AUTODESK UNIVERSITY

Connecting Autodesk Fusion 360 to SAP Using the Autodesk Forge Data API

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About me

- Stefan Schaarschmidt
  - Development Manager @ CIDEON
  - Based close to Dresden, Germany
  - Married, 2 kids
  - Diplom (equiv. Master) in Computer Science
  - Very interested in technology, seen some changes over time

CIDEON Software & Services

- **Autodesk partner for 25+ years**
  - Consulting, implementation, training, project solutions, individual software development
  - Based in Germany and Austria
  - Cross-industry customer base with an emphasis on Mechanical engineering and Plant Design
- **SAP implementation partner for 20+ years**
  - Provider of CAD integrations for SAP
  - Integration customers worldwide

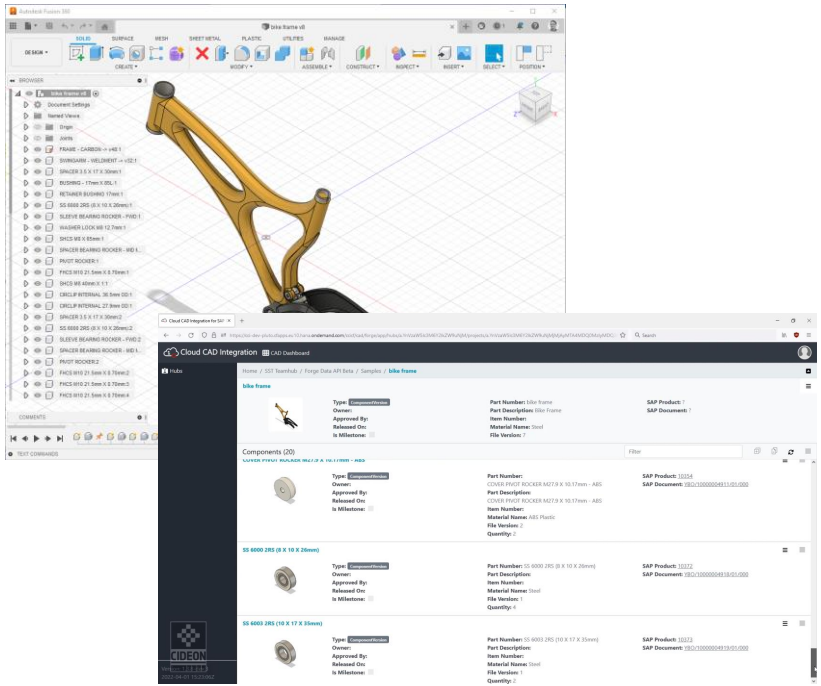
AUTODESK
Platinum Partner

SAP Platinum Partner

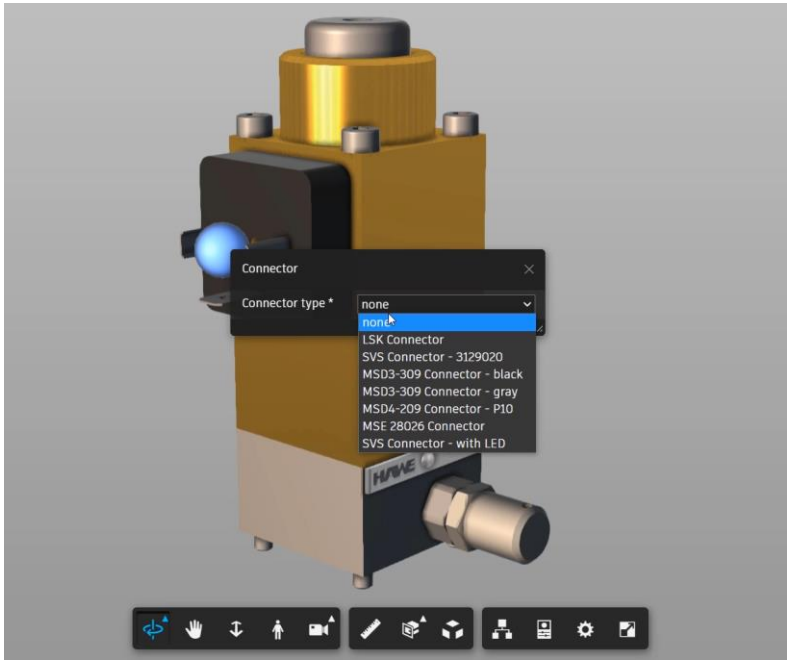
SAP integration use cases with Forge APIs

