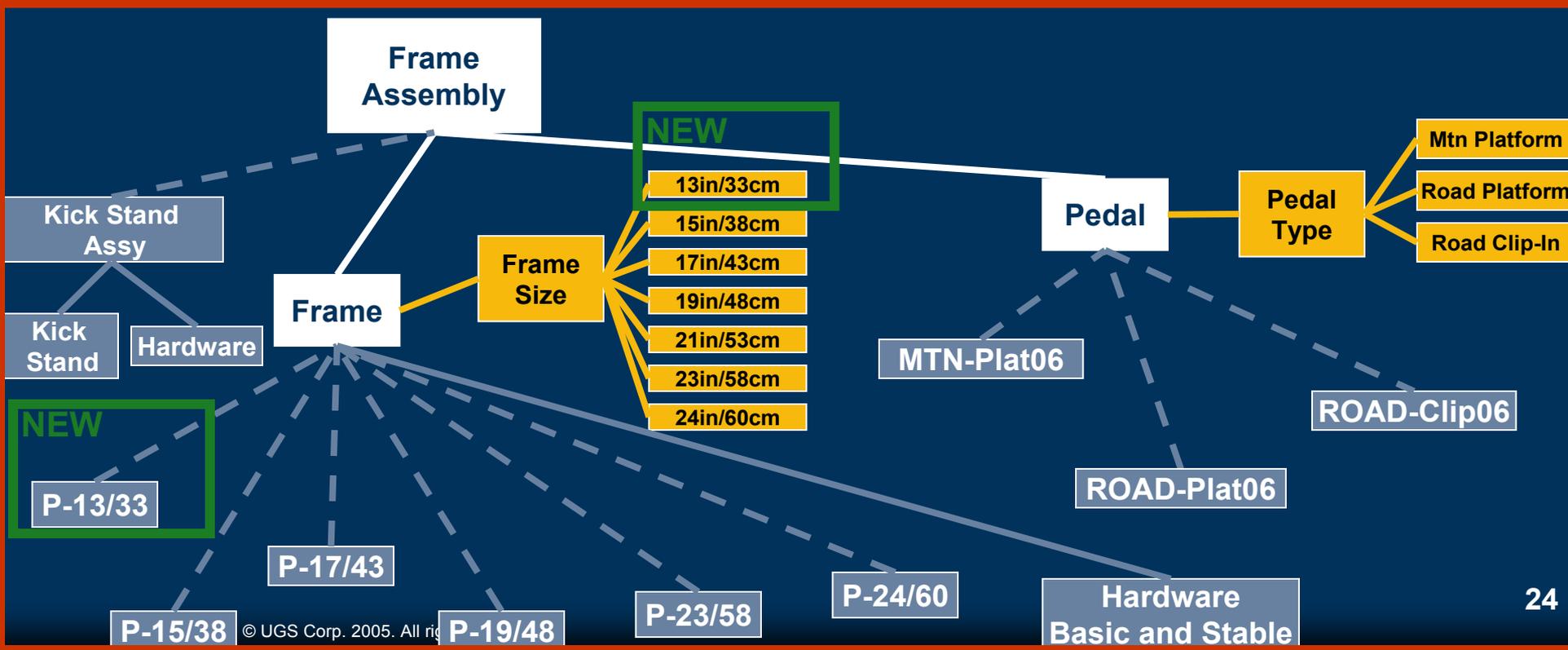
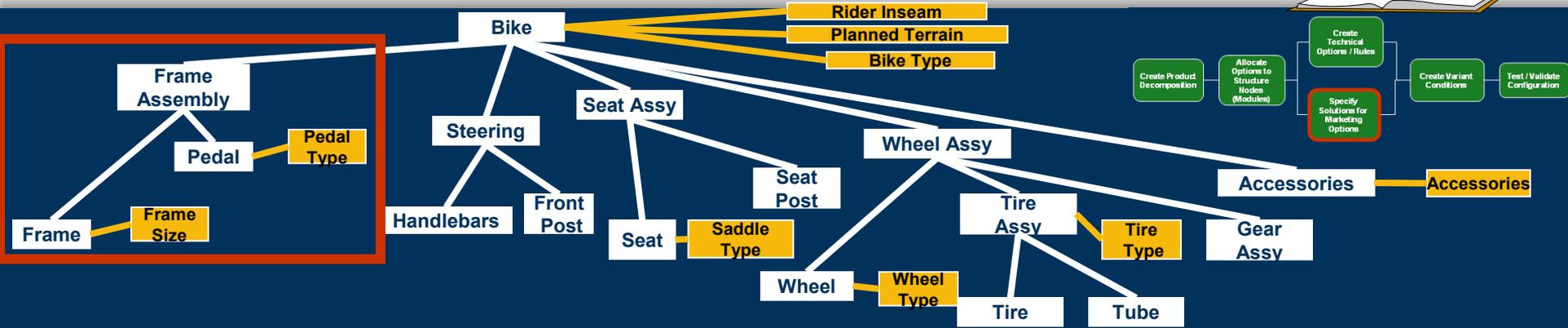
Product Model = Performance Mountain  
Performance Hybrid

		Frame Size				
		13 in / 33 cm	15 in / 38 cm	17 in / 43 cm	19 in / 48 cm	21 in / 53
Rider Inseam	28 in / 71 cm	X				
	29 in / 73 cm	X				
	30 in / 75 cm		X			
	31 in / 78 cm		X			
	32 in / 80 cm			X		
	33 in / 82 cm			X		
	34 in / 85 cm				X	
	35 in / 88 cm					X
	36 in / 90 cm					
	37 in / 93 cm					

But if same rider applies their choices to a Mountain or Hybrid bike, they will get the 19" frame

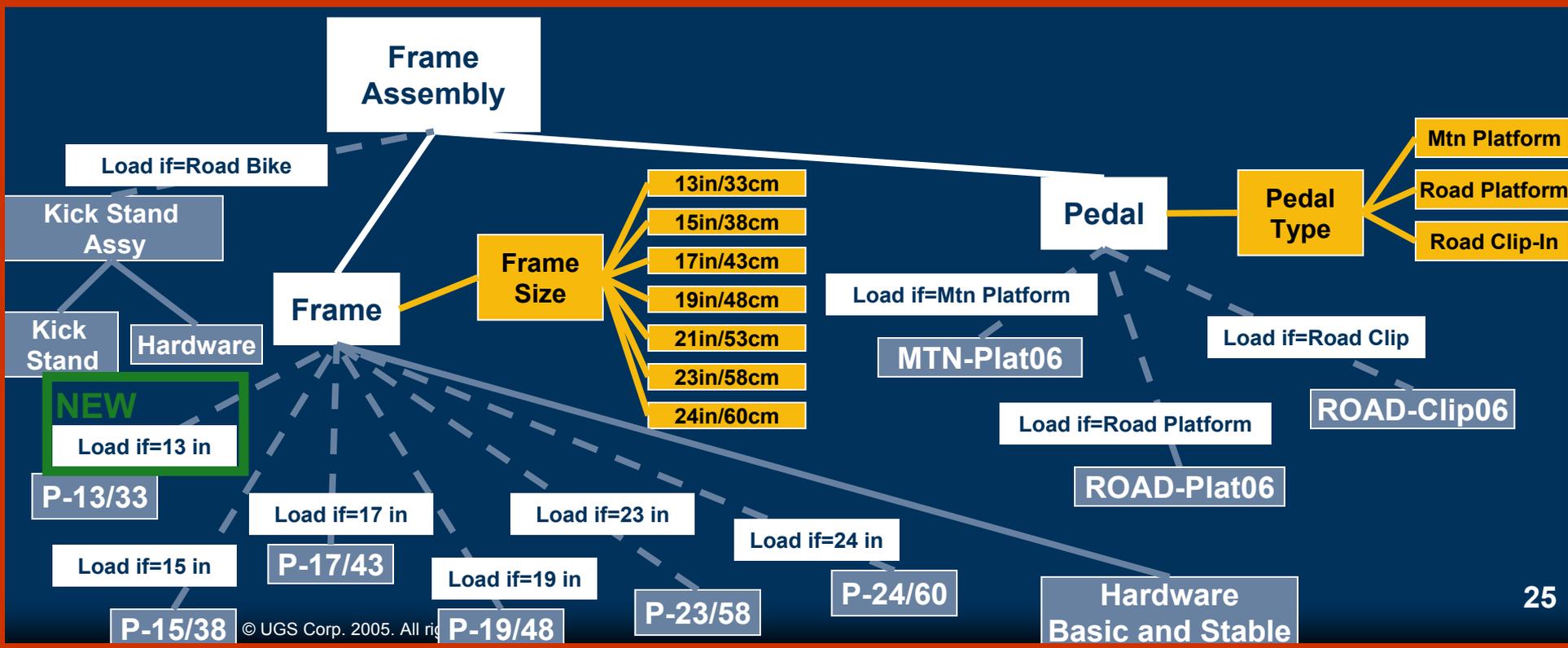
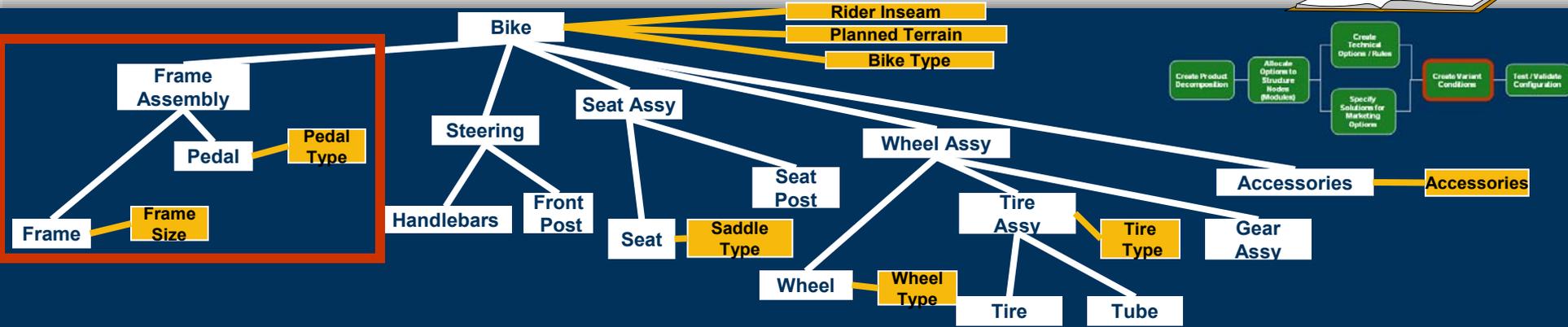


