

PTC® Live Global

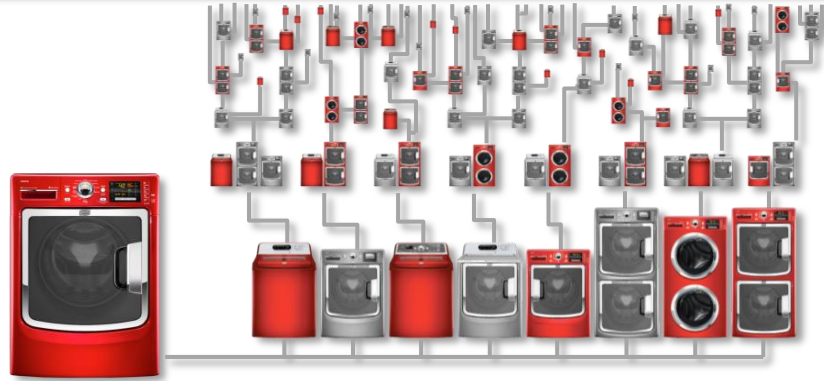
201 - Global Platforms

Managing Configurable Product Platforms

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Vice President , PTC Windchill Solutions
June 2015



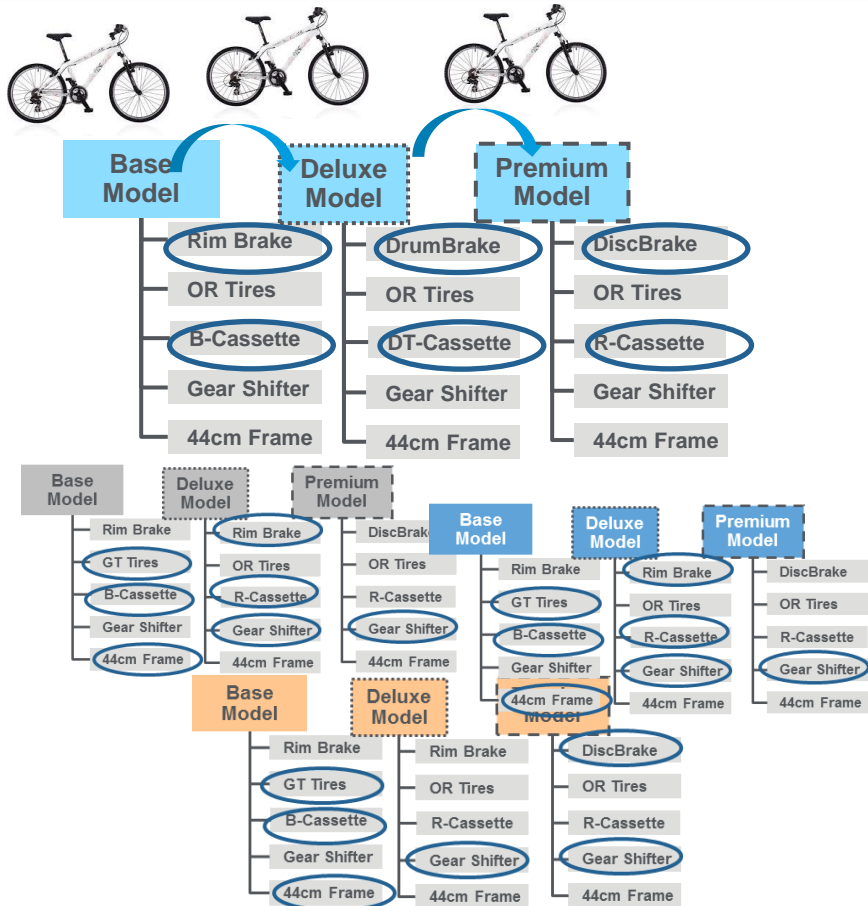
- Platform Strategies
 - Traditional Approaches
 - Platform Approach
 - Demonstration
- Global Platforms Solution
 - Practice groups
 - Key concepts
- Recent Global Platform Solutions Enhancements
- Related Solutions & Roadmap
 - Platform Structures
 - Manufacturing Planning
 - Service Information



STRATEGY: An enterprise strategy to efficiently meet diverse customer needs by focusing on high levels of re-use.

DEFINITION: A platform includes elements and architectural rules that enable a set of broad product offerings

Traditional Configuration Mgt Strategies



• Traditional Development

– Planning

- Market reqts define a set of offerings
- Each configuration represents a set of sales and design reqts
- Goal to re-use as much as possible

– Design

- New Sales and Design reqts are interwoven in the product structure
- Some Parts are unique to some configurations to address incompatibility

– Challenges

- Often many (+100s) configurations to maintain
- Difficult Traceability of Reqts to affected parts
- Upgrading Product next year - Mass change can become difficult!
- As variety gets higher and higher, more complicated for mfg and service plans



Platform Development

– Planning

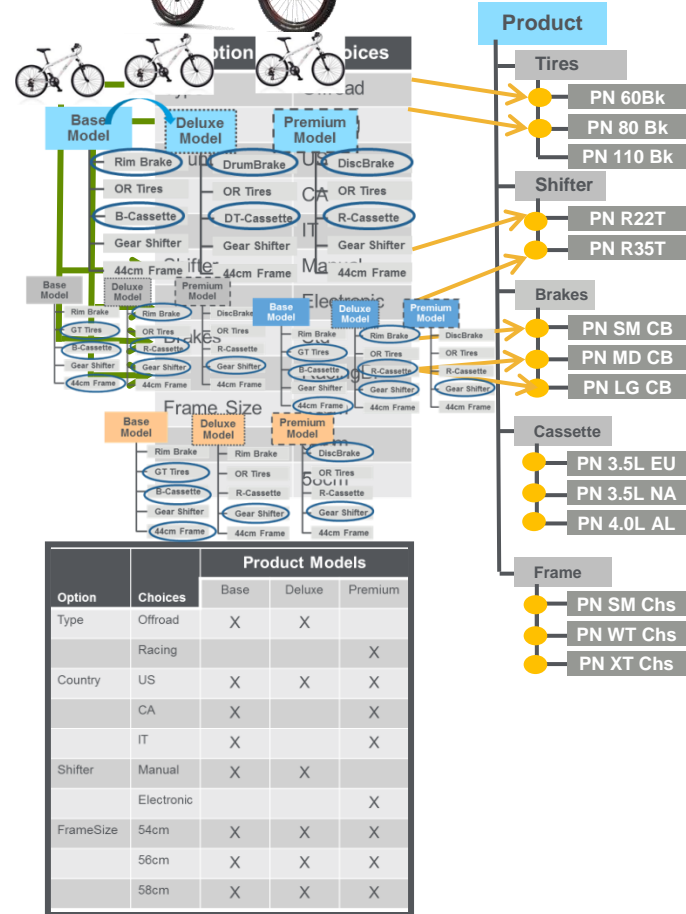
- Options & Choices capture Market & Design reqts that affect product configurations
- Structure is organized into interchangeable functional/physical modules
- Define Models for the Product
- Define constraints between Options to manage dependencies and constraints

– Design

- Design interchangeable modules
- Assign logic to select module variants

– Benefits

- Product Configurations are defined independently of Product structure
 - Easy to change Product configurations
 - Easier to change Parts
- Less Platform Parts are unique to some configurations
- Upgrading Product next year
 - Impacts and assessment can be better partitioned
- Clearer impacts for mfg and service plans