Two case studies

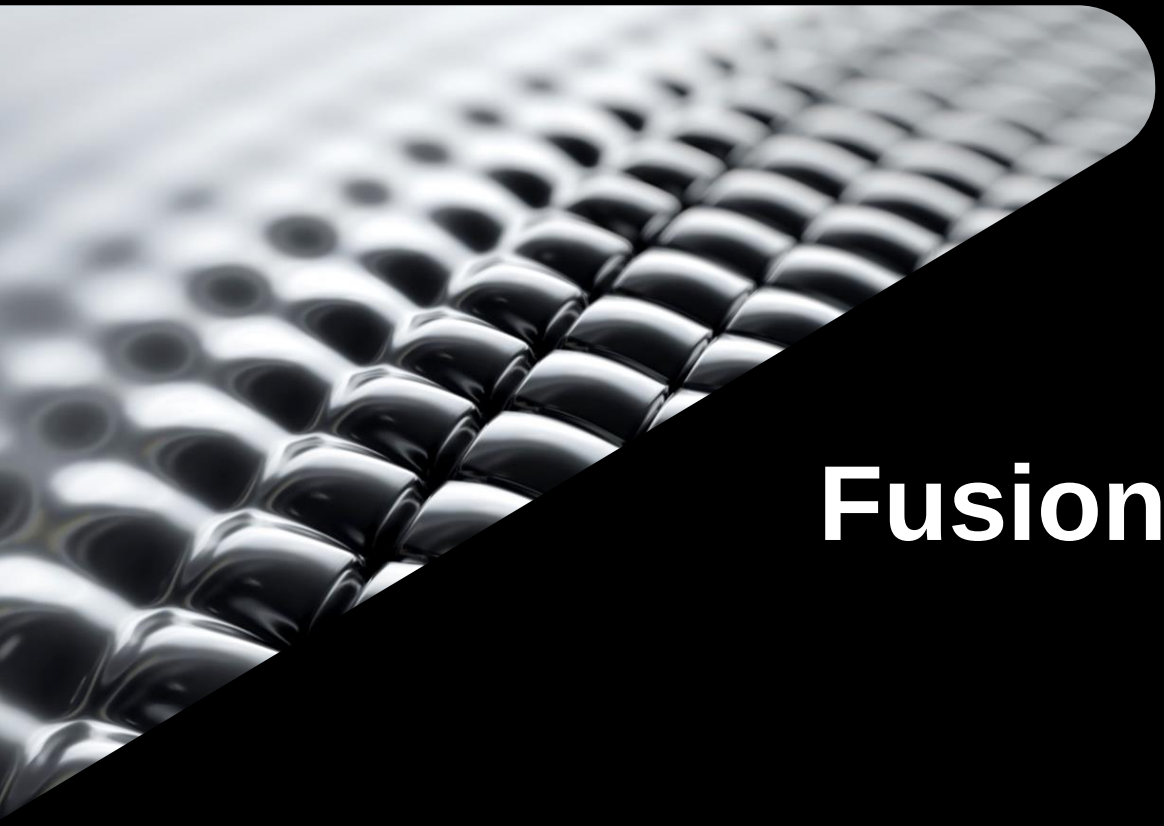
Fusion 360 data integrated with SAP



SAP configuration within the Forge viewer (“bonus”)



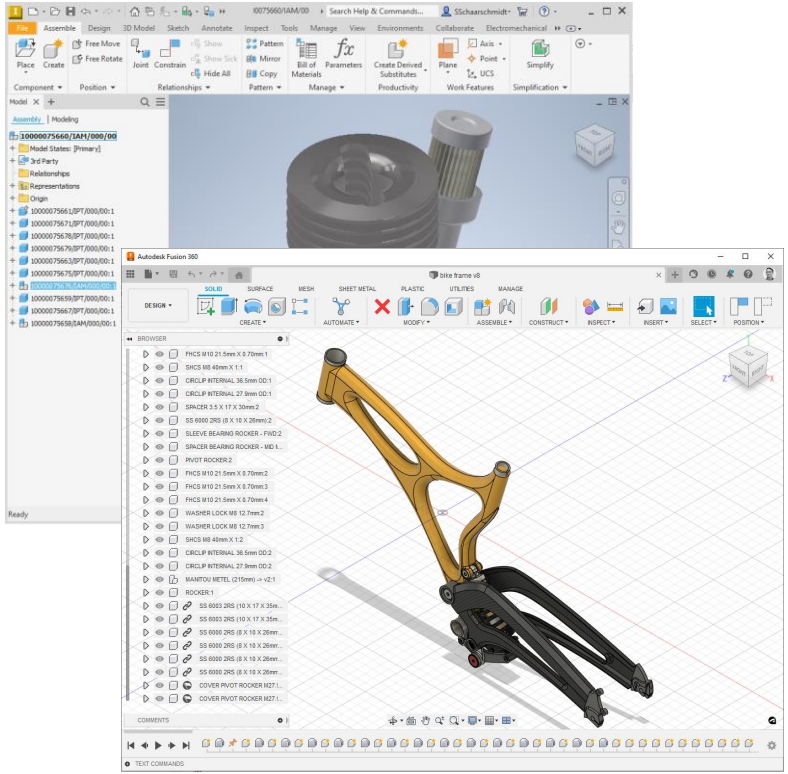
Bike frame model by Autodesk, from Fusion 360 samples. Valve Model by HAWE Hydraulik SE



Fusion 360 and SAP

CAD is great

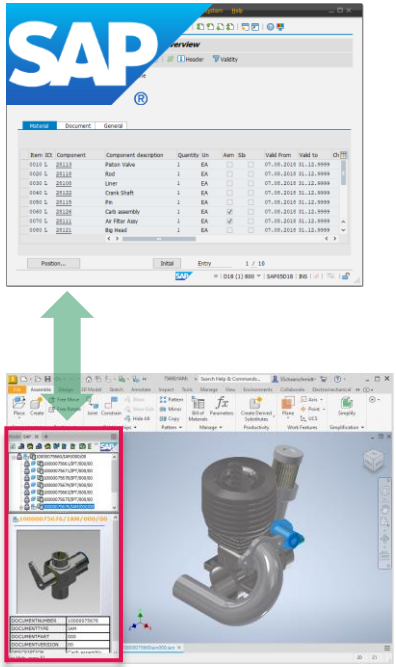
But you also know questions like this – right?