# Bicycle Variable Structure: Create New Design Solution(s)



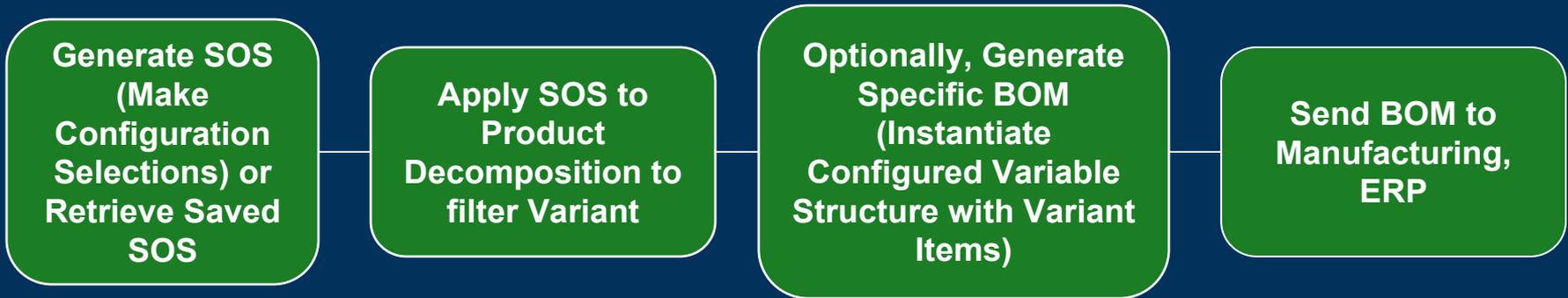
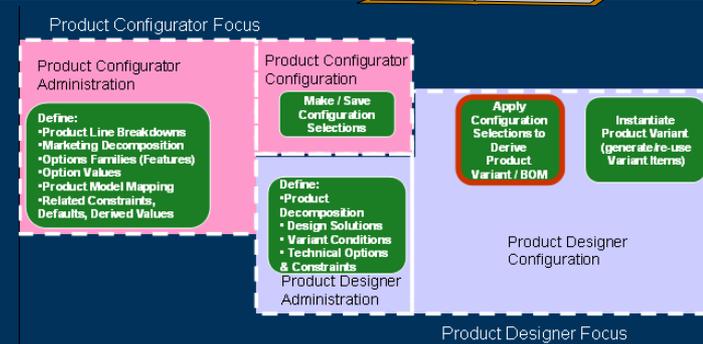


# Bicycle Variable Structure: Create New Variant Condition(s)





# Product Designer Configuration Activity Diagram





# Bicycle Variable Structure: Create / Retrieve and Apply SOS

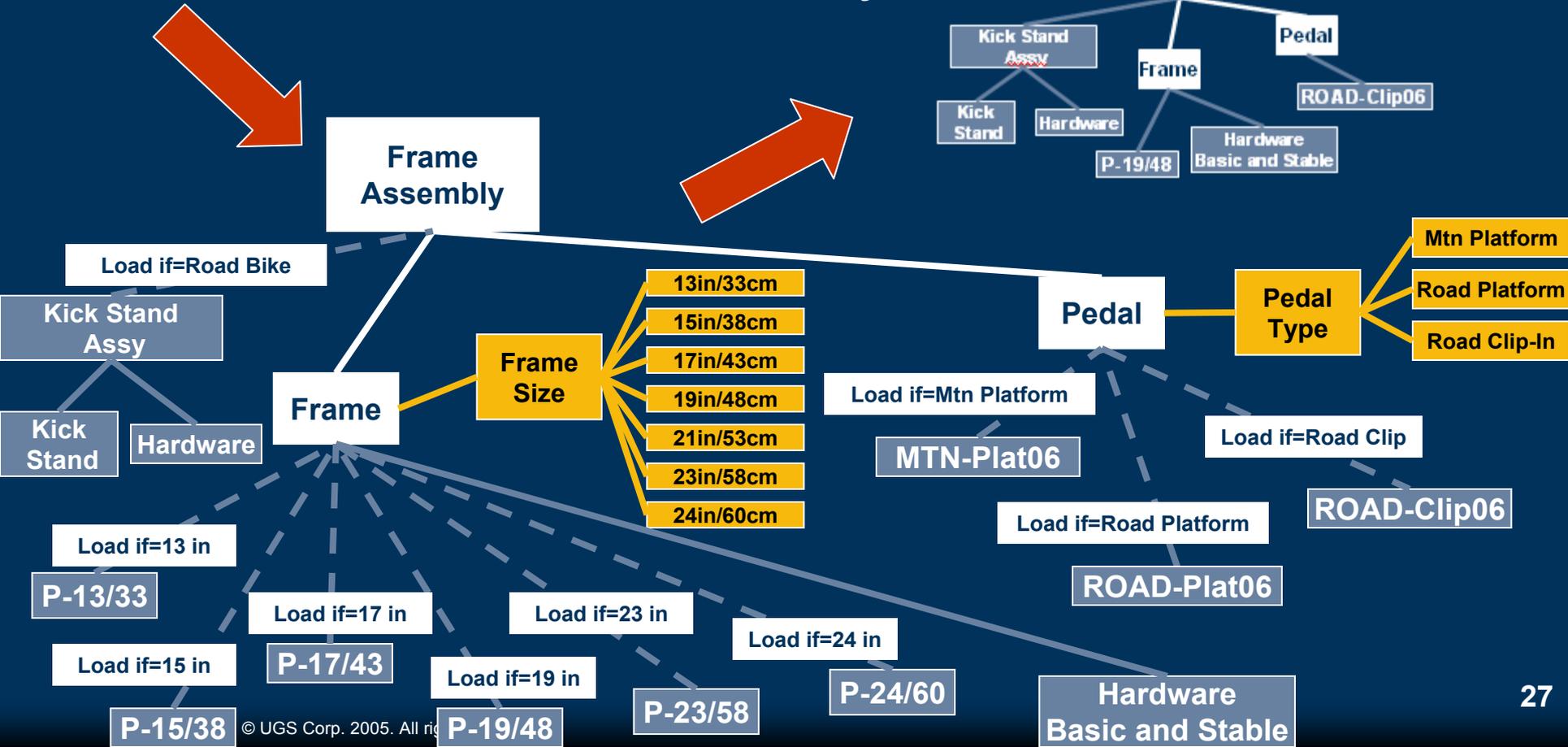
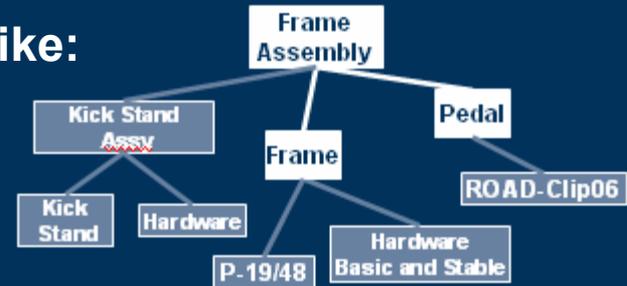


