A Deep Dive Into the Advanced Variant Configuration Data Model for SAP S/4HANA
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Session ID 82492
About the Speaker

Steve Schneider

• Sr. Consulting Product Data Analyst, Steelcase Inc.
• 41 years employment at Steelcase, 26 years in Product Configuration
• Avid motorcyclist since 1970
• Craft Beer Nerd (not while riding!)
About Steelcase
For more than 106 years, Steelcase Inc. has helped create great work, education and healthcare experiences for the world's leading organizations. Our family of brands, including Steelcase®, Coalesse®, Designtex®, PolyVision®, Turnstone® and AMQ™, offer a comprehensive portfolio of furniture and technology products and services. Steelcase is globally accessible through a network of dealers, including over 800 Steelcase dealer locations, and is a publicly traded company with fiscal 2019 revenue of $3.4 billion.
Key Outcomes/Objectives

1. Understand some of the primary differences between the LO-VC and AVC data models as of release 1809 (on Premise)

2. Understand some of the ways your LO-VC data model may need to change to leverage new capabilities
Agenda

• Generic Product Configuration Related changes with S/4 HANA
• Specific LO-VC AVC differences
Disclaimer

This presentation is to be used as demonstration only. Do not make purchase decisions based on what you see in this presentation! All statements are the authors personal opinion and do not necessarily reflect the opinion of his employer or any other person or company.

Note that this presentation is intended to be downloaded and studied with the presenter notes as they contain important additional information. Make sure you have the presenter layer turned on in the PDF!
What You Will See

• This presentation will compare 2 similar Product models. One built using the traditional LO-VC and the other using the new AVC (Advanced Variant Configuration). An overview of the master data differences between both models will be shown along with some important differences that are not master data related.

• Please note that we will probably NOT get through all the slides. We will stop right at 30 minutes of content to allow time for Questions and Answers.

• Please remember to download the deck after you get back to your office.

• All Data Models are built in a S/4HANA 1809 release On Premise system!
What Is The CWG?

• The **ONLY** international user group for SAP Configuration technology
• **THE** best place to influence SAP on the direction of their Configuration technology
• Multiple forums, technical articles, and blogs to get answers to your pressing business questions about utilizing SAP Configuration technology
• **Two** annual conferences, a spring conference in Europe and a fall conference in the Americas
• Membership is **FREE**, but restricted to SAP employees, customers, and partners which accept, respect and follow our bylaws.
  • [http://www.configuration-workgroup.com/node/1850](http://www.configuration-workgroup.com/node/1850)
LOVC to AVC Improvement List and Comparison (in PDF Format!)

Hello everyone,

Attached to this forum post, please find the newly released "AVC Improvement List 1.0".

This comes directly from the Development team in Walldorf and I am posting it here with their permission.

I'm told there are no plans to release this as a support note, so come back often!

Happy reading!

Cheers!

Steve

attachment:
AVC Improvement list 1.0.pdf

Edited by: Steve Schneider on 10/08/2018 - 16:02
In This Presentation

• Change of Material Length from 18 to 40
• Change of Characteristic Length from 30 to 70
• Actions going away (replaced with procedures but still working in the AVC model)
• Classification as a selection condition going away
• Overview page for VC Modeler
• Processing Modes
• Negative Domain Restriction syntax (including Variant Tables)
• All characteristics (Including Multi Value) being restrictable
• Pre-Conditions acting like constraints
• Characteristic groupings
• New AVC Syntax checks
• Alternative values
• More Precise rounding
• BOM Explosion
• Intermediate variable values
### LO-VC Model

**Configuration for BICYCLE_MIXED_LOVC 21.08.2018**

<table>
<thead>
<tr>
<th>Object</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>BICYCLE_MIXED_LOVC</td>
<td>LO-VC Model for CWG Demonstration</td>
<td></td>
</tr>
<tr>
<td>300 BICYCLE</td>
<td>Bicycle Class</td>
<td></td>
</tr>
<tr>
<td>300 BICYCLEMIXOPTLOVC</td>
<td>Options for Bicycle LOVC</td>
<td></td>
</tr>
<tr>
<td>300 FRAME_SIZE_LOVC</td>
<td>Frame Size LOVC</td>
<td></td>
</tr>
<tr>
<td>1 01</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### AVC Model