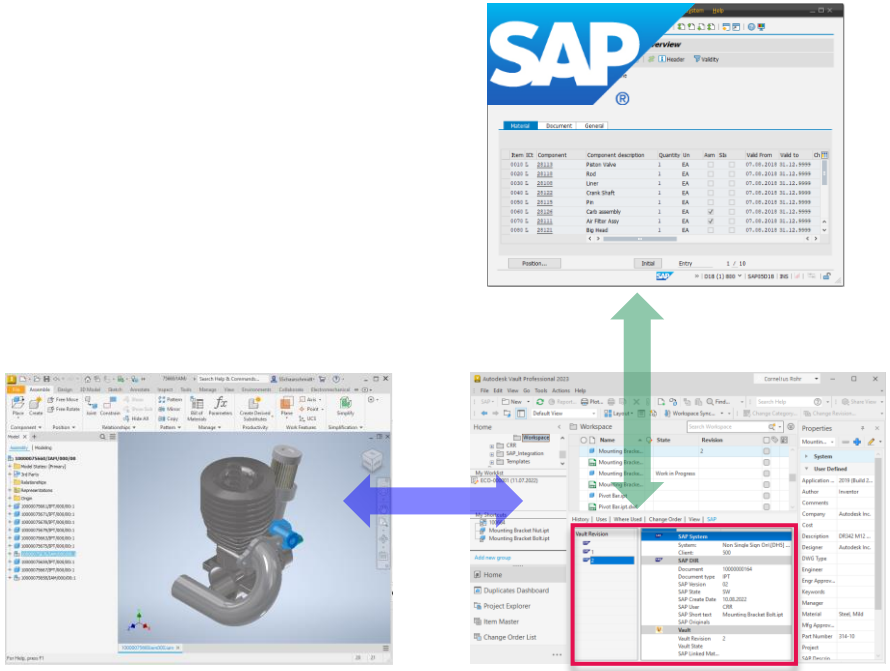
- My manufacturing process is controlled by the ERP system, can I have the full BOM available there? And could it please be correct and complete?
- I need to pre-order some of the parts, way ahead of manufacturing. Could we create a BOM now, even if design is not complete yet? And update it later without manual side-by-side comparison?
- And what about plant maintenance, spare parts orders?
- Can I have a *serious* cost calculation, based on country, customer, special VAT conditions …?
- What is the price / availability of this part? (Should I use a different one?)

Our answer to that are integrations

CAD Direct Integrations
e.g. Inventor – SAP – Integration



PDM Integrations
e.g. Vault – SAP - Integration



Engine model by Autodesk, from Inventor samples.

Cloud business is growing

Things are changing – a bit

Autodesk offers more and more cloud solutions. Just think of:

- AutoCAD Web
- BIM360 / Autodesk Construction Cloud
- Fusion 360
- Fusion Manage
- Rendering Services, Generative Design
- Sharing Services from AutoCAD, Inventor, Revit

SAP offers cloud solutions – e.g. S/4HANA public cloud

- Centrally hosted by SAP
- Software-as-a-Service (SaaS)
- Web based instead of (Windows-) SAPGUI

How does an integration fit into this scenario?

Fusion 360 – SAP

Analyzing the requirements

Some properties of Fusion 360:

- One CAD Version
- CAD data in the cloud
- Built-in document management (access management, search, versions, milestones)

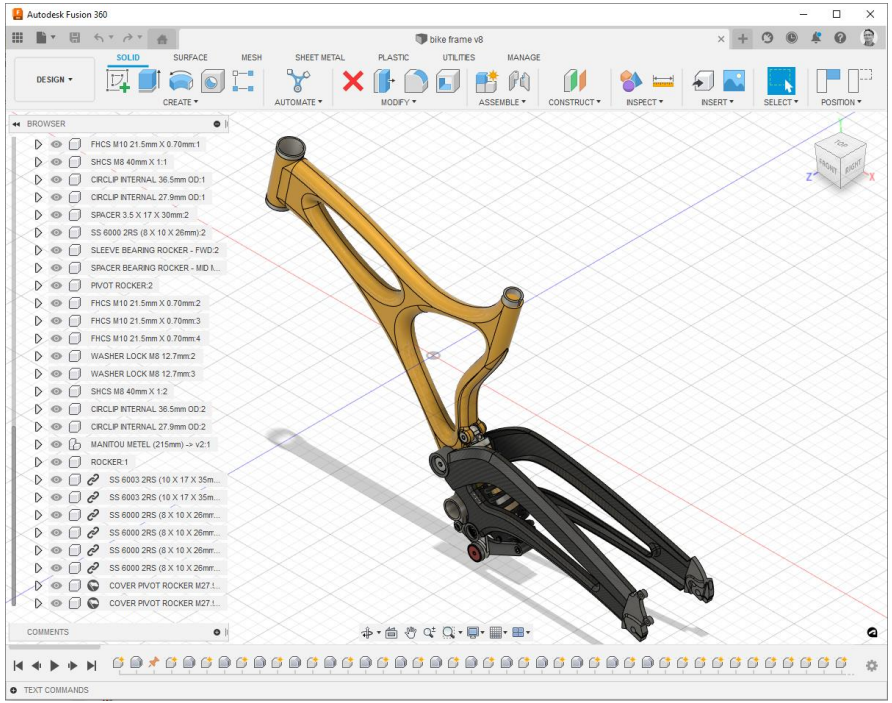
Main requirements:

- Transfer Bill of Materials into the ERP system, including all the data necessary
- Make SAP information accessible for a specific CAD component

Some optional document management requirements:

- Neutral files for follow-up processes in SAP (STEP, STL)
- Some previews
- Maybe an indicator which CAD documents are released

Fusion 360 integration tasks



Provide functionality to:

- Assign SAP items to F360 components
- Create SAP items using CAD information
- For reused CAD component recognize SAP info
- Create and update SAP BOM from CAD structures
- Display SAP data for a selected component

CIDEON Cloud CAD Integration with Fusion 360

How we approached it

Technology platform

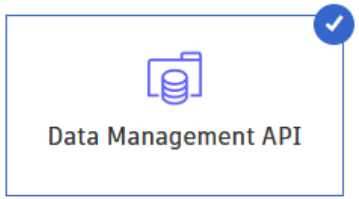
- Web-based, SaaS solution
- Using the SAP BTP (SAP Business Technology Platform)

Accessing Fusion 360’s data

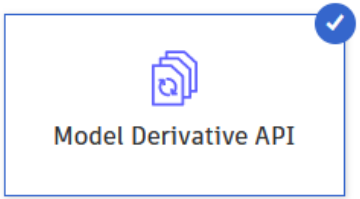
- No frontend modules (means: not using Fusions local API)
- Using Forge APIs

Checking out Forge APIs

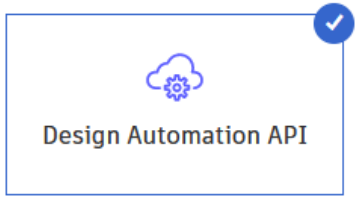
What was available



- Data Management API – works well for Project and Folder navigation, finding model versions, but of course not the contents of the CAD models



- Model Derivative API – Neutral file creation as well as delivering some metadata, including structures. However, not designed for tracking of changes or recognition of re-used parts in different model versions



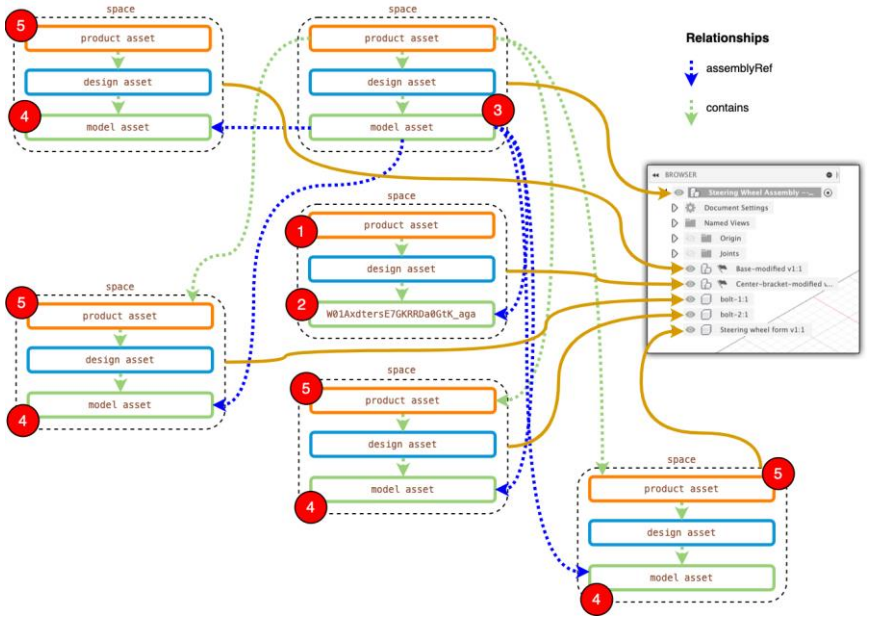
- (Design Automation API) – Powerful automation tool for AutoCAD, Inventor, Revit, 3ds Max. Not available for Fusion 360, but a background CAD action would be too expensive anyway.

→ PoC / Demo implementation, then seeking conversation with Autodesk

Along comes Forge Data

A two-part journey – Part 1

- Autodesk started working on Forge Data some years ago
- Invitation for the “Forge Data Vanguard team”
- CIDEON participated in the Private Beta
- First task: Understanding the underlying data model
- Feedback sessions with Autodesk, good discussions



CIDEON’s Feedback: This would solve our needs; however, it seems a steep learning curve.

Forge Data illustration by Autodesk from Forge Data documentation.