Option Set

Rules

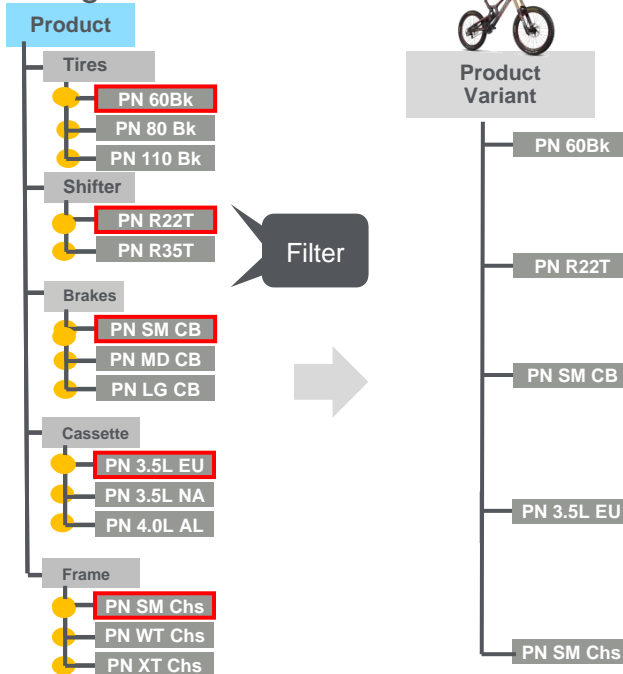
Option	Choices
Type	Offroad
	Racing
Country	US
	CA
	IT
Shifter	Manual
	Electronic
Brakes	Std
	RacingBr
Frame Size	54cm
	56cm
	58cm

Product Models

Option	Choices	Product Models		
		Base	Deluxe	Premium
Type	Offroad	X	X	
	Racing			X
Country	US	X	X	X
	CA	X		X
	IT	X		X
Shifter	Manual	X	X	
	Electronic			X
FrameSize	54cm	X	X	X
	56cm	X	X	X
	58cm	X	X	X

Variant Specifications

Configurable Structure



Demo Steps

- Navigating Product
- Viewing Product Models
- Navigating Option Set & Rules
- Creating a Variant

Part - DT00-001, DT-OffRoad-Bike, A.2 (Design)

In Work

[Details](#) |
 [Structure](#) |
 [Related Objects](#) |
 [Changes](#) |
 [History](#) |
 [Where Used](#) |
 [Traceability](#) |
 [Relationship Explorer](#) |
 [Options](#)

Editing | **Check Out/in** | **Clipboard** | **Viewing** | **New/Add To** | **Filter** | **Tools** | **Reports**

Insert Existing | Remove | Check Out | Revise | Paste | Copy | Show/Hide | Views | Display | New | Add to | Edit Filter | Current Filter | Saved Filters | Compare | Open in | Reports | Export

Find in Structure

- Identity
- DT00-001, DT-OffRoad-Bike, A.2 (Design)
 - 000000021, Derailleurs, A.1 (Design)
 - C3000002, WHEEL_ASSEMBLY, A.1 (Design)
 - C3000006, FRAME, A.1 (Design)
 - C3000009, DRIVE_TRAIN, A.1 (Design)
 - C3000013, FrontBars, A.1 (Design)
 - C3000016, SEATING, A.1 (Design)
 - C3000023, BRAKES, A.5 (Design)
 - C3000029, SUSPENSION, A.1 (Design)

[Attributes](#) |
 [Uses](#) |
 [Occurrences](#) |
 [Supersedes](#)

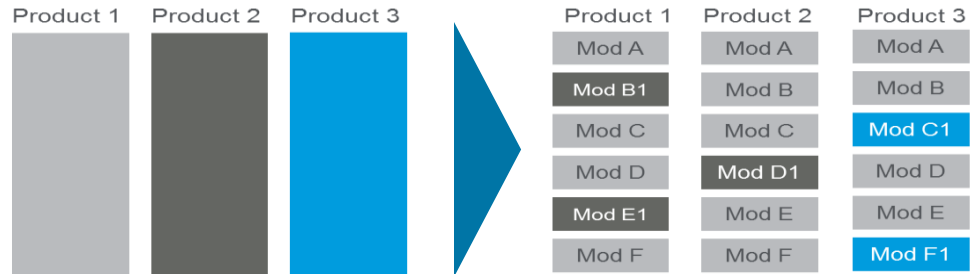
Number	Name	Assigned Usage Expressions
000000021	Derailleurs	
C3000002	WHEEL_ASSEMBLY	
C3000006	FRAME	
C3000009	DRIVE_TRAIN	
C3000013	FrontBars	
C3000016	SEATING	
C3000023	BRAKES	
C3000029	SUSPENSION	
Enter Number	Enter Name	



Enabling companies to streamline
Platform-based Development

Share Platform Definition for:

- Manufacture
- Service
- Sales



Practice Groups

Plan

Product Family Management

- Manage product model definitions
- Manage platform BOM structures

Platform Planning

- Requirements analysis and early BOM planning
- Platform road-mapping & analytics

Develop

Platform Structures

- Modular Architecture Definition
- Platform Change Management
- Interface Definition and Mgt
- Configurable Product Platform Design

Platform Models

- Top Down Design
- Platform CAD Structure Mgt

Platform Validation

- Platform Visualization
- Virtual Platform Analysis

Share

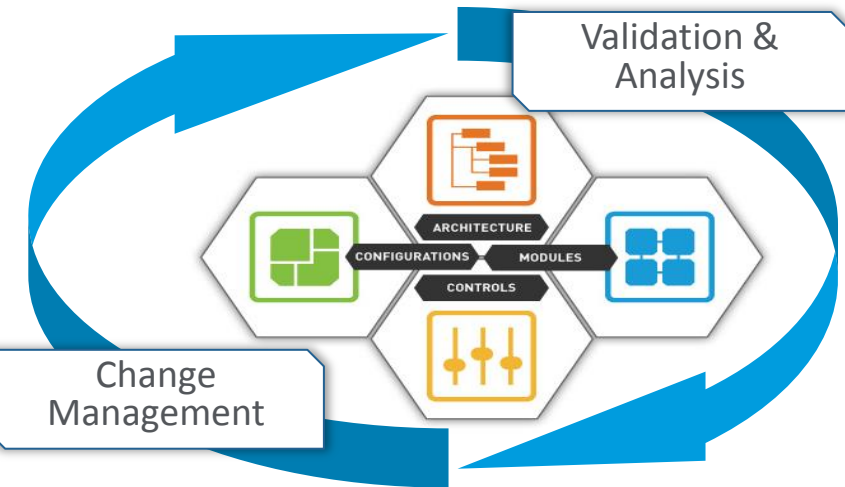
Platform Operations

- Product configuration logic sharing to the enterprise

PTC Products

- PTC Windchill PDMLink with Platform Structures
- Creo Options Modeler
- PTC Windchill Interference Management





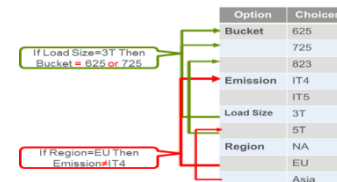
PLATFORM ARCHITECTURE



MODULES



CONTROLS



CONFIGURATIONS

Option	Choices	Product Models		
		Asia Small	EU Medium	NA Large
Bucket	625	X		
	725		X	
	823			X
Emission	IT4	X	X	
	IT5			X
Region	NA			X
	EU		X	
	Asia	X		



PTC's solution manages modular platform "elements"

Platform Structures

- A separately licensed module to help companies support modular and other advanced configuration management capabilities such as:
 - Platform Architecture
 - Platform Logic Management
 - Platform Change Management

- The Platform Structures module enhances capabilities for:
 - PTC Windchill PDMLink
 - PTC Windchill MPMLink
 - Service Information solutions

Available starting with PTC Windchill 10.2 M010



Global Platform Design

Platform Change Management

- Architecture Change Management
- Controls Change Management

Platform Structures

- Modular Architecture Definition
- Interface Definition and Management
- Configurable Product Platform Design

Platform Models

- Top Down Design
- Platform CAD Structure Management

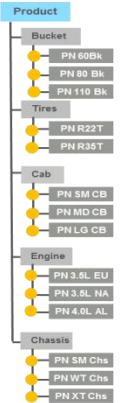
Platform Vis & Analysis

- Platform Visualization
- Platform Analysis and Validation



Option	Choices	Product Models		
		Asia Small	EU Medium	NA Large
Bucket	625	X		
	725		X	
	823			X
Emission	IT4	X	X	
	IT5			X
Region	NA			X
	EU		X	
	Asia	X		

Modular Platform



Topics



Enhanced Platform Rules and Assigned Expressions

- Alias - Streamline rule and assigned expression definition
- Choices with Numeric values – simplify rules and reduce maintenance