**Configuration for BICYCLE_MIXEDADVANCEDVARIANTCONFIG 21.08.2018**

<table>
<thead>
<tr>
<th>Object</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>BICYCLE_MIXEDADVANCEDVARIANTCONFIG</td>
<td>AVC Model for CWG Demonstration</td>
<td></td>
</tr>
<tr>
<td>300 BICYCLE</td>
<td>Bicycle Class</td>
<td></td>
</tr>
<tr>
<td>300 BICYCLEMIXOPTAVC</td>
<td>Options for Bicycle AVC</td>
<td></td>
</tr>
<tr>
<td>1 01</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Generic Changes With S/4 HANA

The information contained in the next few slides are things that are not specific to the AVC. They are part of the general S/4HANA release but are relevant to understand when moving your VC model into S/4HANA.
The Material Master

18 Characters

35 Characters
Characteristics

30 Characters

70 Characters
Actions Removed

LOVC (ECC 6.0)

LOVC & AVC (S/4HANA)
Classification As A Selection Condition

LOVC (ECC 6.0)

LOVC & AVC (S/4HANA)
Specific LO-VC ↔ AVC differences

The information contained in the next slides are specific differences between the LO-VC and AVC data Models. Note that in some cases, the exact methods used in LO-VC will provide different results in the AVC!
Variant Configuration Overview Page

**Primarily AVC Models**

- Locked Sales Order Items
  - Sales Order Items With Locked Configuration

- Locked VC Objects
  - Current Status
  - Constraints: 6
  - Dependencies: 163

- Changed VC Objects
  - Last 7 days
  - Characteristics: 20
  - Classes: 2
  - Constraints: 12
  - Dependencies: 14
  - Profiles: 5

- My Recently Changed Dependencies
  - C_AVC_BICYCLE_MV_OPT
  - C_AVC_BICYCLE_MV_OPT_EQ
  - MULTI_VALUE_IN_TABLE
  - C_AVC_MV_OPT_TABLE
  - AVC_BICYCLE_COLOR_NEG_TABLE
  - AVC_BICYCLE_COLOR_NEGATIVE

- Quick Links
  - Simulate Configuration Models
  - Variant Configuration Modeling
  - Manage Classes
  - Manage Characteristics
  - My Favorite Configurations

- My Recent Simulations
  - IMC02_70000_C525222_20180631170042
    - Incomplete
  - AVC_SPECIAL_RESTRICTING_CASES_C525222...
Processing Mode - Configuration Profile

LOVC

AVC
Processing Mode - Constraints

LOVC

AVC
Processing Mode – Non Constraint

**LOVC**

**AVC**

### Maintain Dependency: Basic Data

**Dependency**
- **TEST_DATA**
- **SCE Format**

**General Data**
- **Description**
- **In Preparation**
- **Status**
- **Dependency Group**
- **Maintenance Auth.**

**Dependency Type**
- **Processing Mode**
  - **Classic**
- **Precondition**
- **Selection condition**
- **Procedure**

**Administrative Data**
- **Created By**
- **Created On**
  - 07.09.2018

### Maintain Dependency: Basic Data

**Dependency**
- **TEST_DATA**
- **SCE Format**

**General Data**
- **Description**
- **In Preparation**
- **Status**
- **Dependency Group**
- **Maintenance Auth.**

**Dependency Type**
- **Processing Mode**
  - **A Advanced Variant Configuration**
- **Precondition**
- **Selection condition**
- **Procedure**

**Administrative Data**
- **Created By**
- **Created On**
  - 07.09.2018
Domain Restrictions Using Constraints (IN)

LO-VC – Can Be Done Exactly the Same Way in AVC
Domain Restrictions using NE Statement

AVC Only – Not Possible in LO-VC

No Inferences Section Necessary!

Easier Domain Restrictions!

LO-VC

ctl

AVC

ctl

OBJECTS:

?A is_a (300) Bicycle where
?FC = Frame_color;
?FW = Front_Wheel_color;
?RW = Rear_Wheel_Color.

Restrictions:
?FC IN ('Green', 'Blue', 'Black'),
?FW IN ('Green', 'Blue', 'Black'),
?RW IN ('Green', 'Blue', 'Black').

Inferences:
?FC, ?FW, ?RW.

?A IS_A (300) BICYCLE WHERE
?FC = FRAME_COLOR;
?FW = FRONT_WHEEL_COLOR;
?RW = REAR_WHEEL_COLOR.

RESTRICTIONS:
?FC NE 'RED',
?FW NE 'RED',
?RW NE 'RED'.

asug
Domain Restrictions Using Negative Tables

**LO-VC**

Constraint Net: BICYCLE_MIXED_LOVC_RESTRICTION

Constraint: BICYCLE_MIXED_LOVC_COLORS

**AVC**

Constraint Net: AVC_BICYCLE_COLORS

Constraint: AVC_BICYCLE_COLOR_NEG_TABLE

**OBJECTS:**

- ?A is_a (300) BICYCLE where
- ?FC = Frame_Color;
- ?FW = Front_Wheel_Color;
- ?RW = Rear_Wheel_Color.