Along comes ~~Forge~~ Fusion Data

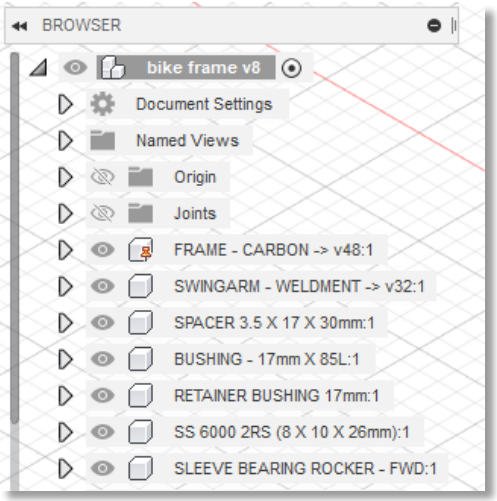
A two-part journey – Part 2

Fusion Data API

- A GraphQL-based API with the familiar CAD object terminology and structure

GraphQL-based

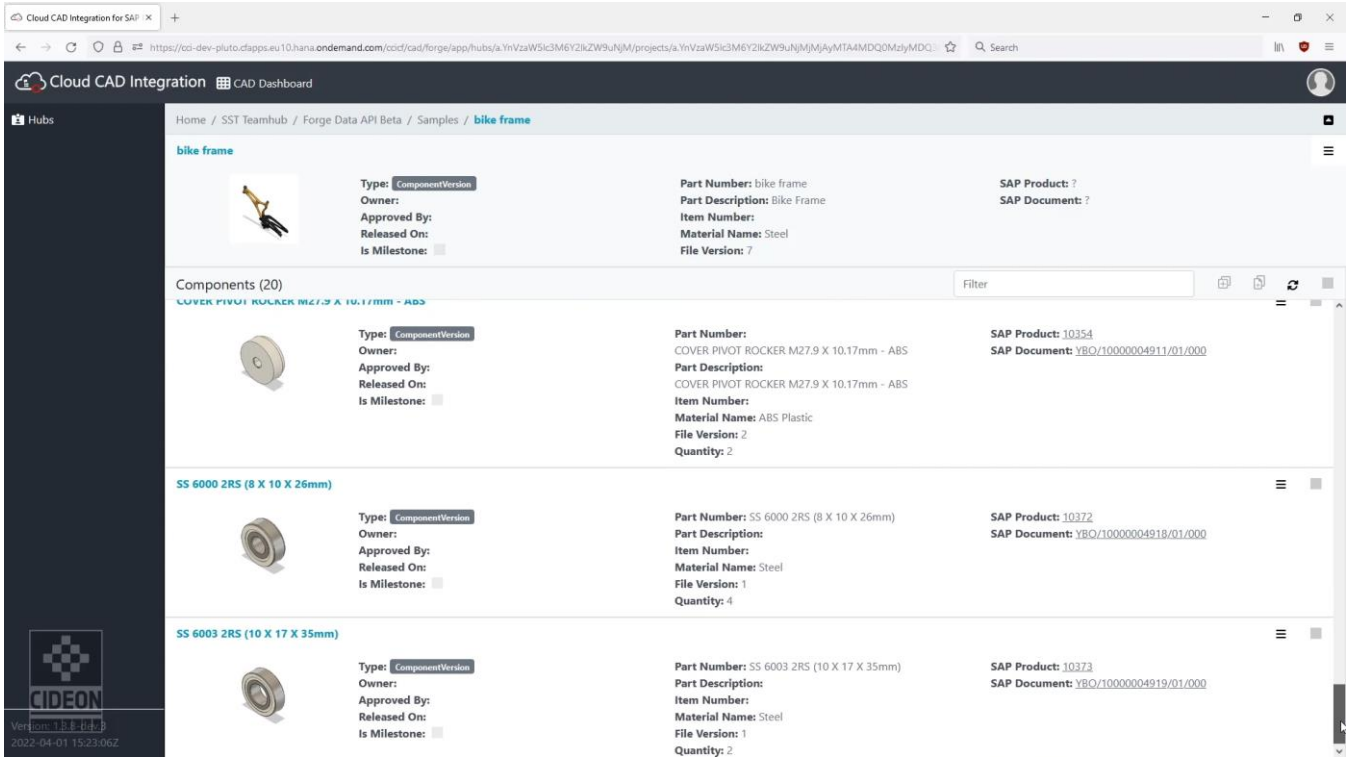

```
{
  "data": {
    "component": {
      "name": "bike frame",
      "tipVersion": {
        "name": "bike frame",
        "modelOccurrences": {
          "results": [
            {
              "componentVersion": {
                "name": "FHCS M10 21.5mm X 0.70mm",
                "id": "Y29tcH5jby5HcTlGRXljYlJKNmplWlNXdzh2dzlRfk5
              }
            },
            {
              "componentVersion": {
                "name": "WASHER LOCK M8 12.7mm",
                "id": "Y29tcH5jby5HcTlGRXljYlJKNmplWlNXdzh2dzlRfjV
              }
            },
            {
              "componentVersion": {
                "name": "SS 6000 2RS (8 X 10 X 26mm)",
                "id": "Y29tcH5jby5HcTlGRXljYlJKNmplWlNXdzh2dzlRfmV
              }
            },
            {
              "componentVersion": {
                "name": "SLEEVE BEARING ROCKER - FWD",
```