Improved Platform Logic Change Management

- Added Local Rule Change Management
- Added Assigned Expressions Change Management



Enhancements for Managing Module Variants

- Support for Assigned Expressions on Part Occurrences
- Create & Edit Module Variants with Spreadsheets



New Administrative Support for Creating Configurations

- Spreadsheet and API support to create & update configurations (variant specifications)
- Programmatically create and update variant product structures



Usability and Filtering Enhancements

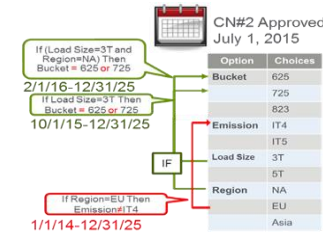
- New filter type – filter out incomplete assigned expressions
- Tailor-able logic expression display (with/without Options)



SmallTires →

Tires=28IN/30IN/32IN/36IN/48IN

IF (Tires>=32IN) THEN HP=45HP/55HP



Create new Module Variants in the Matrix

Line Number	First Number	Unit of Measure	Quantity	Name	Number	Matrix Quantity
1	65	ea	1	CP0001-01	1	1
2	65	ea	1	CP0001-01	1	1
3	70	ea	1	CP0001-02	1	1
4	75	ea	1	CP0001-03	1	1
5	80	ea	1	CP0001-04	1	1
6	85	ea	1	CP0001-05	1	1
7	90	ea	1	CP0001-06	1	1
8	110	ea	1	CP0001-07	1	1
9	120	ea	1	CP0001-08	1	1
10	130	ea	1	CP0001-09	1	1
11	140	ea	1	CP0001-10	1	1
12	150	ea	1	CP0001-11	1	1
13	160	ea	1	CP0001-12	1	1
14	170	ea	1	CP0001-13	1	1
15	180	ea	1	CP0001-14	1	1
16	190	ea	1	CP0001-15	1	1
17	200	ea	1	CP0001-16	1	1
18	210	ea	1	CP0001-17	1	1
19	220	ea	1	CP0001-18	1	1
20	230	ea	1	CP0001-19	1	1
21	240	ea	1	CP0001-20	1	1
22	250	ea	1	CP0001-21	1	1
23	260	ea	1	CP0001-22	1	1
24	270	ea	1	CP0001-23	1	1
25	280	ea	1	CP0001-24	1	1
26	290	ea	1	CP0001-25	1	1
27	300	ea	1	CP0001-26	1	1
28	310	ea	1	CP0001-27	1	1
29	320	ea	1	CP0001-28	1	1
30	330	ea	1	CP0001-29	1	1
31	340	ea	1	CP0001-30	1	1
32	350	ea	1	CP0001-31	1	1
33	360	ea	1	CP0001-32	1	1
34	370	ea	1	CP0001-33	1	1
35	380	ea	1	CP0001-34	1	1
36	390	ea	1	CP0001-35	1	1
37	400	ea	1	CP0001-36	1	1
38	410	ea	1	CP0001-37	1	1
39	420	ea	1	CP0001-38	1	1
40	430	ea	1	CP0001-39	1	1
41	440	ea	1	CP0001-40	1	1
42	450	ea	1	CP0001-41	1	1
43	460	ea	1	CP0001-42	1	1
44	470	ea	1	CP0001-43	1	1
45	480	ea	1	CP0001-44	1	1
46	490	ea	1	CP0001-45	1	1
47	500	ea	1	CP0001-46	1	1
48	510	ea	1	CP0001-47	1	1
49	520	ea	1	CP0001-48	1	1
50	530	ea	1	CP0001-49	1	1
51	540	ea	1	CP0001-50	1	1
52	550	ea	1	CP0001-51	1	1
53	560	ea	1	CP0001-52	1	1
54	570	ea	1	CP0001-53	1	1
55	580	ea	1	CP0001-54	1	1
56	590	ea	1	CP0001-55	1	1
57	600	ea	1	CP0001-56	1	1
58	610	ea	1	CP0001-57	1	1
59	620	ea	1	CP0001-58	1	1
60	630	ea	1	CP0001-59	1	1
61	640	ea	1	CP0001-60	1	1
62	650	ea	1	CP0001-61	1	1
63	660	ea	1	CP0001-62	1	1
64	670	ea	1	CP0001-63	1	1
65	680	ea	1	CP0001-64	1	1
66	690	ea	1	CP0001-65	1	1
67	700	ea	1	CP0001-66	1	1
68	710	ea	1	CP0001-67	1	1
69	720	ea	1	CP0001-68	1	1
70	730	ea	1	CP0001-69	1	1
71	740	ea	1	CP0001-70	1	1
72	750	ea	1	CP0001-71	1	1
73	760	ea	1	CP0001-72	1	1
74	770	ea	1	CP0001-73	1	1
75	780	ea	1	CP0001-74	1	1
76	790	ea	1	CP0001-75	1	1
77	800	ea	1	CP0001-76	1	1
78	810	ea	1	CP0001-77	1	1
79	820	ea	1	CP0001-78	1	1
80	830	ea	1	CP0001-79	1	1
81	840	ea	1	CP0001-80	1	1
82	850	ea	1	CP0001-81	1	1
83	860	ea	1	CP0001-82	1	1
84	870	ea	1	CP0001-83	1	1
85	880	ea	1	CP0001-84	1	1
86	890	ea	1	CP0001-85	1	1
87	900	ea	1	CP0001-86	1	1
88	910	ea	1	CP0001-87	1	1
89	920	ea	1	CP0001-88	1	1
90	930	ea	1	CP0001-89	1	1
91	940	ea	1	CP0001-90	1	1
92	950	ea	1	CP0001-91	1	1
93	960	ea	1	CP0001-92	1	1
94	970	ea	1	CP0001-93	1	1
95	980	ea	1	CP0001-94	1	1
96	990	ea	1	CP0001-95	1	1
97	1000	ea	1	CP0001-96	1	1
98	1010	ea	1	CP0001-97	1	1
99	1020	ea	1	CP0001-98	1	1
100	1030	ea	1	CP0001-99	1	1
101	1040	ea	1	CP0001-100	1	1

Add parts for a set of module variants



CONTROLS

- Options describe Platform variety
 - Includes Sales, Technical, Manufacturing choices
 - Captures required vs. non-required capabilities
 - Define Date Effectivity availability of Choices
- Rules represent technical, manufacturing and business constraints
 - Include
 - Exclude
 - Disable
 - Enable
 - Requires
- Assigned Expressions on Part or Part usage define when a module variant will be available for a specific configuration
- Logic can be shared with other enterprise systems

Option	Choices	Rules
Alternator	100A, 130A	
Axles	CVL Lock-Diff	
Bucket Capacity	625 725 625SN	Include
Counterweight	Yes No	
Exhaust	FIBlk Chrome	Disable
Fenders	Full Front Only	
Hydraulics	2F 3F 3FJ	OR
Language	FTC EN FR RU	Require
Mirrors	Std. Htd.	
Tires	29RFS 875/65R	
TPMS	TPY TPN	IF
Transmission	4SP 5SP	

• Key Challenges

- Distributing assigned expression rule definition to teams can be tricky
- Some logic expressions are repetitive or commonly used and complex to write
 - Tires=28IN/30IN/32IN/36IN/48IN
 - Country=CANADA/BELGIUM/FRANCE/MONACO/CH/LUXENBOURG
 - (HP=45HP/55HP/65HP/85HP and DIFF=IVT/CVT)
- Changing complex expressions is a time consuming task with a lot of check
 - We just added 42IN Tire size – we need to fix a lot of logic – where is it used?