## My Bike Selected Option Set (SOS)

Bike Type	Road
Frame Size	19 in
Pedal Type	Road Clip-In



## My Bike:

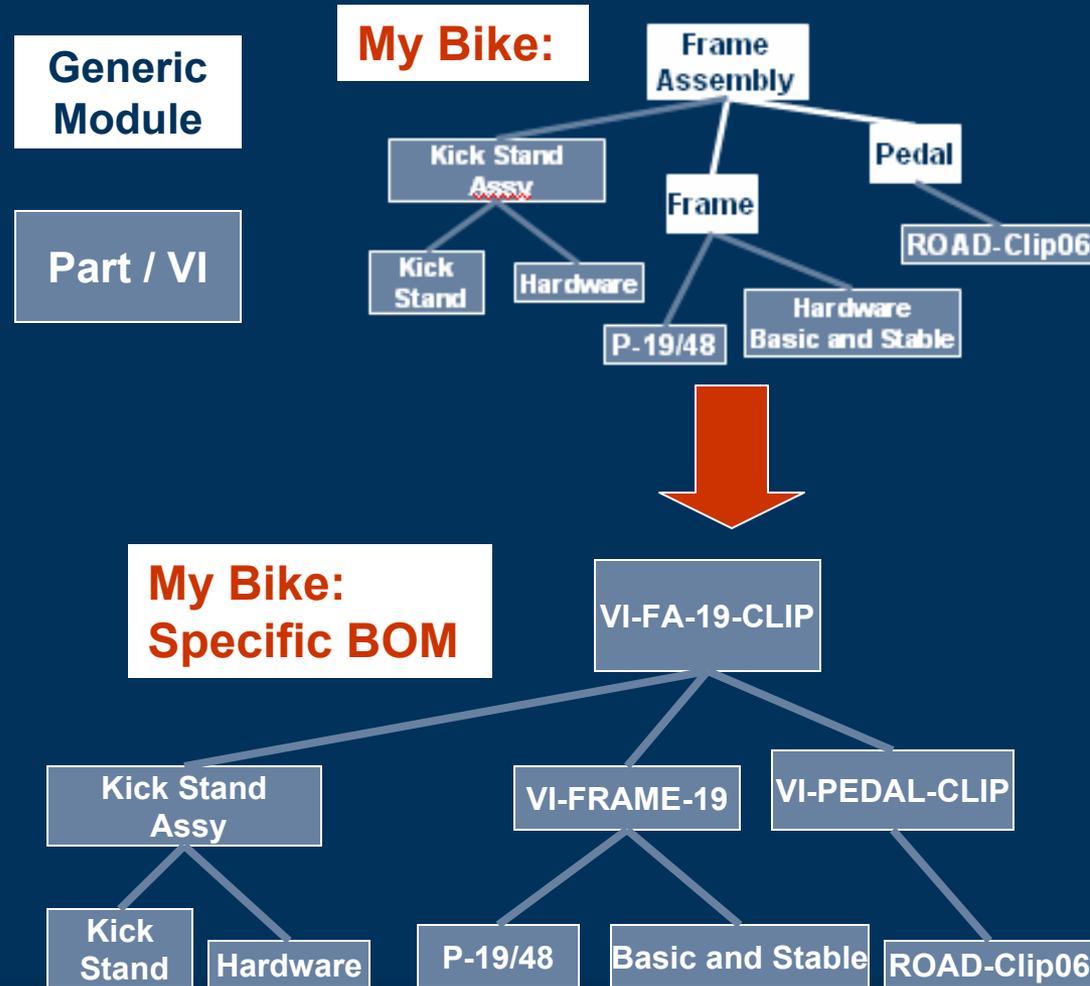




# Bicycle Variable Structure: Create / Retrieve and Apply SOS



- ▶ Generic modules contain ambiguity and therefore cannot themselves be manufactured
- ▶ Fully configured modules may need a part number (e.g. for associating documentation, tracking within ERP and through the shop floor)
- ▶ This is possible by (optionally) storing the configuration for a module as a **Variant Item (VI)**
- ▶ VIs can be searched for and reused (this is cheaper than creating new part numbers for configurations that have already been manufactured)





# Product Configuration Enhancements

## *Teamcenter Enterprise 2005 SR1*

- ▶ Global Options are set once for a product; the selected value applies everywhere the option is referenced
  - ▶ E.g. Voltage applies to all electrical components in a product
  - ▶ E.g. Exterior Color applies to all body panels of a vehicle
- ▶ Variant expressions can reference a combination of global and local options
- ▶ Tabular UIs enhanced to support global options

- ▶ Marketing User or Sales Engineer / Customer doesn't need any knowledge or visibility of product structure
  - ▶ User selects Product Model to Configure
  - ▶ Configuration Wizard is presented to user showing only valid customer-facing selections for that Model
- ▶ In fact, any global marketing options and rules based on these options can be exercised before any product structure exists

Operation	Module to Option Family Relation	Variant Condition
Replace Node	Relation propagated to new node	Updated to reference new node
Insert Level	No Change	Propagated down to new level; Context module unchanged
Remove Level	Relations of removed level are duplicated one level up	Moved up one level and updated to reference new child
Split Qty	No Change	Copied over to new relation

- ▶ Restrict re-use of Variant Items to only those that are designated as re-usable
  - ▶ OOTB Configuration Point :
    - ▶ Can set Variant Item default to Re-Usable or not Re-Usable
    - ▶ Administratively controlled by a condition
  - ▶ Supports business process that requires explicit review and approval before allowing re-use of Variant Items



# Product Configuration Enhancements

## *Teamcenter Engineering 2005 SR1*



# TcEngineering Enhancements for 2006



## Automatic creation of VIs for an entire configured structure

- ▶ Configuration Point - allow a site to configure auto-naming of VIs relative to generic node they were derived from or to allow user input for each new VI.
- ▶ Configuration Point - allow site to specify that processing should be stopped at a node with no variability at its own level or to continue processing to leaf nodes.
- ▶ % Progress and activity status messages will be provided in UI window.

## Selectively revise VI when corresponding generic node it was derived from revises

- ▶ If user wishes to re-use by revising or updating an existing VI when the derived-from generic structure is updated, they will search for related VIs, and choose desired VI to update/revise.
- ▶ Allows re-use of existing VIs where it is desirable for them to evolve based on evolution of underlying generic structure



# Product Configuration Summary



## Product Configurator enables users to

- ▶ Manage Product Models and option definitions including feature packages and option availability
- ▶ Manage hierarchy of Option Families and Characteristics
- ▶ Utilize Task focused UI – tables and wizards to simplify model and option definitions as well as rule definition
- ▶ Filter options, rules and constrains by Product Model applicability
- ▶ Define Mutual Exclusivity and Mandatory/ Discretionary completeness rules
- ▶ Perform Dynamic constraint evaluation

## Product Designer enables users to

- ▶ Model families of design solutions - Organize these to facilitate design reuse and libraries of designs
- ▶ Define technical dependencies and compatibility rules
- ▶ Define Variant Conditions and Instantiate and manage specific variants
- ▶ Perform Variant Sensitive BOM Rollup (e.g. cost and weight)

All Teamcenter 2005 Product Configuration applications use common OVE rules evaluation engine



# Summary of Product Configurator Administration Capabilities

✓	Available NOW
✓	Tc2005 SR1

	<u>Tc Ent</u>
<i>Product Model</i>	✓
<i>Model-Option Value Availability</i>	✓
<i>Mandatory / Discretionary completeness rules</i>	✓
<i>Feature Packages</i>	✓
<i>Price and Weight Attributes</i>	✓
<i>Multi-Select Option Values</i>	✓
<i>Variant Expressions Qualified by Model</i>	✓
<i>Marketing Feature Structures</i>	✓
<i>Tabular UI: Variant Conditions</i>	✓
<i>Tabular UI: Model-Option Value Mapping</i>	✓
<i>Tabular UI: Compatibility Constraints</i>	✓
<i>Tabular UI: Fixed / Derived Defaults</i>	✓
<i>Tabular UI: Derived Values</i>	✓
<i>Global Options</i>	✓



# Summary of Product Configurator Configuration Capabilities



Available NOW



Introduced in 2006

Tc Ent

*Author and apply Selected Option Set*



*Configure by Model*



*Option Value Filtering by Model*



*Constraint Filtering by Model*



*Completeness / Consistency Checks on Selected Option Set*



*Display All Failed Rules Simultaneously*



*Dynamic Constraint Evaluation*



*SOS Effectivity*



*Errors, Information and Warning messages*



*Rollup of price or weight based on variant*



*Configure Directly By Product Model (Complete Decoupling from Structure)*







Questions?