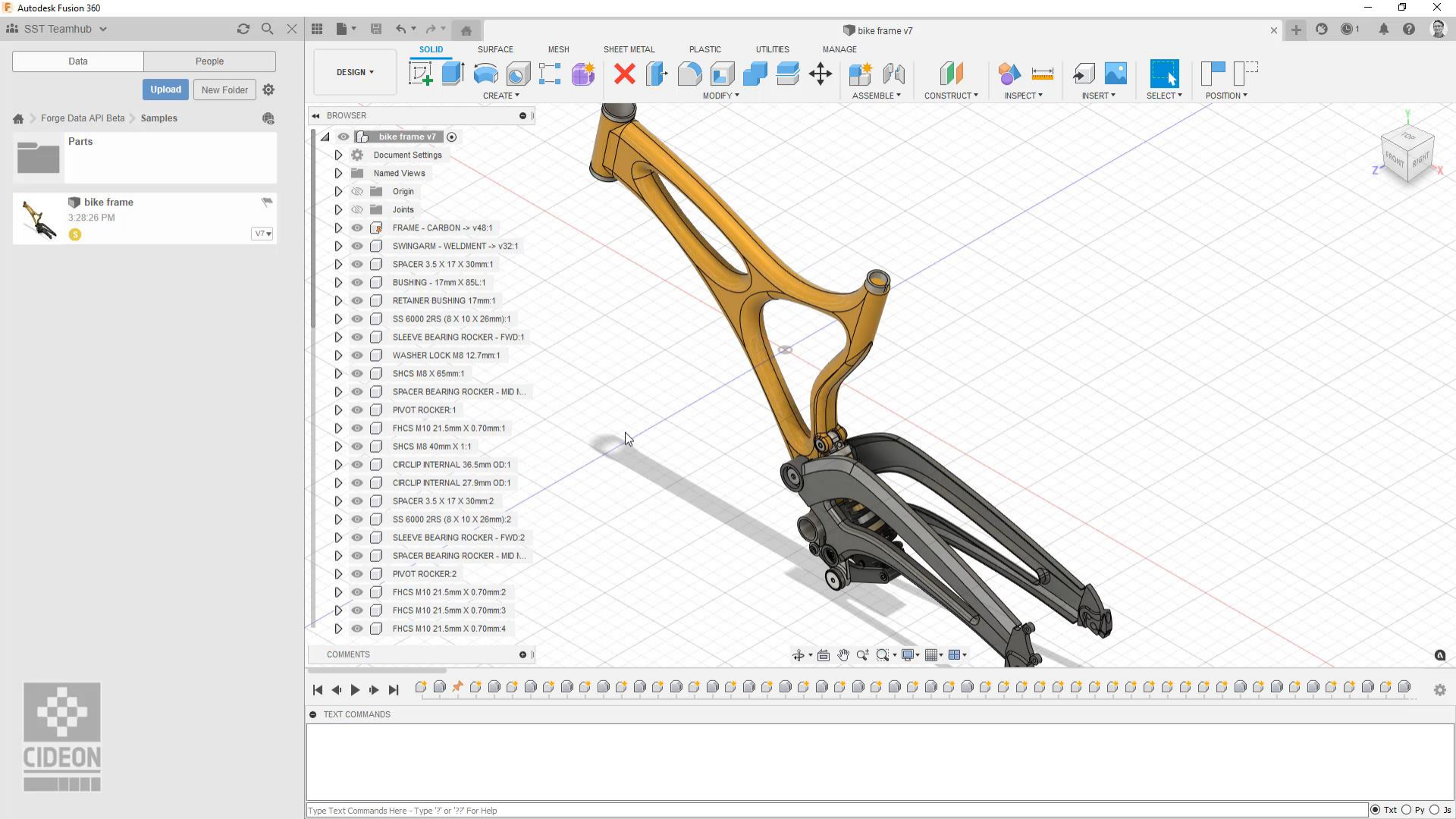



CAD Terminology

- Component
- Component Version
- Occurrence
- Component Version

A Short Demo of the Solution

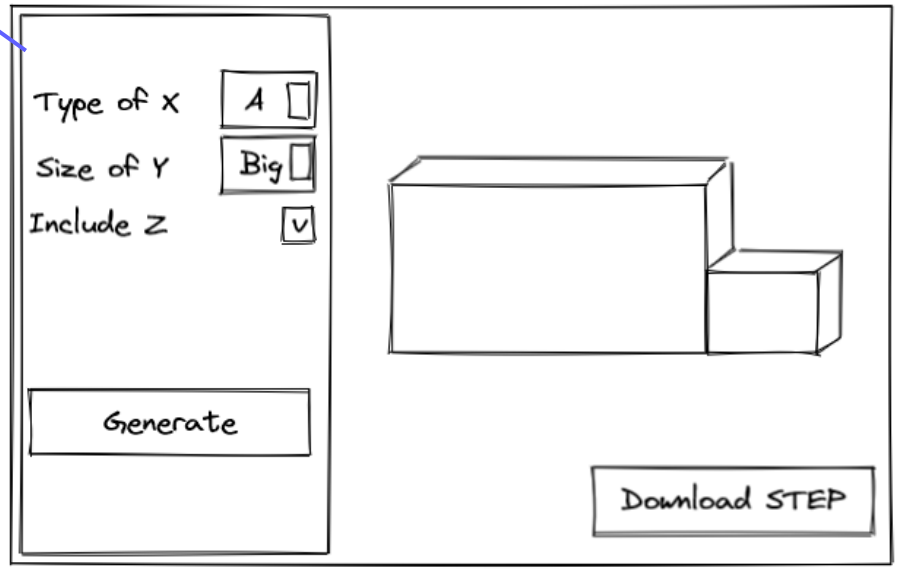



Autodesk Fusion 360
SST Teamhub
Data
People
Upload
New Folder
Forge Data API Beta
Samples
Parts
bike frame
3:28:26 PM
V7
bike frame v7
DESIGN
SOLID
SURFACE
MESH
SHEET METAL
PLASTIC
UTILITIES
MANAGE
CREATE
MODIFY
ASSEMBLE
CONSTRUCT
INSPECT
INSERT
SELECT
POSITION
BROWSER
bike frame v7
Document Settings
Named Views
Origin
Joints
FRAME - CARBON -> v48:1
SWINGARM - WELDMENT -> v32:1
SPACER 3.5 X 17 X 30mm:1
BUSHING - 17mm X 85L:1
RETAINER BUSHING 17mm:1
SS 6000 2RS (8 X 10 X 26mm):1
SLEEVE BEARING ROCKER - FWD:1
WASHER LOCK M8 12.7mm:1
SHCS M8 X 65mm:1
SPACER BEARING ROCKER - MID I...
PIVOT ROCKER:1
FHCS M10 21.5mm X 0.70mm:1
SHCS M8 40mm X 1:1
CIRCLIP INTERNAL 36.5mm OD:1
CIRCLIP INTERNAL 27.9mm OD:1
SPACER 3.5 X 17 X 30mm:2
SS 6000 2RS (8 X 10 X 26mm):2
SLEEVE BEARING ROCKER - FWD:2
SPACER BEARING ROCKER - MID I...
PIVOT ROCKER:2
FHCS M10 21.5mm X 0.70mm:2
FHCS M10 21.5mm X 0.70mm:3
FHCS M10 21.5mm X 0.70mm:4
COMMENTS
TOP
FRONT
RIGHT
TEXT COMMANDS
Type Text Commands Here - Type '?' or '??' For Help
Txt
Py
Js
CIDEON