Engineers

WC 10.2
M030

• Logic Alias – a shortcut or summary expression

- Helps to reduce the effort for teams to create repetitive common expressions
 - Tires=28IN/30IN/32IN/36IN/48IN → SmallTires
 - Country=CANADA/BELGIUM/FRANCE/MONACO/CH/LUXENBOURG → FRSpeakCountries
 - (HP=45HP/55HP/65HP/85HP and DIFF=IVT/CVT) → MidPowertrain
- Manage the update of common definitions
 - Update **SmallTires** → **Tires=28IN/30IN/32IN/36IN/42IN/48IN**
 - Process can be controlled by select team members and / or with a Change process
- Can be used with Assigned Expressions and Rules

IF ((HP=45HP/55HP/65HP/85HP and DIFF=IVT/CVT) and
Tires=28IN/30IN/32IN/36IN/48IN) THEN Enable
Country=CANADA/BELGIUM/FRANCE/MONACO/CH/LUXENBOURG →

IF (MidPowerTrain and SmallTires)
Then Enable FRSpeakCountries

BEFORE

With Alias



NEW - Improve Rule and Expression Efficiency

Key Challenges

- Some Product Options have many Choices for each size

- Tires=28IN/30IN/32IN/36IN/48IN
- Floors= 1F/2F/3F/4F/5F/6F/7F/8F/9F/10F/11F/12F/13F/14F/15F/16F/17F/18F/19F/20F



- Therefore, some Rules get very long to consider all Choices

- IF (Tires=32IN/36IN/48IN) THEN HP=45HP/55HP
- IF (Floors= 1F/2F/3F/4F/5F/6F/7F/8F/9F/10F) THEN PANEL=SINGLE
- IF (Floors=11F/12F/13F/14F/15F/16F/17F/18F/19F/20F) THEN PANEL=DOUBLE



- For some Assigned Expressions with many Choices, it is sometimes error prone and more difficult to maintain.

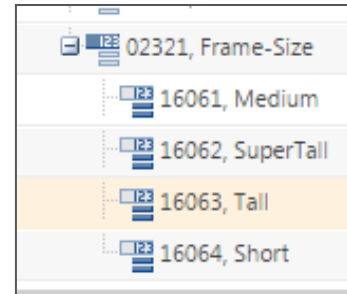
Option Definition Enhancement

- NEW** – optional ability for Choices to hold a numeric value

- Each Choice may have a numeric value and a unit of measure
- Example - Tires = 32IN – could be defined as 32 inch, or 2.66 feet or 0.88 yards

- Enhanced Rule and Expression writing – new support for >, >=, <, <=

- IF (Tires>=32IN) THEN HP=45HP/55HP
- IF (Floors<=10F) THEN PANEL=SINGLE
- IF (Floors<=20F and Floors>10F) THEN PANEL=DOUBLE



Benefits

- Shorten rule writing and reduce maintenance for many complex rule areas
- Easier to read and understand





CONFIGURATIONS

- Manage a family of configurations for Sales, Engineering and Manufacturing
- Generate complete definitions of specific configurations

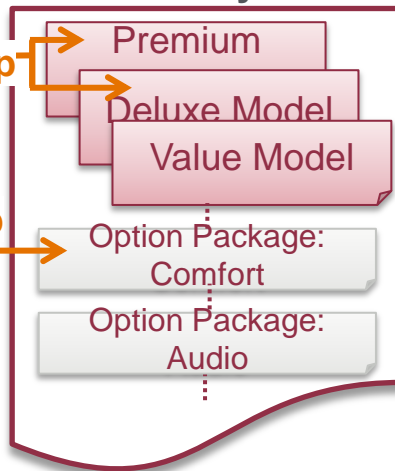
Technical Logic “What the product can do”

Option	Choices	Rules
Alternator	100A, 130A	<p>Mapping</p>
Axles	CVL LockDiff	
Bucket Capacity	625 725	
	625SN	
Counterweight	Yes No	
	FIBIk Chrome	
Exhaust	Full Front Only	
	2F 3F	
Hydraulics	3FJ	

Master Feature List “What can be sold”

OPERATOR'S STATION:
Air Conditioning and Heat
Electronic Throttle Control
with Auto Idle
Efficiency/Productivity Modes
Cloth Suspension Seat with
Fore/Aft Adjustment
2 in. Retractable Seat Belt
Horn
Hour Meter
Instrumentation

Price List “What the customer can buy”



Model EU Medium



Option	Choices	Product Models		
		Asia Small	EU Medium	NA Large
Bucket	625	X		
	725		X	
Emission	823			X
	IT4	X	X	
Region	IT5			X
	NA			X
	EU		X	
	Asia	X		

Model NA Large



• Challenge

- Managing Assigned Expressions under development
 - PTC Windchill will not evaluate Assigned Expressions which are undefined – filter module variant into view
 - SAP evaluates undefined Assigned expressions as False – filter module variant out of view
- Example - Assigned Expression – **Color !=Green**
 - WC - If user has not selected a Color, WC will not evaluate this expression – module variant will stay in view
 - SAP Variant Configurator - SAP will consider the expression False
 - In some cases, this could produce different results

• New Filter Type

- **Alternate** – Filter out Module Variants with incompletely defined Assigned Expressions
 - A module variant is filtered out unless if its Assigned Expression completely evaluates to TRUE
- **Standard** Filter – current PTC Windchill Filter behavior

The screenshot displays the PTC Windchill CONFIGURATIONS interface. On the right, a product tree shows a 'Product' node with sub-nodes: 'Bucket' (containing 'PN 60Bk', 'PN 80 Bk', 'PN 110 Bk'), 'Tires' (containing 'PN R22T', 'PN R35T'), and 'Cab'. A red box labeled 'Filter Type' points to a dropdown menu in the 'dit Filter' window. The dropdown menu is open, showing three options: 'Standard', 'Standard', and 'Alternate'. The 'Alternate' option is highlighted. Below the dropdown, a table lists various options and their groups. The table has columns for 'Name', 'Choices', and 'Group'. The 'Seat Shell Type' row is highlighted in orange.

Name	Choices	Group
Frame Type		Group 1
Has Seat Cover		Group 2
Locale	D30025, (UK)	Group 3
Material		Group 4
Seat Shell Type	D30013, (Hard Shell) D30014, (Soft Shell)	Group 2
Size		Group 4
Steering Type		Group 2

- **Key Challenges**

- Sharing important product configuration definitions across enterprise
- Creating sales order BOMs with Windchill configurable products

- **Share Information**

- Provide an ability to programmatically create and load important configurations (variant specifications) into Windchill from other enterprise systems
- Create Variant Specs associated with Option Sets
 - These variant specs may be applied to multiple configurable structures using the same Option Set
- Sharing Activities
 - Create a new variant specification for a configurable product
 - Update an existing variant specification with new inputs
 - Create a variant part structure from a variant specification

- **Notes**

- Ability to update a variant part structure from a variant spec is in the roadmap – not available today
- ADMIN ONLY FEATURE – spreadsheet may not be loaded by end users

- **Benefits**

- Improved product quality of important configuration definitions
- Streamline variant generation processes