Backup Slides, Graphics, Etc



# Product Configuration TC2005 SR1

## *Global Options*



- ▶ Global Options are set once for a product; the selected value applies everywhere the option is referenced
  - ▶ E.g. Voltage applies to all electrical components in a product
  - ▶ E.g. Exterior Color applies to all body panels of a vehicle
- ▶ Variant expressions can reference a combination of global and local options
- ▶ Tabular UIs enhanced to support global options



# Product Configuration TC2005 SR1

## *Configure directly by Product Model*



- ▶ Marketing User or Sales Engineer / Customer doesn't need any knowledge or visibility of product structure
  - ▶ User selects Product Model to Configure
  - ▶ Configuration Wizard is presented to user showing only valid customer-facing selections for that Model
- ▶ In fact, any global marketing options and rules based on these options can be exercised before any product structure exists



Operation	Module to Option Family Relation	Variant Condition
Replace Node	Relation propagated to new node	Updated to reference new node
Insert Level	No Change	Propagated down to new level; Context module unchanged
Remove Level	Relations of removed level are duplicated one level up	Moved up one level and updated to reference new child
Split Qty	No Change	Copied over to new relation



# Product Configuration TC2005 SR1

## *Reusable Variant Items*



- ▶ Restrict re-use of Variant Items to only those that are designated as re-usable
  - ▶ OOTB Configuration Point :
    - ▶ Can set Variant Item default to Re-Usable or not Re-Usable
    - ▶ Administratively controlled by a condition
  - ▶ Supports business process that requires explicit review and approval before allowing re-use of Variant Items



# Model Option Mapping (USE TO REPLACE .XLS SLIDE)



Option Family	Option Value	Included Models		
		VRSCA	VRSCD	VRSCR
ABS	Yes	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	No	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Color	Red	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Yellow	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Blue	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Silver	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Crate	Wood	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Steel	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Destination	C-California	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	D-Domestic	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	CN-Canada	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	HDI-International	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Ha-Australia	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	HE-England	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Engine	HJ-Japan	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	115 hp	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
EngineCover	98 hp	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Polished	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
FrameColor	Chrome	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Black	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
HandleBar	Silver	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	High	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Security	Low	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	No	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Wheel	Yes	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Disk ABS	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Cast Spoke ABS	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Disk	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Cast Spoke	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Laced	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Option Values

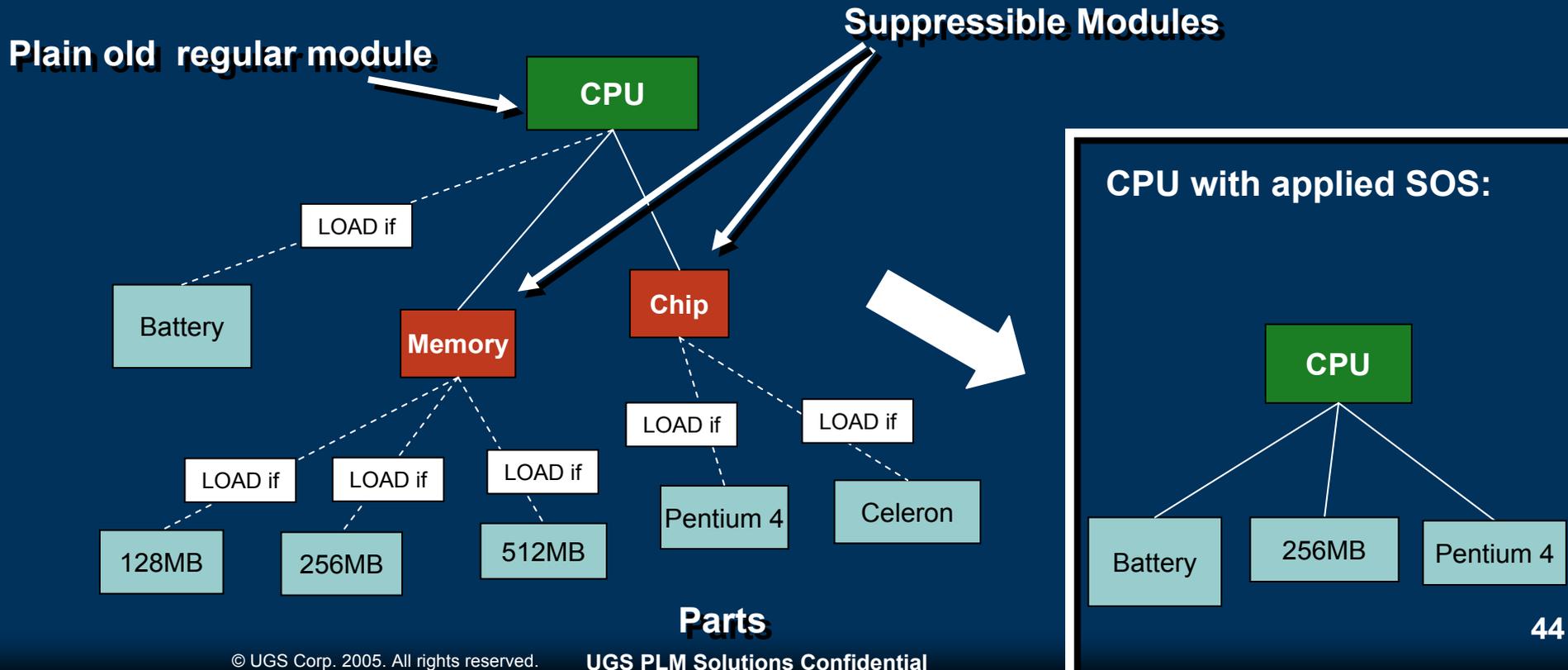
Product Models



# Filtering Using Suppressible Modules (PLMx)

X=1100

- ▶ **Suppressible Modules** can be used when the applied SOS will always configure exactly 1 Variant for that Module
- ▶ When configured, the Suppressible Module is replaced with the selected part for viewing / expansion / sending to ERP





# Actors

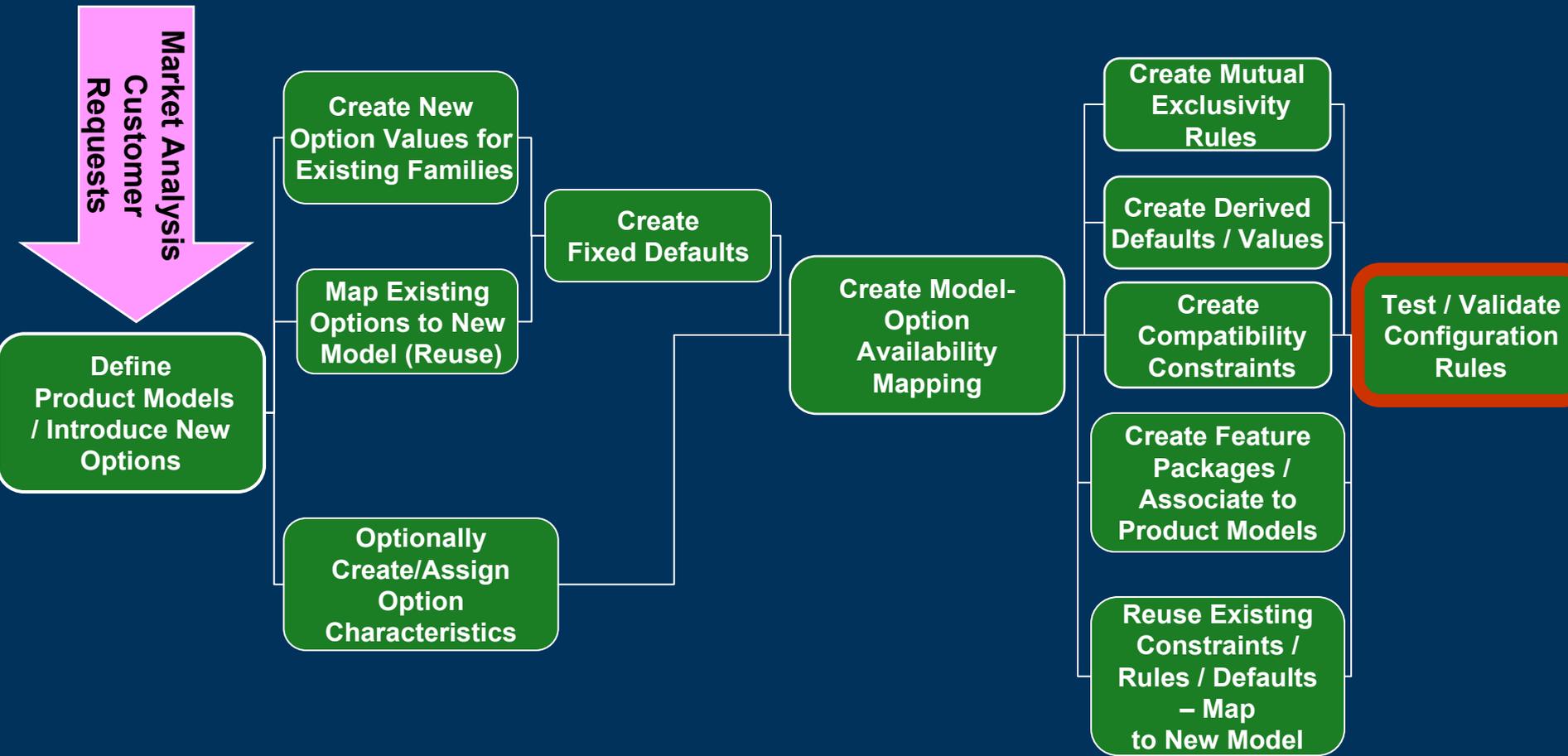
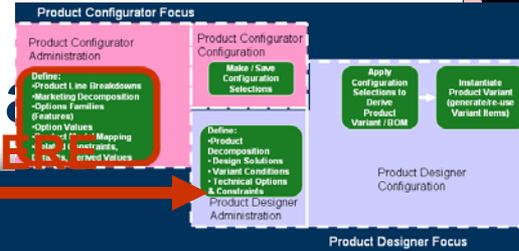