SAP Configuration within the Forge Viewer

A “typical” graphical configurator

Selection fields with pre-defined lists
(Logic often in Web UI)



1 User makes selections and starts generation

2 Trigger generation

Design Automation / Model Derivative

3 Download generated Files (single SVF, STEP, CAD)

Our Solution Requirements

- Model once, configure anywhere!
- Better user experience, as intuitive as possible
  - Configuration by interacting within the graphics.
  - Ideally, have an immediate graphical response
- Starting at the source of CAD data (in our project: Inventor). Test and verify right in CAD!

Model once – configure anywhere

Commerce Solutions

Configure
Request Quote Offer

Custom Solutions

Variant Configuration and Pricing

Cloud Platform

Sales Solutions

CPQ -
Configure Price Quote

SAP
S/4HANA

Engineering

Manufacturing

Variant Configuration

Order Management

Procurement

Delivery

Service

Approaching the Solution

- Lightweight auto-assembly functionality in the viewer
- Component combination is a good starting point
- We need a connection point system

Forge Viewer API Check list

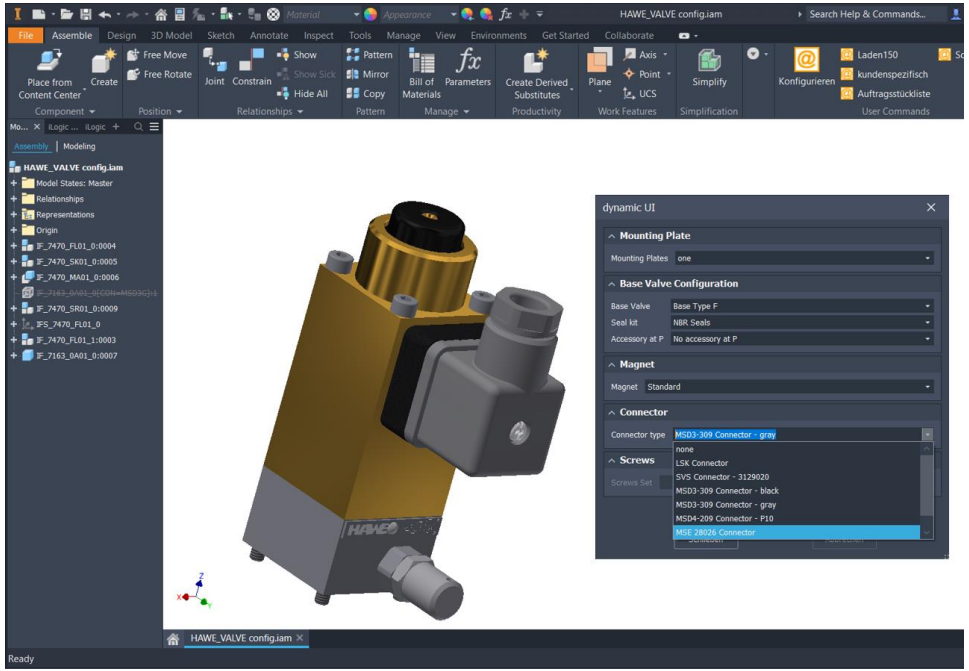
• Can it load several models (instead of one SVF)?	**Yes!**
• How about the placement of viewables in 3D space?	**Yes!**
• Does it have built-in constraint logic?	**No.**
• SVF as the viewable format?	**Yes!**

CAD model creation

Inventor as source system

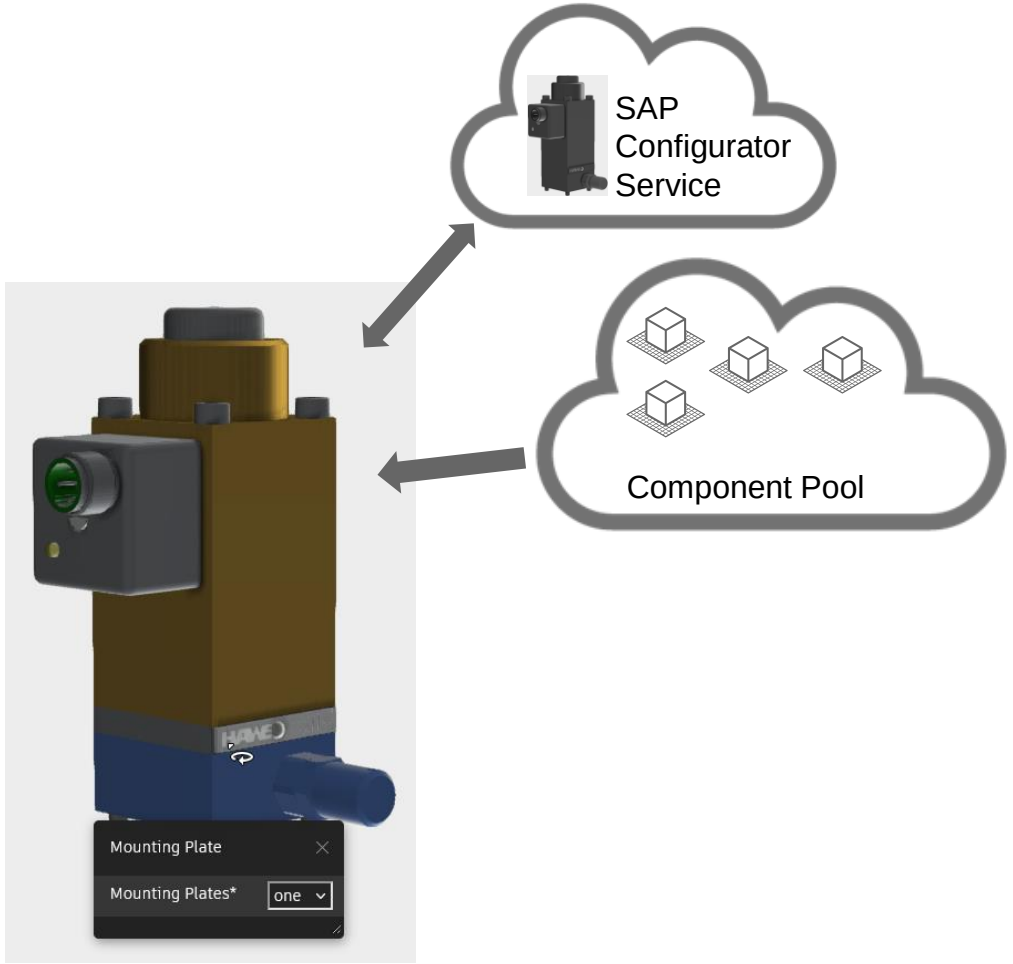
Create models with Inventor functionality, UI to support component creations:

- Define named connection points at the component
- Validation against configuration model, Inventor as test environment for logical and graphical configuration
- Upload component files and conversion to SVF
- Store viewables and meta info on our server

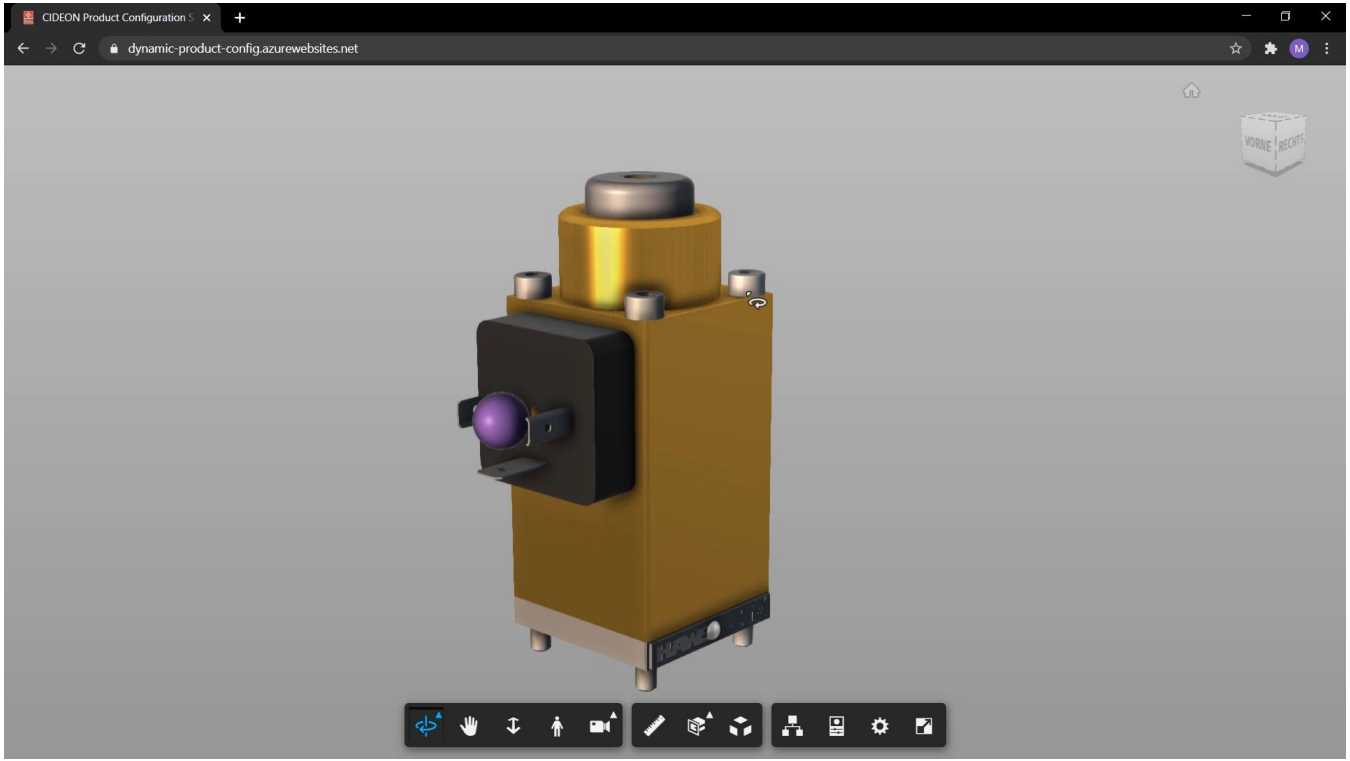


Final application logic

- User interacts with the component
- SAP configuration service delivers config options based *on the current state of the product configuration*
- After user input
  - Configuration metadata is recalculated by the configurator service
  - Add / remove components as needed
  - Place the components according to connection point logic



A short demo of the solution

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RECHTS

Q&A

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