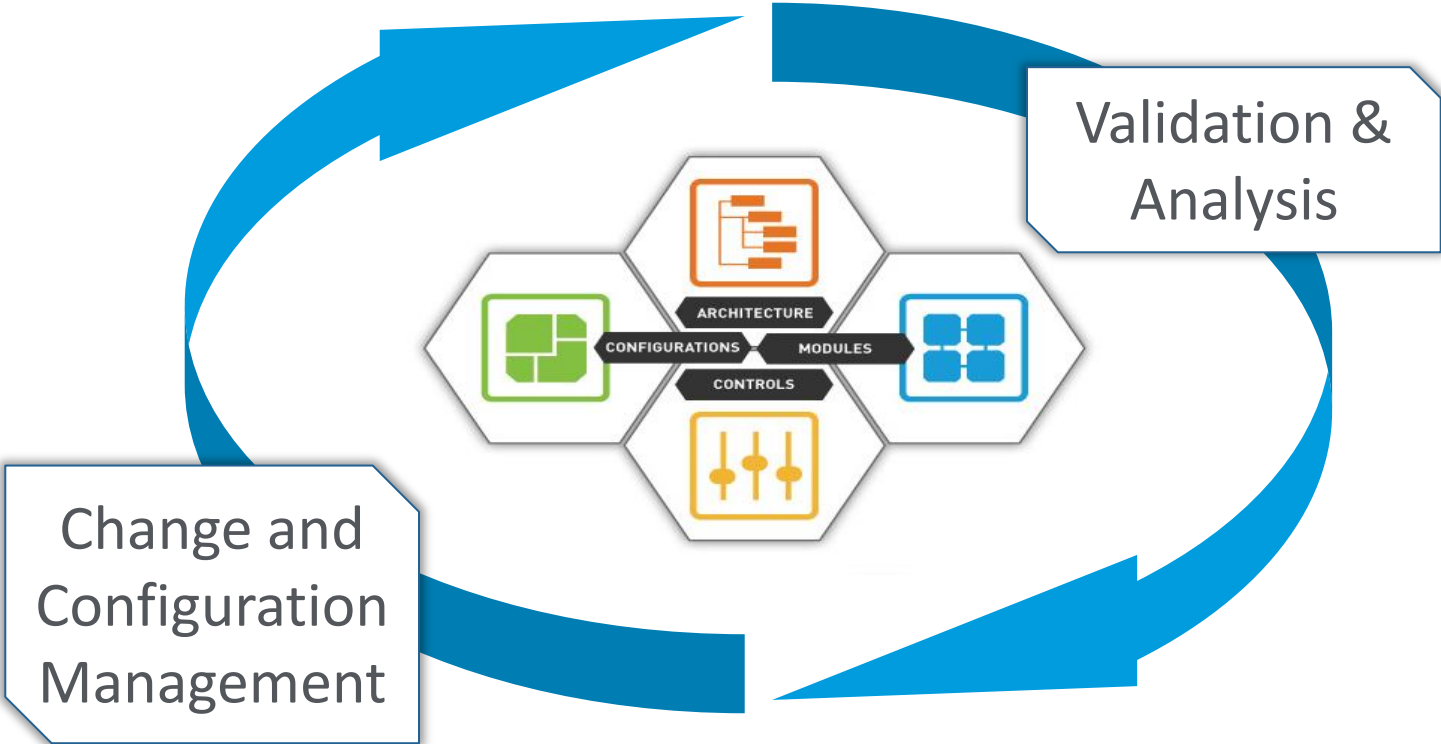


CONFIGURATIONS

Option	Class	Product Models		
		Asia Small	EU Medium	NA Large
Bucket	810	X		
	825		X	
	830			X
Emission	IT4	X	X	
	IT5			X
Region	NA			X
	EU		X	
	Asia	X		



Integral to managing the four, modular 'platform elements' is a foundation of Change and Configuration management with the ability to Validate and Analyze offerings.



NEW – PTC Windchill 10.2 M020 and M030 Managing Platform Evolution – Changing Rules



• Changing Business Requirements

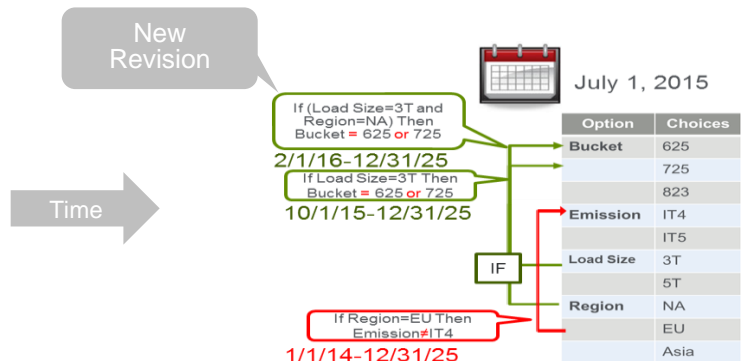
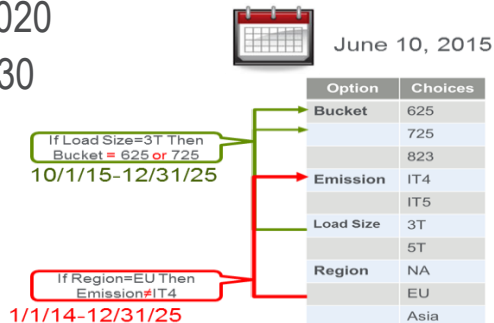
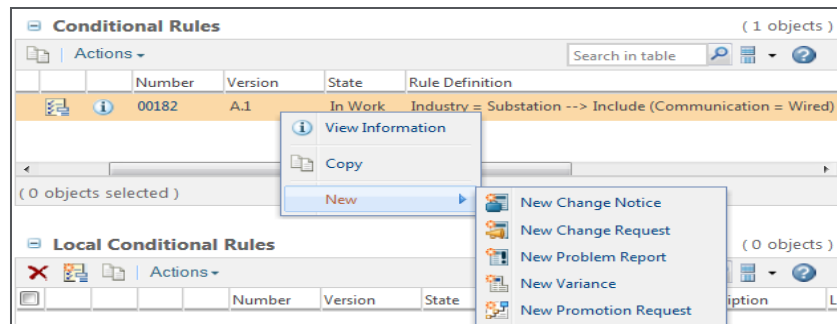
- New marketing restrictions
- Changing government regulations
- Production in new factories

• NEW - Change Manage Rules

- Revise Rules as requirements change
- Lifecycle and Date Effectivity Mgt

• Full Change Mgt Support

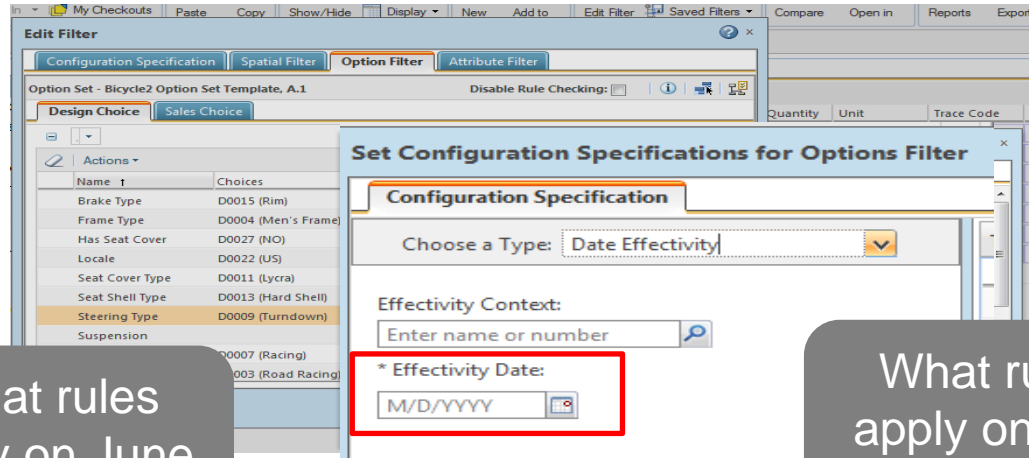
- Global Rules in WC 10.2 M020
- Local Rules in WC 10.2 M030





• Rule Effectivity

- Use rule revisions which are valid for:
 - Lifecycle state
 - and/or Date effectivity
- Behavior for:
 - Filter
 - Configure



What rules apply on June 7, 2015?

What rules apply on Nov 15, 2015?