**Restrictions:**

Table BICYCLE_MIXED_LOVC (table1_LOVC = ?FC),

Table BICYCLE_MIXED_LOVC (table1_LOVC = ?FW),

Table BICYCLE_MIXED_LOVC (table1_LOVC = ?RW).

**Inferences:**

?FC, ?FW, ?RW.

**Restrictions:**

FALSE IF TABLE AVC_BICYCLE_COLOR (TABLE1_AVC = ?FC),

FALSE IF TABLE AVC_BICYCLE_COLOR (TABLE1_AVC = ?FW),

FALSE IF TABLE AVC_BICYCLE_COLOR (TABLE1_AVC = ?RW).
Table Content Comparison

<table>
<thead>
<tr>
<th>LO-VC</th>
<th>AVC</th>
</tr>
</thead>
<tbody>
<tr>
<td>TABLE1_LOVC</td>
<td>TABLE1_AVC</td>
</tr>
<tr>
<td>BLACK</td>
<td>RED</td>
</tr>
<tr>
<td>BLUE</td>
<td></td>
</tr>
<tr>
<td>GREEN</td>
<td></td>
</tr>
</tbody>
</table>
# Multi Value Domain Restrictions

## Pre-Conditions

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BICYCLE_MIXED_OPTIONS_LOVC</td>
<td>LOUDRINGINGBELLFORCHILDREN</td>
</tr>
<tr>
<td></td>
<td>REALSMALLCARRYBAGFORHANDLEBARS</td>
</tr>
<tr>
<td></td>
<td>HARDRACINGSEAT</td>
</tr>
<tr>
<td></td>
<td>SOFTPAUDEDRACINGSEAT</td>
</tr>
<tr>
<td></td>
<td>LONGSTRINGYTHINGSFORHANDLEBARS</td>
</tr>
<tr>
<td></td>
<td>NEATBASEBALLCARDSFORSPOKESOUND</td>
</tr>
</tbody>
</table>

- **Allowed Values**: LOUDRINGINGBELLFORCHILDREN, REALSMALLCARRYBAGFORHANDLEBARS, HARDRACINGSEAT, SOFTPAUDEDRACINGSEAT, LONGSTRINGYTHINGSFORHANDLEBARS, NEATBASEBALLCARDSFORSPOKESOUND

## No Pre-Conditions!

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BICYCLE_MIXED_OPTIONS_NVC</td>
<td>LOUDRINGINGBELLFORCHILDREN</td>
</tr>
<tr>
<td></td>
<td>REALSMALLCARRYBAGFORHANDLEBARS</td>
</tr>
<tr>
<td></td>
<td>HARDRACINGSEAT</td>
</tr>
<tr>
<td></td>
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- **Allowed Values**: LOUDRINGINGBELLFORCHILDREN, REALSMALLCARRYBAGFORHANDLEBARS, HARDRACINGSEAT, SOFTPAUDEDRACINGSEAT, LONGSTRINGYTHINGSFORHANDLEBARS, NEATBASEBALLCARDSFORSPOKESOUND
Multi Value Precondition Vs Constraint

LO-VC Pre-Conditions

AVC Constraint!
Interface Design Using Characteristic Groups

**LO-VC**

**AVC**
Characteristics Groups

**AVC ONLY**

### BICYCLE_MIXEDADVANCEDVARIANTCO

<table>
<thead>
<tr>
<th>Characteristic Group</th>
<th>Description</th>
<th>Number of Characteristics</th>
<th>Sorting Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristic Group: BICYCLE_MIXED_AVG</td>
<td>Colors Group For CMG Bicycle Demonstration</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>BICYCLE_MIXED_AVG</td>
<td>Colors Group For CMG Bicycle Demonstration</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Characteristic Group: HIDDEN_AVG_BICYCLE</td>
<td>Used to hide a color assigned incorrectly that I cannot delete</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>HIDDEN_AVG_BICYCLE</td>
<td>Used to hide a color assigned incorrectly that I cannot delete</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Characteristic Group: OPTIONS_BICYCLE_MIXED_AVG</td>
<td>Options for Bicycle</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>OPTIONS_BICYCLE_MIXED_AVG</td>
<td>Options for Bicycle</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>
User Interface