Role	Responsibility
Marketing / Product Manager	Provides product planning inputs based on Market Analysis / Customer Request
Model Option Manager	Creates Option (Feature) hierarchies and values, Model-Option availability mapping and Marketing constraints, rules, defaults, and feature packages
Product Specialist	Creates / Manages Product Decomposition, manages technical constraints
Designer	Creates Design Solutions to fulfill allowed option combinations
Configurator	Validates configuration rules
Sales Engineer / Customer	Makes / Saves configuration selections for a product; If Engineer-to-Order (ETO) allowed, may request additional selections
Sales Engineer /	Applies SOS to generate variant; generates VIs for static BOM (may be automated) / BOM Solve

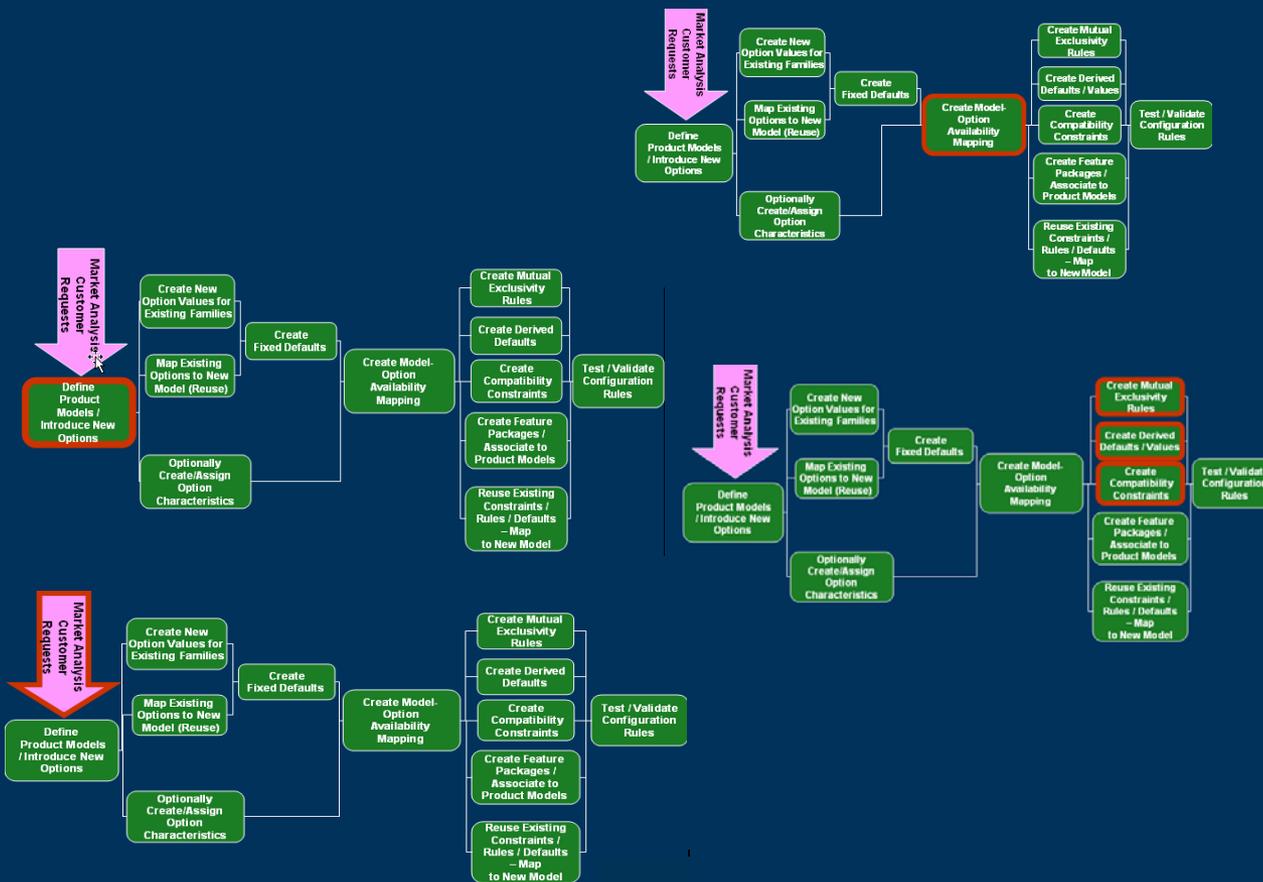


# Product Configurator Administration Activity Diagram

We are HERE



\* All rules, defaults, constraints, packages can apply for one or more product models





# Product Configuration Overall Flow



## Product Configurator Focus

### Product Configurator Administration

**Define:**

- Product Line Breakdowns
- Marketing Decomposition
- Options Families (Features)
- Option Values
- Product Model Mapping
- Related Constraints, Defaults, Derived Values

### Product Configurator Configuration

**Make / Save Configuration Selections**

**Define:**

- Product Decomposition
- Design Solutions
- Variant Conditions
- Technical Options & Constraints

### Product Designer Administration

**Apply Configuration Selections to Derive Product Variant / BOM**

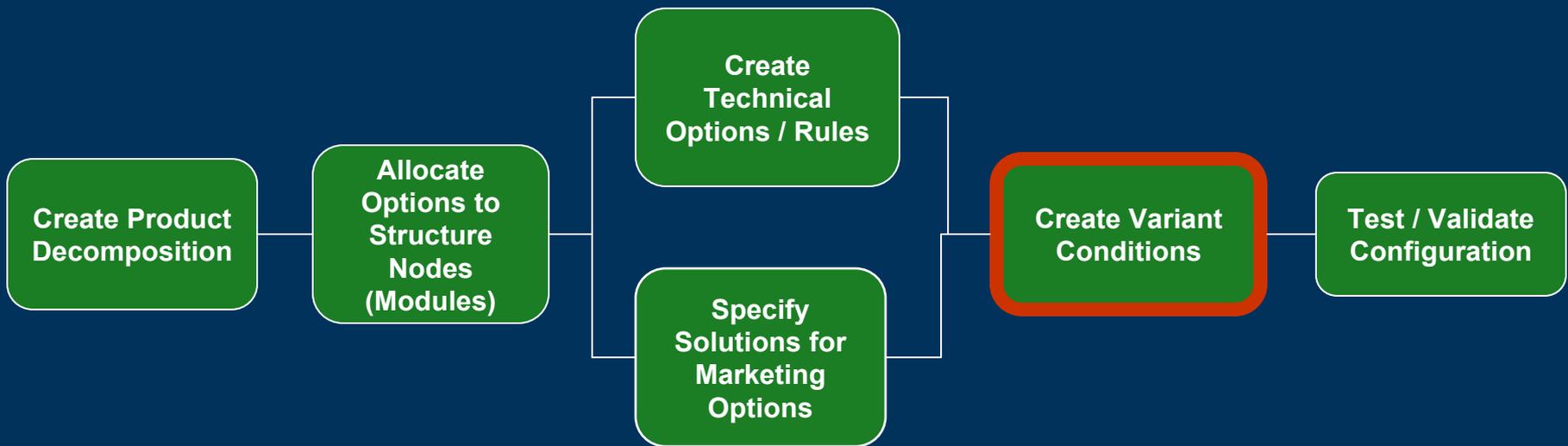
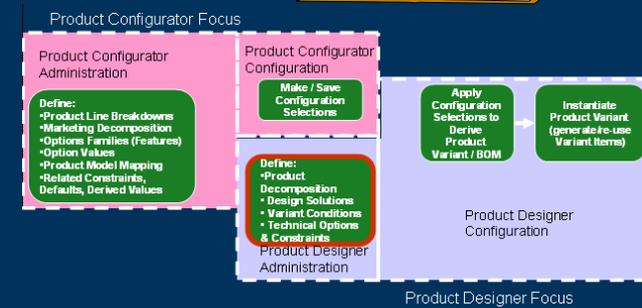
**Instantiate Product Variant (generate/re-use Variant Items)**