Calendar icon: CN#1 Approved June 10, 2015

Option	Choices
Bucket	625
	725
	823
Emission	IT4
	IT5
Load Size	3T
	5T
Region	NA
	EU
	Asia

If Load Size=3T Then Bucket = 625 or 725
10/1/15-12/31/25

If Region=EU Then Emission#IT4
1/1/14-12/31/25

Calendar icon: CN#2 Approved July 1, 2015

Option	Choices
Bucket	625
	725
	823
Emission	IT4
	IT5
Load Size	3T
	5T
Region	NA
	EU
	Asia

If (Load Size=3T and Region=NA) Then Bucket = 625 or 725
2/1/16-12/31/25
If Load Size=3T Then Bucket = 625 or 725
10/1/15-12/31/25

If Region=EU Then Emission#IT4
1/1/14-12/31/25

Calendar icon: CN#3 Approved Aug 1, 2015

Option	Choices
Bucket	625
	725
	823
Emission	IT4
	IT5
Load Size	3T
	5T
Region	NA
	EU
	Asia

If (Load Size=3T and Region=NA) Then Bucket = 625 or 725
2/1/16-12/31/25
If Load Size=3T Then Bucket = 625 or 725
10/1/15-12/31/25

If Region=EU Then Emission#IT4
1/1/14-12/31/25

If Region=Asia Then LoadSize # 3T
10/15/15-11/11/20

NEW - Enhanced Management of Assigned Expressions

- Key Challenge

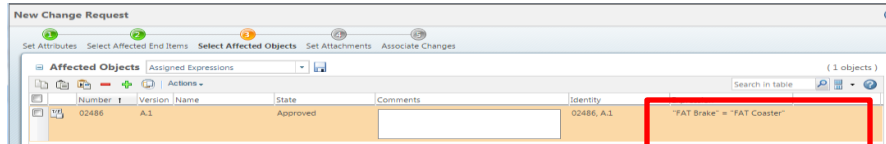
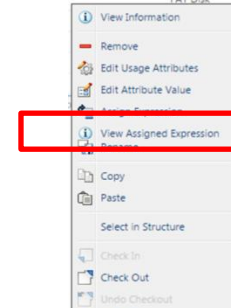
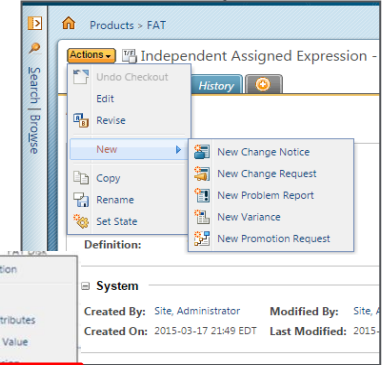
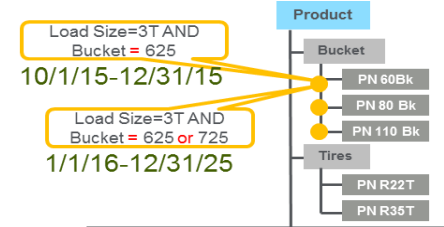
- Properly governing the logic to select module variants
- Reducing un-wanted changes to Configurable Modules and Module Variants

- Enhancement

- **Independent Assigned Expressions** - Teams can independently govern and change manage Assigned Expressions without affecting module variants
 - Support for start/end date effectivity, lifecycle state
- New Assigned Expressions may be Revised and Change Managed
 - Use Table views on Change Forms to display Expression information
- Logic Configuration Specification information is used to evaluate which Assigned Expression revision to evaluate

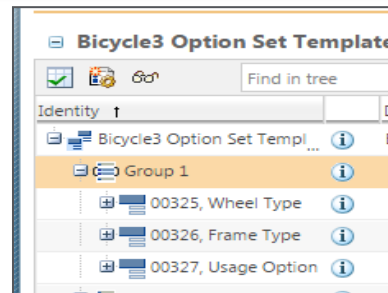
- Important Notes

- Decision to use Independent Assigned Expressions – applies for all Assigned Expressions of a Configurable Product
- Windchill setting for Independent Assigned Expressions must be setup by an administrator **before** starting development of a product
 - Dependent Assigned Expressions on Configurable Products created before WC 10.2 M030 will be ignored during Filter and Configure actions
- Existing customers – Upgrade - For existing customer data a conversion tool is planned for Windchill X-26 release



- Usability Rule Display Enhancements

- Enhanced consistency in the basic and Advanced Expression display
 - Assigned Expressions are displayed in consistent formats
- Improved readability - Tailorable expression format
 - Remove Options in display
 - Display Choices by name or number



The screenshot shows a dialog box titled "Choices" with a table of choice options. The table has columns for checkboxes, "Number", "Name", and "Description". There are four rows of data. Below the table, it says "(0 objects selected)".

<input type="checkbox"/>	Number	Name	Description
<input type="checkbox"/>	01696	D30038	Small
<input type="checkbox"/>	01697	D30039	Medium
<input type="checkbox"/>	01698	D30040	Large
<input type="checkbox"/>	01699	D30041	Extra Large

The screenshot shows a preference configuration dialog. It has a "Context" field set to "Product - Bicycle3" and a "Value" field set to "Non-numeric Choice Format : name, (description)". There are also fields for "Numeric Choice Format" (set to "name, value (description)") and "Rule and Expression Format" (set to "Name"). A "Comments" text area is empty. A "Locked" checkbox is checked. At the bottom right, there are buttons for "Revert to Default", "OK", and "Cancel".

Managing Module Variant BOMs

- **Key Challenges**
 - Effectively manage multiple similar module variant BOMs
- **Managing Module Variants**
 - Easily export set of related module variants to spreadsheet
 - View module variant BOMs together
 - Add, Remove and Edit Parts for these module variants
 - Leverage Excel functions such as copy/paste and drag values
 - Control which Parent Part attributes, and Usage attributes are displayed in the matrix view
 - Edit Usage attributes directly in the matrix view
 - Add additional Parent and Child Parts to the Matrix
 - Use Windchill Excel Import to create and update module variants
 - Import Validation
 - BOM compare preview – old vs. new

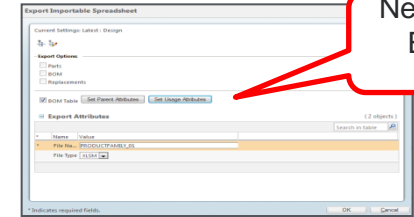


Manage parts for a set of module variants

Line Number	Find Number	Unit of Measure	Quantity	Name	Number	Usage	CP0001	CP0002	CP0003	CP0004	CP0005	CP0006	CP0007	CP0008	CP0009	CP0010
1		ea	-	CP001-01	1	1	1	1	1	1	1	1	1	1	1	1
2	65	ea	-	CP001-02	1	1	1	1	1	1	1	1	1	1	1	1
3	70	ea	-	CP001-03	1	1	1	1	1	1	1	1	1	1	1	1
4	75	ea	-	CP001-04	1	1	1	1	1	1	1	1	1	1	1	1
5	80	ea	-	CP001-05	1	1	1	1	1	1	1	1	1	1	1	1
6	85	ea	-	CP001-06	1	1	1	1	1	1	1	1	1	1	1	1
7	90	ea	-	CP001-07	1	1	1	1	1	1	1	1	1	1	1	1
	110	ea	-	CP001-08	1	1	1	1	1	1	1	1	1	1	1	1
	105	ea	-	CP001-09	1	1	1	1	1	1	1	1	1	1	1	1
	91	ea	-	CP001-10	1	1	1	1	1	1	1	1	1	1	1	1
	92	ea	-	CP001-11	1	1	1	1	1	1	1	1	1	1	1	1
	93	ea	-	CP001-12	1	1	1	1	1	1	1	1	1	1	1	1
	94	ea	-	CP001-13	1	1	1	1	1	1	1	1	1	1	1	1
10	101	ea	-	CP001-14	1	1	1	1	1	1	1	1	1	1	1	1
20		ea	-	CP001-15	1	1	1	1	1	1	1	1	1	1	1	1

Quickly add additional Module Variants to the Matrix

New selection to Export BOM Table.