LO-VC

AVC

AVC Model for CWG Demonstration
BICYCLE_MIXEDADVANCEDVARIANTCONFIG

Configuration Status: Released 06.09.2018
Quantity: 1
Configuration Profile: BICYCLE_MIXEDADVANCEDVARIANTCONFIG
Plant: 0001
BOM Application: PPO1

Configurable Items
- BICYCLE_MIXEDADVANCEDVARIANTCONFIG
- FRAME_PKG_ADVANCED
- BRAKE_ASM_ADVANCED
- REAR_WHEEL_ADVANCED
- WHEEL_ASM_ADVANCED
- WHEEL_ADVANCED

Colors Group For CWG Bicycle D
- FRAME_COLOR: BLACK
- FRONT_WHEEL_COLOR: BLUE
Coming Attractions (Release Dates TBD)!

• Ability to maintain assignment of Characteristic Groups to Configuration Profiles with ECM

• Ability to maintain assignment of characteristics within characteristic groups with ECM
AVC Syntax Check – If You See This....

Simulation cannot be created

- An exception was raised
- An internal error during validation of the model.
- The validation of the current configuration failed.
- Simulation cannot be created

Show Configuration Objects
Run The New AVC Syntax Check
AVC Syntax Check
Alternative Values in LO-VC

Restricted Domain

Alternative Values
Alternative Values in AVC

Restricted Domain

Alternative Values

AVC Model for CWG Demonstration
BICYCLE_MIXEDADVANCEDVARIANTCONFIG

Configuration Status: Incomplete
Date: 06.09.2018
Quantity: 1
Configuration Profile: BICYCLE_MIXEDADVANCEDVARIANTCO
Plant: BO
Werk 0001

Configurable Items

Product

BICYCLE_MIXEDADVANCEDVARIANTCO
FRAME_PKG_ADVANCEDVARIANTCO

Colors Group For CWG Bicycle D

Options for...

FRAME_COLOR:

(frame_color:)

(Select)

(Exclude)

(frame_color:)

BICYCLE_MIXEDADVANCEDVARIANTCO
FRAME_PKG_ADVANCEDVARIANTCO
WHEEL_PKG_ADVANCEDVARIANTCO

Predefined Value

BLACK
BLUE
GREEN
RED

Selected
Excluded

AVC Model for CWG Demonstration
BICYCLE_MIXEDADVANCEDVARIANTCONFIG

Configuration Status: Incomplete
Date: 16.09.2018
Quantity: 1
Configuration Profile: BICYCLE_MIXEDADVANCEDVARIANTCO
Plant: BO
Werk 0001

Configurable Items

Product

BICYCLE_MIXEDADVANCEDVARIANTCO
FRAME_PKG_ADVANCEDVARIANTCO
WHEEL_PKG_ADVANCEDVARIANTCO

Colors Group For CWG Bicycle D

Options for...

FRAME_COLOR:

(Select)

(Exclude)

(frame_color:)

BICYCLE_MIXEDADVANCEDVARIANTCO
FRAME_PKG_ADVANCEDVARIANTCO
WHEEL_PKG_ADVANCEDVARIANTCO

Predefined Value

BLACK
BLUE
GREEN
RED

Selected
Excluded
More Precise Rounding

Note that for this particular item, there are no master data differences between LO-VC and AVC..

It’s all in how the underlying engine does math..
Same Mathematics

**LO-VC**

**AVC**

```plaintext
OBJECTS:

A IS A (300) Frame_Size_LOVC where
  ?FS = Frame_Size_LOVC,
B IS A (300) Frame where
  ?FS1 = Frame_Size.

Restrictions:

?FS1 = (?FS*0.39370154693125).
```

```plaintext
OBJECTS:

A IS A (300) Frame_Size_AVC where
  ?FS = Frame_Size_AVC,
B IS A (300) Frame where
  ?FS1 = Frame_Size_AVC_1.

Restrictions:

?FS1 = (?FS*0.39370154693125).
```
More Precise Rounding

LO-VC

What you first see on screen

AVC

What you see if clicking the “Information” Button

What you see if clicking into the field
More Precise Rounding

Precision and Rounding

AVC uses up to 34 digits for computation results

- $1.23456789876543 \times 3.45678987654321$ can be computed exactly
- That’s $4.2676418143575609510750492303$ (in case you wondered)

Obviously, that is not always enough: $X = 1 / 3$

- AVC applies advanced algorithms to further control rounding errors (based on IEEE’1788-2015 standard)
Bill Of Material Explosion

LO-VC

AVC

Characteristic Value Assignment

Configuration Structure

Material

WHEEL_PRO_LOVC

LO-VC Model for CWG Demonstration

Date

07.09.2018

Characteristic Value Assignment

Char. description

Char. Value

1.