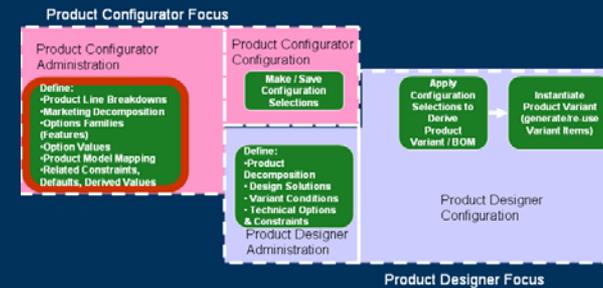
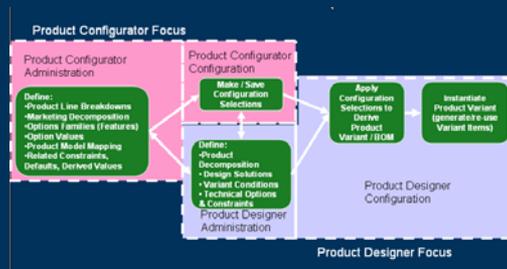
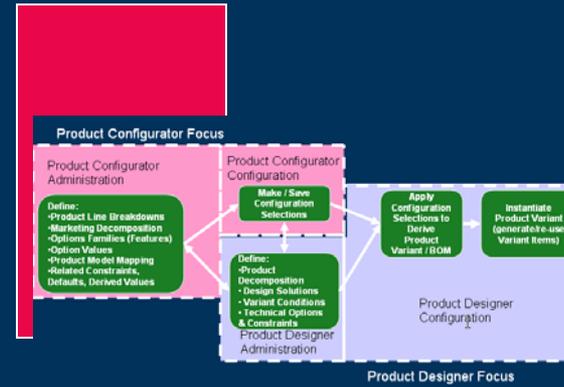
### Product Designer Configuration

## Product Designer Focus



# Product Designer Administration Activity Diagram







# Bike Example



<u>Level</u>	<u>Assembly/Component</u>
1	AB 1000: Bike Assembly
2	AB 1100: Frame Sub-Assembly
3	AB 1110: Frame
3	AB 1120: Pedal
2	AB 1200: Steering Sub-Assembly
3	AB 1210: Handlebars
3	AB 1220: Front Post
2	AB 1300: Gears Sub-Assembly
3	AB 1310: Gear
3	AB 1320: Chain
2	AB 1400: Seat Sub-Assembly
3	AB 1410: Seat
3	AB 1420: Seat Post
3	AB 1430: Reflector
2	AB 1500: Wheel Sub-Assembly
3	AB 1510: Wheel
3	AB 1520: Axle





**Orville Wright in Wright bicycle shop 1897**



# Graphics





# Graphics





## Tandem road bike

	Frame	Road Tandem
	Fork	Fatty R Tandem
	Rear Shock	N/A
	Rims	Mavic A719 w/eyelet and machined sidewall, 40 hole
	Hubs	DT Swiss Tandem Disc
	Spokes	DT Swiss Champion
	Tires	Continental Ultra GatorSkin, 700 x 28c
	Pedals	N/A
	Crank	TruVativ Elita Tandem, 30/39/52
	Chain	Shimano 9-speed (drive), SRAM 9-speed (timing)
	Rear Cogs	SRAM PG-970, 11-34
	Bottom Bracket	TruVativ Giga X Drive
	Front Derailleur	Shimano Ultegra
	Rear Derailleur	Shimano XT
	Shifters	Shimano Ultegra 9-speed
	Handlebars	Cannondale Fire, 31.8mm front, stoker rear
	Stem	Cannondale 3-D Forged
	Headset	Cane Creek S-1
	Brakeset	Avid BB7 Disc
	Brakelevers	Shimano Ultegra
	Saddle	Fi'zi:k Aliante Sport Mg
	Seat Post	Kalloy SP-248D front, Satori Poise XC suspension rear
	Colors	Patriot Blue w/Blazer Blue HyperHighlight (gloss) (BLU), Tangerine w/Citron HyperHighlight (gloss) (TNG)
	Sizes	MS, LS, XS, XM, JL



### ADULT'S MOUNTAIN BIKE

#### Inside leg measurement

- Approx. 75cm => XSmall or 14 - 15inch frame
- Approx. 80cm => Small or 16 - 17inch frame
- Approx. 84cm => Medium or 18 - 19inch frame
- Approx. 87cm => Large or 20 - 21inch frame
- Approx. 90cm => XLarge or 22 - 23inch frame

### HYBRID

#### Inside leg measurement

- Approx. 78cm => XSmall or 14 - 15inch frame
- Approx. 82cm => Small or 16 - 17inch frame
- Approx. 85cm => Medium or 18 - 19inch frame
- Approx. 88cm => Large or 20 - 21inch frame
- Approx. 92cm => XLarge or 22 - 23inch frame

### ROAD

#### Inside leg measurement

- Approx. 765cm => XSmall or 50 - 52cm frame
- Approx. 80cm => Small or 52 - 54cm frame
- Approx. 84cm => Medium or 54 - 56cm frame
- Approx. 86cm => Large or 56 - 58cm frame
- Approx. 90cm => XLarge or 58 - 60cm frame



Frame Mounted Pump

Mountain-X Platform Pedals



TECHNICAL SHEET

TECNOLOGIA



TECHNICAL SHEET

TECNOLOGIA

### STORIKA

195 g | 275 x 135 mm | TI ALLOY | ●



### SLC GEL FLOW

210 g | 273 x 134 mm | KIT CARBONIO | ●





## Mountain Bike Wheels Tubeless or Traditional

[http://bike.shimano.com/catalog/cycle/products/component.jsp?PRODUCT%3C%3Eprd\\_id=845524441763179&FOLDER%3C%3Efolder\\_id=2534374302040281&ASSORTMENT%3C%3East\\_id=1408474395181419&bmUID=1145216667016](http://bike.shimano.com/catalog/cycle/products/component.jsp?PRODUCT%3C%3Eprd_id=845524441763179&FOLDER%3C%3Efolder_id=2534374302040281&ASSORTMENT%3C%3East_id=1408474395181419&bmUID=1145216667016)



# The Lemond Method



- ▶ Two measurements needed:
  - ▶ Inseam:
    - ▶ Your center-to-center seat tube will equal  $(\text{inseam} \times 0.65)$ .
    - ▶ Your center-to-top seat tube will equal  $(\text{inseam} \times 0.67)$ .
    - ▶ Your bb-saddle height will equal  $(\text{inseam} \times 0.883)$ .
  
- ▶ Torso length and Arm length:
  - ▶ Your total effective reach (i.e. the sum of your top tube length plus your stem length) will equal  $(\text{torso} + \text{arm})/2 + 4$ .
  - ▶ Alternatively, instead of torso length, you might be asked for the length of your sternal notch to the ground. In this case, your total effective reach will equal  $(\text{sternal notch} - \text{inseam} + \text{arm})/2 + 4$ .
  
- ▶ Most folks rely on the Lemond method for one good reason: it's quite accurate. **Over time, though, we became fixated on the two significant drawbacks of the process:**



- ▶ Show Effectivity on Option Values?
- ▶ Show Option Value information (photo, etc)
- ▶ Frame Module or Wheel Module with pics
- ▶ List of Options / Option Values
- ▶ Model Hierarchy
  - ▶ Mountain / Road are separate structures
  - ▶ Models
- ▶ Configuration