- **Benefits**
 - Improved designer productivity
 - Enhanced quality and module variant planning



Topics



Enhanced Platform Rules and Assigned Expressions

- Alias - Streamline rule and assigned expression definition
- Choices with Numeric values – simplify rules and reduce maintenance



Improved Platform Logic Change Management

- Added Local Rule Change Management
- Added Assigned Expressions Change Management



Enhancements for Managing Module Variants

- Support for Assigned Expressions on Part Occurrences
- Create & Edit Module Variants with Spreadsheets



New Administrative Support for Creating Configurations

- Spreadsheet and API support to create & update configurations (variant specifications)
- Programmatically create and update variant product structures



Usability and Filtering Enhancements

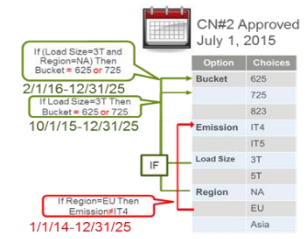
- New filter type – filter out incomplete assigned expressions
- Tailor-able logic expression display (with/without Options)



SmallTires →

Tires=28IN/30IN/32IN/36IN/48IN

IF (Tires>=32IN) THEN HP=45HP/55HP



Create new Module Variants in the Matrix

Metric Quantity		Sorting Number		Name	Value
1	12	12	12		
2	65	ea		CP001-01	1 1 1 1 1 1 1 1
3	70	ea		CP001-02	1 1 1 1 1 1 1 1
4	75	ea		CP001-03	1 1 1 1 1 1 1 1
5	80	ea		CP001-04	1 1 1 1 1 1 1 1
6	85	ea		CP001-05	1 1 1 1 1 1 1 1
7	90	ea		CP001-06	1 1 1 1 1 1 1 1
8	100	ea		CP002-01	1 1 1 1 1 1 1 1
9	105	ea		CP002-02	1 1 1 1 1 1 1 1
10	110	ea		CP002-03	1 1 1 1 1 1 1 1
11	115	ea		CP002-04	1 1 1 1 1 1 1 1
12	120	ea		CP002-05	1 1 1 1 1 1 1 1
13	125	ea		CP002-06	1 1 1 1 1 1 1 1
14	130	ea		CP002-07	1 1 1 1 1 1 1 1
15	135	ea		CP002-08	1 1 1 1 1 1 1 1
16	140	ea		CP002-09	1 1 1 1 1 1 1 1
17	145	ea		CP002-10	1 1 1 1 1 1 1 1
18	150	ea		CP002-11	1 1 1 1 1 1 1 1
19	155	ea		CP002-12	1 1 1 1 1 1 1 1
20	160	ea		CP002-13	1 1 1 1 1 1 1 1
21	165	ea		CP002-14	1 1 1 1 1 1 1 1
22	170	ea		CP002-15	1 1 1 1 1 1 1 1

Add parts for a set of module variants

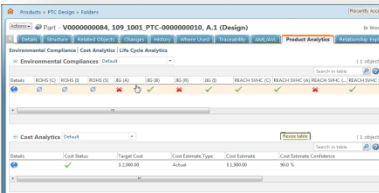
- **Solution**
 - Automate interference analysis for Platform Configurations
- **Capabilities**
 - Identify configurations for analysis
 - Schedule interference analysis
 - Virtually Identify component interferences
 - Assign and email clash detection issues to team members
 - Status and resolve issues
 - Loop → Repeat analysis
- **Value**
 - Reduce cost and time with prototypes
 - Enhance product quality
 - Reduce manufacturing re-work costs
- **Roadmap Candidates for PTC Windchill X-26**
 - Support for Interference Definition by Variant Specification
 - Grouping Interference Definitions



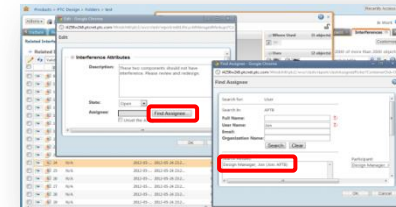
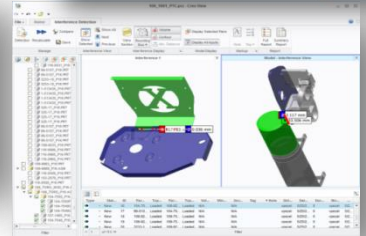
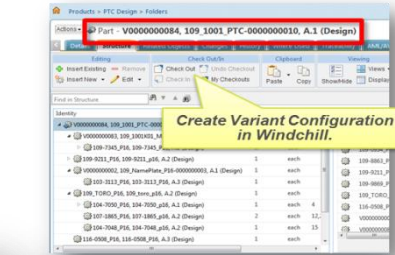
CONFIGURATIONS

Select Configurations to Analyze/Validate

Perform Analysis



Communicate & resolve

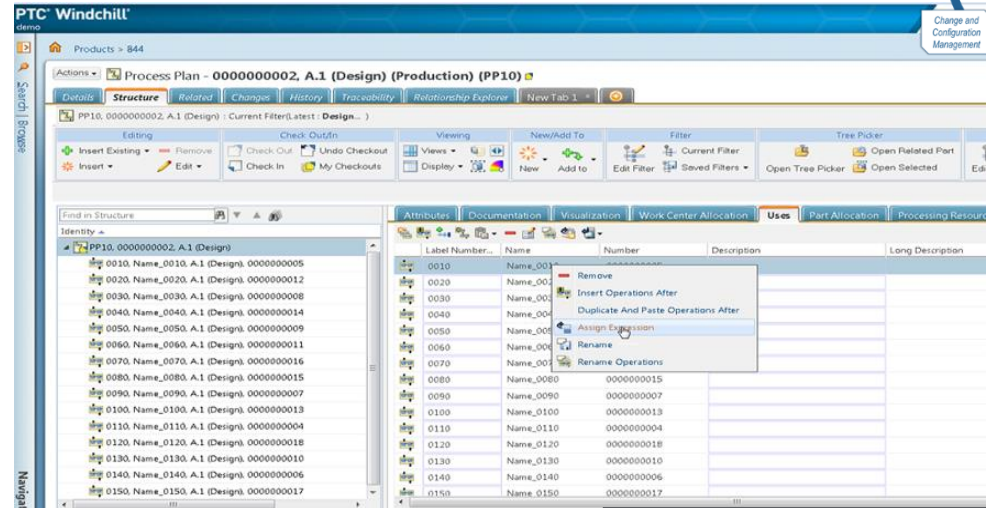


- Available Today



- Support for controlling mBOM and Process Plans

- Assigning Controls
- Viewing configurations with Saved Filters



Manufacturing Process Management PTC



BEFORE
Struggling to reduce rework and scrap due to disconnected design and production teams

AFTER
Reduce time to production with design and manufacturing planning working in parallel

An enterprise solution to...

- Unify design, manufacturing planning and resources together on a single system
- Streamline process planning development leveraging virtual product representations
- Optimize manufacturing planning across products and sites

...achieve concurrent, MFG process planning

- Reduce Time-to-Manufacturing 10-50%
- Productivity 10% increase
- Reduced production cost via configuration-specific plans



• Features for Platforms

- Ability to define Options & Choices or re-use from E-BOM
- Ability to Assign Expressions (Applicability) for Information Elements
- Ability to filter and navigate information structures based upon Options & Choices
- Create service content based upon Platform logic and additional criteria

The screenshot displays the PTC Service Information Manager interface. On the left, a 3D model of an aircraft is shown with numbered callouts (1-10). In the center, a table lists parts with columns for 'Part No.', 'MFG Stock No.', 'Name', and 'Description'. On the right, a detailed view of a landing gear assembly is shown with numbered callouts (1-6).

Part No.	MFG Stock No.	Name	Description
Part No. UM11.000	001	Unpowered Aerial Vehicle	POWERS
Part No. UM11.000	002	WING ASSEMBLY	WING ASSEMBLY
Part No. UM11.000	003	DIFFUSER	DIFFUSER
Part No. UM11.000	004	FOOTPAD LANDING	FOOTPAD LANDING

• PTC Products

- Service Information Manager
- S1000D

The screenshot shows the PTC Service Information Manager interface with a hierarchical structure of information elements. A red box highlights a specific element, and a red arrow points to it with the text "Hellfire DM is removed". A configuration specification dialog is also visible on the right side of the screen.

Hellfire DM is removed

Configuration Specification

- Type: Details
- Issue Number: 000
- Issue: 01
- Apply to top level objects:
- Apply latest for unresolved dependents:
- Spatial Filter: Not applied.
- Option Filter: Armament = Armaments=Stinger
- Workshop Filter: Not applied.
- Service Effectivity: Not applied.



PRODUCT DIVERSITY
WITH SCALE

BEFORE

Struggling to manage product complexity due to greater demand for tailored products

AFTER

Meet diverse market needs through effective use of product platforms

An enterprise solution to...