REAR_WHEEL_COLOR

BLACK

BOM_CSTIC

VALUESETBYPRESSURE

AVC Model for CWG Demonstration

WHEEL_PRO_ADVANCEDVARANT01

Default Group

BOM_CSTIC

VALUESETBYPRESSURE

REAR_WHEEL_COLOR

BLACK
Bill Of Material Explosion - Trace
BOM Explosion – High Level Configuration

LO-VC

AVC
Trace – Low Level Configuration

LO-VC

AVC
BOM Explosion – Low Level Configuration

LO-VC

AVC
**BOM Explosion – Low Level Configuration**

---

**LO-VC**

*ANY OLD CHARACTERISTIC*

---

**AVC**

Here is SAP’s response, from both OSS and the CWG (Andreas Kraemer is a long time SAP employee in the VC space).

Bottom line, it’s “standard, expected” functionality in high level configuration. Meaning we can use it without the same fears of SAP closing the hole with a support package in ECC 6. This means that as long as we run ECC 6 we won’t have any issues with using this technique.

We know that this hole has been closed in the IPC and SSC. It also turns out that the AVC will NOT allow this technique. All casts must be assigned to classes in the AVC.
Roadmaps

SAP S/4HANA for advanced variant configuration – On Premise (Additional license)

1709 – Recent innovations*

2018 – Planned innovations*

2019 – Product direction*

2020 – Product vision*

Advanced Variant Configuration
- Advanced analytics for configuration data (on-premise)
- Classification: reuse user interface component DP
- New advanced variant configuration leveraging SAP HANA capabilities (on-premise)

Advanced Variant Configuration
- Support of multilevel scenario
- Integration into SAP Hybrid Commerce
- Integration of new configuration along key processes
- Integration of routing with simulation environment
- Support for characteristics of type “decimal” in object dependencies with a high degree of precision
- Improved user experience: Grouping of characteristics, handling of alternative values
- Interactive user selection of material variants during the sales order process
- Overview page for modeler
- Integration of requirement handling

Classification
- Machine-Learning based auto-Classification for documents
- New public interfaces

Classification
- Integration of the advanced variant configurator into further processes
- ML based Analytics
- Variant functions
- Syntax enhancements
- Enhanced simulation and trace possibilities
- Support of product modeling for Hardware, Electrics, Electronics, Software and Services

Advanced Variant Configuration
- Enhanced Engineer To Order Process supported by machine-learning
- Separate configuration for sales and manufacturing through loose coupling
- Integrated interactive 3D visualization for configurable products in Engineering, Sales and Production processes
- Test environment supporting systematically tests and analysis of variant configuration models
- Integration into Asset Intelligence Network and Digital Twin for Business

Classification
- Enhanced mass-change capabilities for classification and variant configuration

*This is the current state of planning and may be changed by SAP at any time without notice.
Roadmaps

SAP S/4HANA
LoB: R&D/engineering (2/5) – discrete and process industries (2)

Recent innovations
- Recipe development
  - Recipe development enhancements for SAP S/4HANA 1809
- Variant configuration
  - Advanced variant configuration leveraging SAP HANA capabilities – enhancements

2019 – Planned innovations¹
- Recipe development
  - PLM recipe development – advanced formulation – on-premise consolidation
- Handover to manufacturing
  - Handover of engineering structures (product structure and engineering BOMs) to manufacturing BOMs
- Variant configuration
  - Advanced variant configuration – enhancements (incl. variant functions)

2020 – Product direction¹
- Recipe development
  - PLM recipe development – enhancements for CPG and chemical industries
- Advanced variant configuration
  - Support of multilevel SET scenario
  - Enhanced engineer-to-order process
  - Syntax enhancements
  - Introduction of a configuration object
  - Support of product modeling for hardware, electronics, software, and services
  - Enhanced ML-based analytics
  - ML-based support creation of configuration

2021 – Product vision¹
- Recipe development
  - PLM recipe development – intelligent formulation and labeling support
- Advanced variant configuration
  - Separate configuration for sales and manufacturing through loose coupling
  - Integrated interactive 3D visualization for configurable products in engineering, sales, and production processes
  - Test environment supporting systematic tests and analysis of variant configuration models

Classification
- Extended characteristic types: Long text, data files, attribute groups

¹ This is the current state of planning and may be changed by SAP at any time without notice.

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Presentation Materials

Access the slides from 2019 ASUG Annual Conference here:
http://info.asug.com/2019-ac-slides
Q&A

For questions after this session, contact me at sschneid@steelcase.com
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