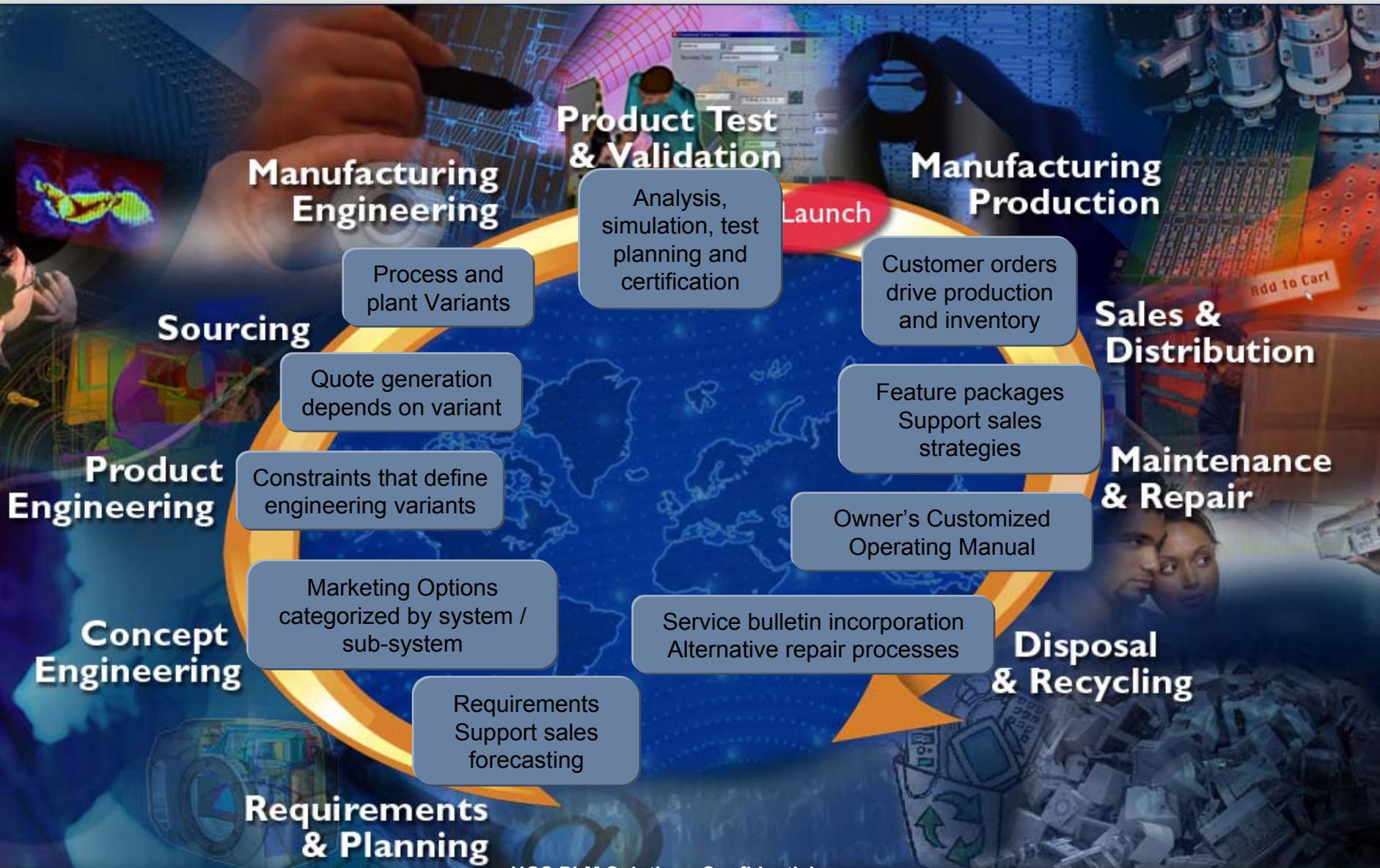
# Brainstorming 2



- ▶ Show TimeLine for Marketing / Engineering Tasks
- ▶ Integrate Tc2005 SR1 features
- ▶ Don't show basics
- ▶ Make slides for TcEng new features
- ▶ Show generation of new marketing info
- ▶ Show building this into the mapping.
- ▶ Offering a new line of bikes to the market



# Managing Product Variety Across the Lifecycle

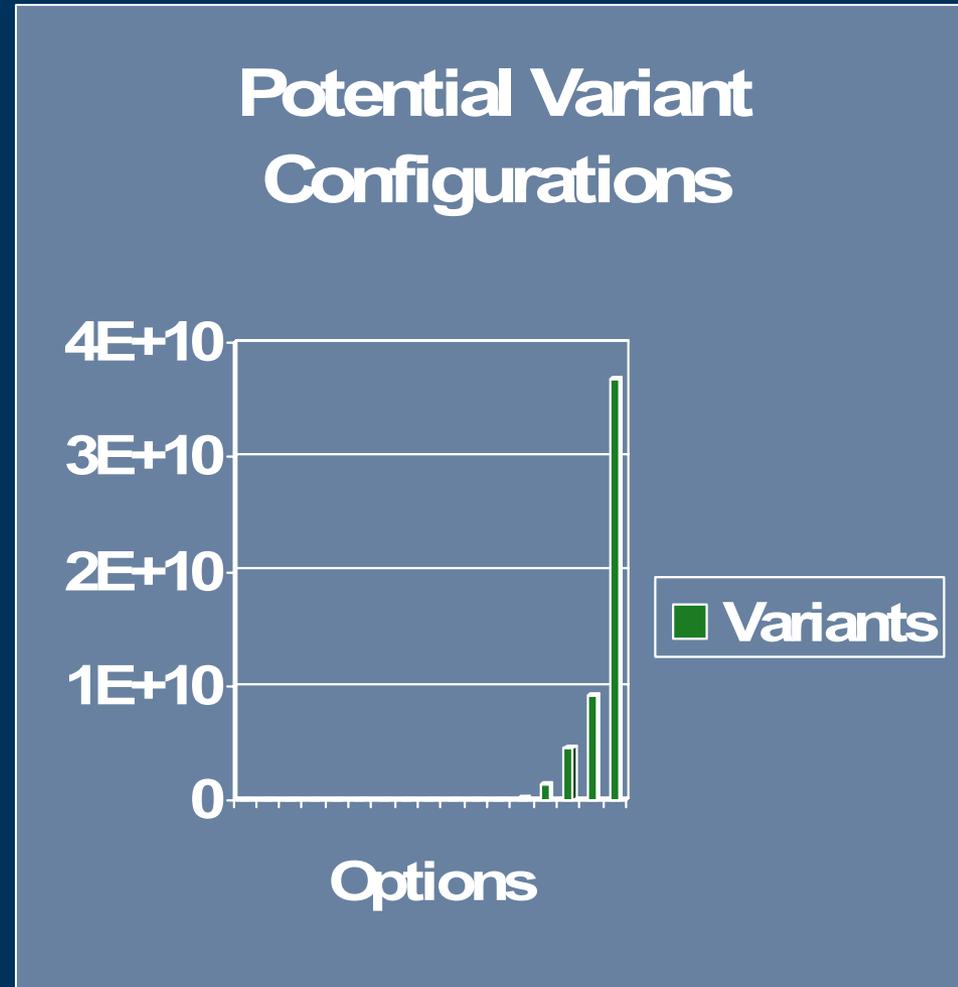




# Number of Potential Variants grows exponentially



▶ Processor, 8 choices	8
▶ Chassis, 3 choices	24
▶ 5.25" Bay 2, 2 choices	48
▶ Video, 4 choices	192
▶ Audio, 2 choices	384
▶ Memory, 4 choices	1536
▶ Hard Drive, 6 choices	9216
▶ Zip Drive, 2 choices	18432
▶ Mouse, 4 choices	73728
▶ Monitor, 11 choices	811008
▶ Video Card, 5 choices	4055040
▶ DVD/CD, 9 choices	36495360
▶ 2 <sup>nd</sup> Drive, 7 choices	255467520
▶ Speakers, 6 choices	1532805120
▶ Sound Card, 3 choices	4598415360
▶ Modem, 2 choices	9196830720
▶ Network Card, 4 choices	36787322880



Note: actual number of allowable variants will be less if constraints are applied



# Product Configurator

Product Configurator	Occurrence Manager
Platform Designer	Product Designer

- ▶ Product Configurator enables Marketing and Sales organizations to define and manage model and feature package definitions, option dependencies and rules, pricing and sales information, configuration completeness criteria and all other product configuration data.
- ▶ Key Features
  - ▶ Model and option definition including feature packages and option availability
  - ▶ Global marketing options
  - ▶ Marketing feature decomposition
  - ▶ Task focused UI – tables and wizards to simplify model and option definitions as well as rule definition
  - ▶ Model applicability on rules and constraints
  - ▶ Mandatory/ Discretionary completeness rules
  - ▶ Dynamic constraint evaluation
  - ▶ Variant-sensitive rollup calculations of business attributes, e.g. price





# Table User Interface

Product Configurator	Occurrence Manager
Platform Designer	Product Designer

X=1

- ▶ This example shows a table user interface used to define or view the option values that are offered on each Product Model

**Model Option Value Availability**  
Model Option Value Availability

Product Model  
Affordable Desktop  
CarModel  
Cutting Edge Desktop  
Excellent Laptop

Option Family Name  
Keyboard

Model Option Value Mapping

Option Family	Option Value	Included Models				
		Affordable Desktop	Cutting Edge Desktop	Excellent Laptop	Superior Desktop	Value Laptop
Memory	128MB	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	256MB	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	512MB	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	1GB	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Query successful.. 11 rows returned.  
Query successful.. 15 rows returned.