- **Architect** modular product families for increasing complexity
- **Develop** platform-based offerings with the rules that drive them
- **Validate** product platforms to meet your business objectives
- Increase **efficiency** of design teams

...achieve product diversity with scale

- **Faster NPI** through greater product reuse
- **25% decrease** in product development time¹
- **30%-40% cost savings** through higher product commonalities¹

¹ Schuh & Co, others from PTC customer experience

PTC[®] **PRODUCT & SERVICE
ADVANTAGE**



- **Loading Variant Specifications from Spreadsheet**
 - Setup spreadsheet : existing part / option set / variant specification, choices, configurations
 - Invoke loading utility from the PTC Windchill command line
 - PTC Windchill `com.ptc.windchill.option.variantspec.loader.VariantSpecLoader -d <My_Spreadsheet_Path>\<My_Spreadsheet>.xlsx -u <my_user> -p <my_password>`
 - Utility provides validations for spreadsheet formatting, data setup issues
 - Processes as many configurations as possible
 - Logs status, warnings and errors
- **Loading Variant Specs Programmatically**
 - Enterprise systems can call APIs to load configurations : [Java Doc](#)
 - [loadVariantSpecs](#) (List<VariantSpecLoadOutoutBean> variantSpecBeans, List<VariantLoadNavCriteriaBean> navCriteriaBeans, List<VariantLoadPartConfigSpecBean> partconfigSpecBeans, List<VariantLoadATORuleConfigSpecBean> atoConfigSpecBeans)
 - [loadVariantSpecs](#) (List<VariantSpecLoadOutoutBean> variantSpecBeans)
 - PTC Windchill Help Center : [Sample1](#), [Sample2](#)
- **Where to Learn more - Documentation**
 - Windchill Help Center : [Loading Variant Specifications](#)
 - Spreadsheet template available in codebase :
WT_HOME\loadFiles\ato\testdata\variantSpecLoader\VariantSpecLoader1.xlsx



Loading Variant Specifications - Spreadsheet



VariantSpecLoader1-Demo - Microsoft Excel

Variant Specification Definition

Top Level Configurable Product

Config Specs – Part & Rule Config Spec

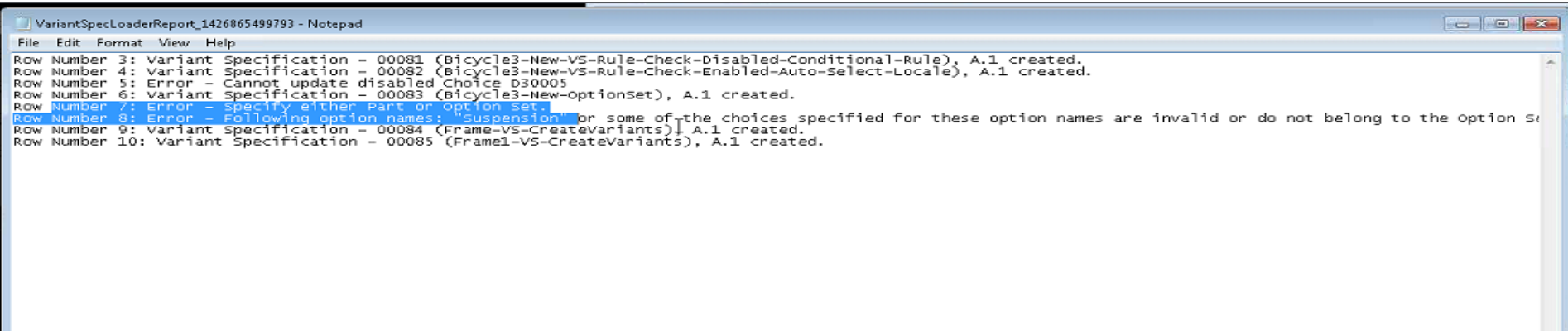
Options & Choices for each variant spec

Variant Specification					Part		Option Set		Navigation Criteria											
Name	Number	Description	Location	Create Variants	Number	Revision	Iteration	Name	Revision	Iteration	Apply to Top Specification	Part Configuration	Option Filter Configuration	Disable Rule Checking	Filter Mode	Start Options	Suspension	Wheel Type	Frame Type	Usage Option
Bicycle3-New-VS-Rule-Check-Disabled-Conditional-Rule			/Default		Bicycle3	A	2								TRUE		D30021	D30001	D30005	D30006
Bicycle3-New-VS-Rule-Check			/Default		Bicycle3	A	2								FALSE		D30021	D30001	D30005	D30006
Bicycle3-New-OptionSet			/Default					Bicycle3 Option Set Template	A	7			LatestOptionFilter ConfigurationSpecification		FALSE		D30021	D30001	D30005	D30006
Bicycle3-VS-Invalid-Spreadsheet-Entries			/Default		SomeBicycle3	A	2	Bicycle3 Option Set Template				LatestPartConfiguration		FALSE						
Bicycle3-VS-Invalid-ChoiceNames-Spreadsheet-Entries			/Default		Bicycle3	A	2					LatestPartConfiguration		FALSE			300021	D30001	D30004	D30006
Frame-VS-CreateVariants			/Default	TRUE	C3000006														D30004_D30005	

Variant Specifications

Define Part & Rule Config Spec details in these tabs

- After loading a set of variant specifications examples, you can see examples of successful loads or errors when there is inconsistent inputs.



```
VariantSpecLoaderReport_1426865499793 - Notepad
File Edit Format View Help
Row Number 3: Variant Specification - 00081 (Bicycle3-New-VS-Rule-Check-Disabled-Conditional-Rule), A.1 created.
Row Number 4: Variant Specification - 00082 (Bicycle3-New-VS-Rule-Check-Enabled-Auto-Select-Locale), A.1 created.
Row Number 5: Error - Cannot update disabled Choice D30005
Row Number 6: Variant Specification - 00083 (Bicycle3-New-optionset), A.1 created.
Row Number 7: Error - Specify either Part or Option Set.
Row Number 8: Error - Following option names: "Suspension" or some of the choices specified for these option names are invalid or do not belong to the option set.
Row Number 9: Variant Specification - 00084 (Frame-VS-Createvariants), A.1 created.
Row Number 10: Variant Specification - 00085 (Frame1-VS-Createvariants), A.1 created.
```



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 - Part Structure Information
 - Part Structure Actions
 - Product Structure Explorer
 - Advanced Assembly Editor Overview
 - Windchill Options and Variants Capabilities
 - Examples and Best Practices for Advanced Configuration
 - Configurations and Instances Overview
 - Managing Change
 - Managing Projects
 - Exchanging Data Between Contexts
 - Using Excel to Export and Import Data
 - Using Packages to Import and Export Data
- Additional PTC Windchill Capabilities
 - Basic Administration
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Sample Code for API #1

Below is a sample code for using API #1 for loading variant specifications.

```
public static void main(String[] args) throws Exception {  
    // Create part config specs  
    List<VariantLoadPartConfigSpecBean> partConfigSpecBeans = new  
        ArrayList<VariantLoadPartConfigSpecBean> (1);  
    VariantLoadPartConfigSpecBean partConfigSpecBean1 = new  
        VariantLoadPartConfigSpecBean("MyPartConfigSpec1", null, null, null);  
    partConfigSpecBeans.add(partConfigSpecBean1);  
  
    // Create a Latest ATO rule Config spec  
    List<VariantLoadATORuleConfigSpecBean> atoConfigSpecBeans = new  
        ArrayList<VariantLoadATORuleConfigSpecBean> (1);  
    VariantLoadATORuleConfigSpecBean atoConfigSpecBean1 = new  
        VariantLoadATORuleConfigSpecBean("MyATOCConfigSpec1", null, null);  
    atoConfigSpecBeans.add(atoConfigSpecBean1);  
  
    VariantLoadNavCriteriaBean bean1 = new VariantLoadNavCriteriaBean();  
  
    bean1.setVariantSpecName("TestThruApi3");  
    bean1.setVariantSpecDescription("Test thru API 1");  
    bean1.setVariantSpecFolder("/Default");  
    bean1.setVariantSpecCreateVariants(false);  
    bean1.setPartNumber("BICYCLE1");  
    bean1.setRuleCheckingDisabled(true);  
  
    List<String> choices = new ArrayList<String>();  
    choices.add("D0022");
```