- ▶ Other table UIs include
  - ▶ Variant condition creation
  - ▶ Compatibility constraint authoring
  - ▶ Derived default authoring
  - ▶ Derived option value authoring
- ▶ Advanced user interfaces are available for complex expressions that cannot be represented in a table



# Product Configurator Option Families and Values

Product Configurator	Occurrence Manager
Platform Designer	Product Designer

X=1

- ▶ Option Values within an Option Family may be defined as **Mutually Exclusive** to each other
  - ▶ E.g. Operating System options are mutually exclusive
  - ▶ E.g. Removable Storage options (e.g. memory stick, floppy drive) are not mutually exclusive
- ▶ Option Values can be grouped and offered together as a **Feature Package**, potentially at a discounted price
  - ▶ A Student PC Package could include the “Affordable” Desktop Model together with a low-end printer/ fax/ photocopier, a digital camera and bundled software applications
- ▶ Option Families and Values can be **Global**, i.e. defined and configured independently of product structure
- ▶ Option Values may move from one family to another over time

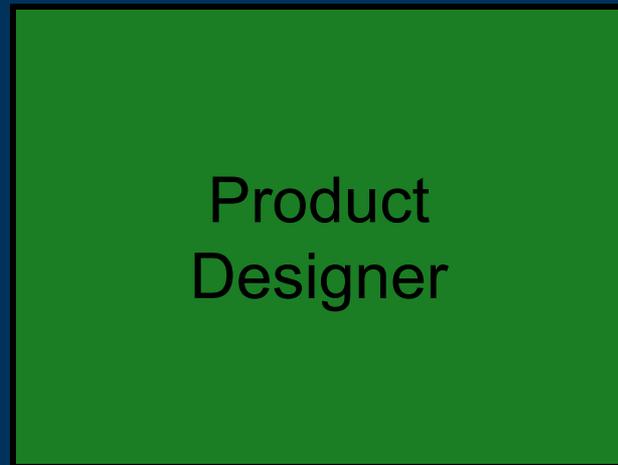




# Product Designer

Product Configurator	Occurrence Manager
Platform Designer	Product Designer

- ▶ Parts and Docs application capabilities allow engineers to model the engineering and design representations of products, including assembly trees with associated geometry
- ▶ Product Designer adds the ability to develop and maintain modularized structures of engineering components that may be parameterized for design re-use purposes
- ▶ Key features
  - ▶ Variant Sensitive BOM Rollup e.g. cost and weight
  - ▶ Model families of design solution. Organize these to facilitate design reuse and libraries of designs
  - ▶ Define technical dependencies and compatibility rules
  - ▶ Ability to instantiate and manage specific variants



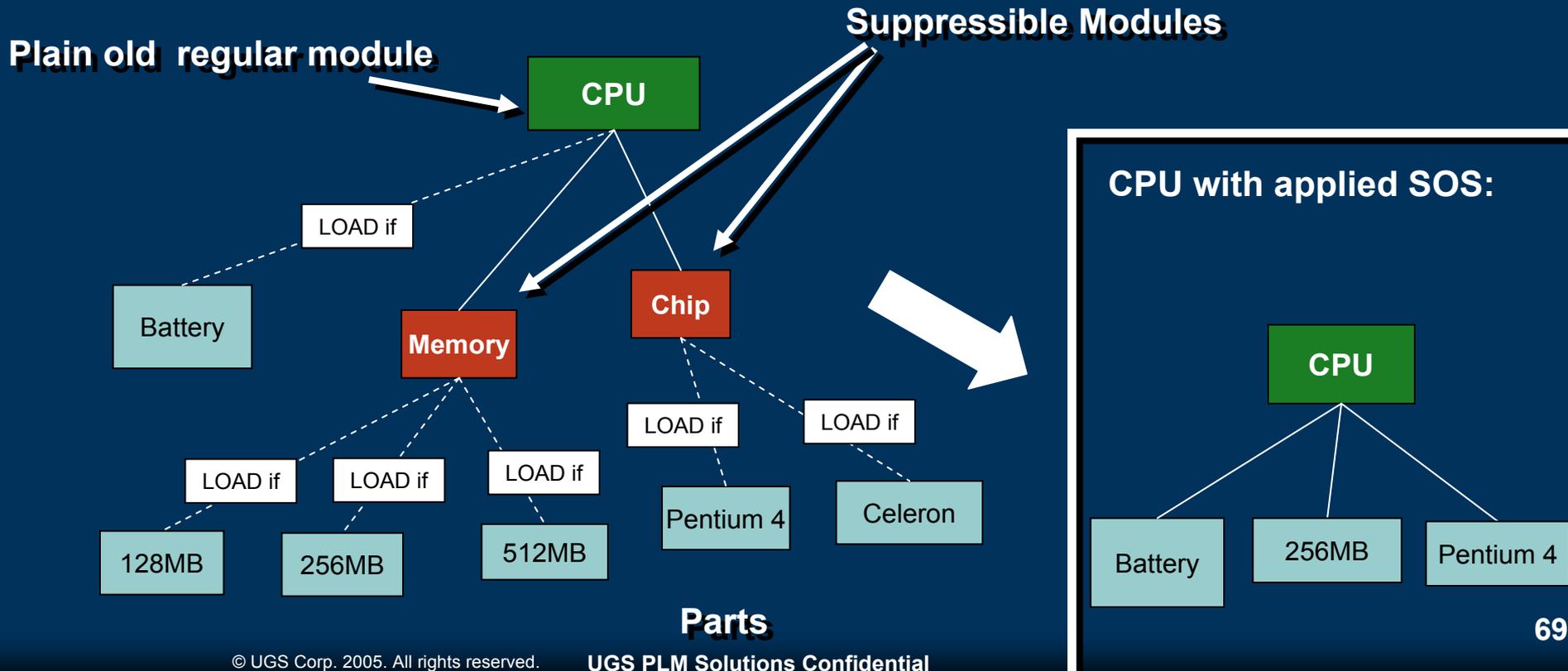


# Filtering Using Suppressible Modules

Product Configurator	Occurrence Manager
Platform Designer	Product Designer

X=1 UG

- ▶ **Suppressible Modules** can be used when the applied SOS will always configure exactly 1 Variant for that Module
- ▶ When configured, the Suppressible Module is replaced with the selected part for viewing / expansion / sending to ERP





# Variant Sensitive Rollup

X=1

Product Configurator	Occurrence Manager
Platform Designer	Product Designer

- ▶ **BOM Rollup** is a generic mechanism to support rollup and visibility of attributes (e.g. cost, weight) at each level of a configured structure
- ▶ Provides the ability to compare totals of different Variants

Results of Cost Rollup for: Computer,A,1:

Product Element	Cost ID	Cost Valid	Description	Total Cost	Material Cost	Material Usage	Weight
Computer.A.1	COST000087	False		97.00	0.00	0.00	
Networking.A.1	COST000085	False		97.00	0.00	0.00	
WirelessNetworking.A.1	COST000093	False		97.00	0.00	0.00	
5000_Tri-band_Mini-PCI_card.A.1.1	COST000072	False		24.00	0.00	0.00	
WirelessRouter.A.1	COST000081	False		56.00	0.00	0.00	
802.11b/g_Wireless_Router.A.1.1	COST000079	False		0.00	0.00	0.00	
3_year_Advance_Exchange.A.1.1	COST000078	False		56.00	0.00	0.00	
1_year_Advanced_Exchange.A.1.1	COST000077	False		0.00	0.00	0.00	
WirelessLANCard.A.1	COST000076	False		17.00	0.00	0.00	
1400_DualBand_Mini-PCI_card.A.1.1	COST000075	False		17.00	0.00	0.00	
1300_WLAN_Mini-PCI_card.A.1.1	COST000074	False		0.00	0.00	0.00	
DialUpAccess.A.1	COST000071	False		0.00	0.00	0.00	
AOL-6.A.1.1	COST000070	False		0.00	0.00	0.00	
EL-6.A.1.1	COST000069	False		0.00	0.00	0.00	
Batteries.A.1	COST000068	False		0.00	0.00	0.00	
OperatingSystem.A.1	COST000067	False		0.00	0.00	0.00	
Processor.A.1	COST000065	False		0.00	0.00	0.00	
2_Button_Scroll_Mouse.A.1.1	COST000065	False		0.00	0.00	0.00	

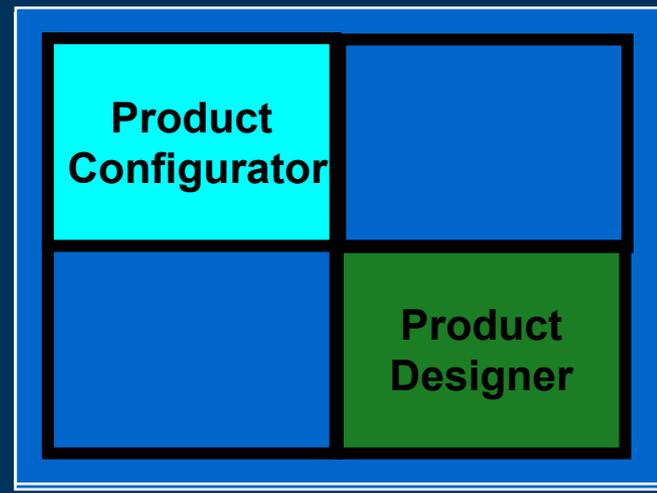
Warning: The option value 2 Button Scroll Mouse for Option Mouse conflicts with existing value 2 Button Scroll Mouse. (35gosses005)  
Selected Option Set applied.  
Query successful. 1 rows returned.

# Teamcenter Enterprise 2005 Applications Packaging and Licensing



## Packaging

- ▶ **Product Configurator** and **Product Designer** are released to market with Teamcenter Enterprise 2005
  - ▶ Product Configurator is renamed from working name, “Model Option Manager (MOM)”
  - ▶ Much functionality from Product Configurator / Product Designer has been available to select customers through Early Adopter Program since June 2004



## Licensing

- ▶ Customer will purchase **Product Configuration** license (Author / Consumer) which will allow access to functionality from any Product Configuration application

