MFG500071

BOM transforming: Align Engineering and Manufacturing Bill of Materials

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Learning Objectives

- Understand the differences between Engineering & Manufacturing Bill of Materials
- Align the product design data with a manufacturing process
- Explain the values of PLM for the EBOM to MBOM transition
- Manage this transition in context of Change Management activities (ECO, MCO)

Description

Deriving a product design into a manufacturing process is a continuous challenge. Catching up with latest design changes often times is a manual, error prone and slow process performed in the ERP system. With the Vault PLM solution offering, this process can be vastly improved as both the Engineering BOM and the Manufacturing BOM are accessible and linked in a single system. Workflow mechanism ensure that data being received from engineering gets transitioned properly & extended to define manufacturing processes. The resulting manufacturing then gets published to ERP upon approval of Manufacturing Change Orders.

In this session you will see how this process is managed in an integrated environment. A custom built, smart editor will be used to automate this process as much as possible and to provide visual indicators to ensure a proper alignment of structures in an easy way.

Speakers

Sven Dickmans helps customers, prospects, and partners in achieving excellence of business process execution with cloud based PDM/PLM solutions from Autodesk. He also engages in developing new collaboration solutions using connected cloud services of Forge. Sven is part of Autodesk's technical specialists' team in Germany.

Peter Van Avondt works for Autodesk as a Technical Specialist Data Management PDM/PLM in Northern Europe, based in Belgium. After graduating as a master in electromechanical engineering he joined an Autodesk channel partner as a technical consultant specialized in 3D CAD and product data management PDM. For the last 17 years he has built up a lot of experience in variety of Autodesk design tools as well as with Autodesk Vault and Fusion Lifecycle. In his current role he uses this wealthy knowledge helping Autodesk resellers, prospects, and customers to adopt and implement the Autodesk solutions across different industries including industrial machinery, pharmaceutical, architecture, engineering and construction companies.
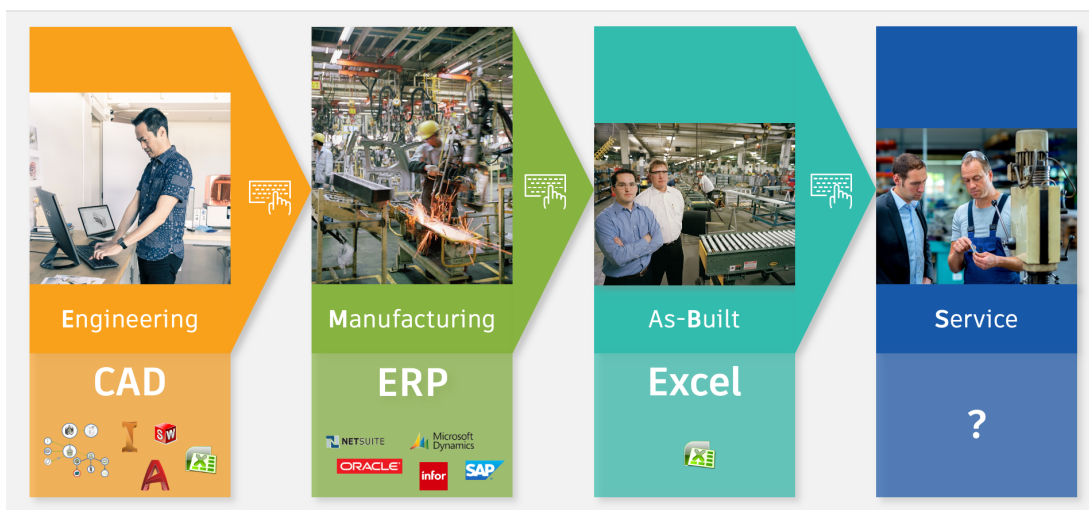
The Bill of Materials Challenge

Customers want to produce better products and require better BOM data to deal with the increasing complexity of evolving products.

But BOM accuracy today often is pretty low as BOM data is managed in various systems, involving a lot of error prone manual data entries.


There is not only a single BOM to manage, but multiple BOM types. During each state of a product lifecycle, a different perspective on product data is required:

- Engineers start building the first BOM by designing the product in CAD. They can generate the Engineering Bill of Materials from their CAD design files, but have to take into account design specific elements like phantom parts which are not required by downstream processes. Often times, engineers use Excel to share the list of components - or they type in this information manually in ERP

- Manufacturing relies on this data to develop the manufacturing process - which derives the Manufacturing Bill of Materials. The manufacturing assembly process isn't often reflected in the design intent captured in product design assemblies and requires a restructuring of the elements. Also, components will be added which are relevant for the manufacturing process, but not included in the design. The process definition also has to take into account purchasing and pre-assembling processes. Further more, there can be multiple MBOM structures for various factories.

- As the product is being manufactured, the As-Built BOM is generated to document the product as it is being delivered to the customer. It consists of serialized items which may carry a serial number to track later replacements and the lifecycle of each component individually.

- During maintenance, repair operations or retrofits, the product specification may change over time. Such changes have to be documented properly to have an up-to-date view of the products' configuration at the customer. This enables better services and lower downtimes.

A key challenge in regards to BOM management is the connection and dependency of the various BOM types. Each BOM depends on the previous one: changes to the Engineering BOM for example cause necessary changes to the Manufacturing BOM and with this also possibly impacts the As-Built and Service BOM. However, as the BOMs often are managed in multiple different systems, it is a severe challenge to keep them in sync.
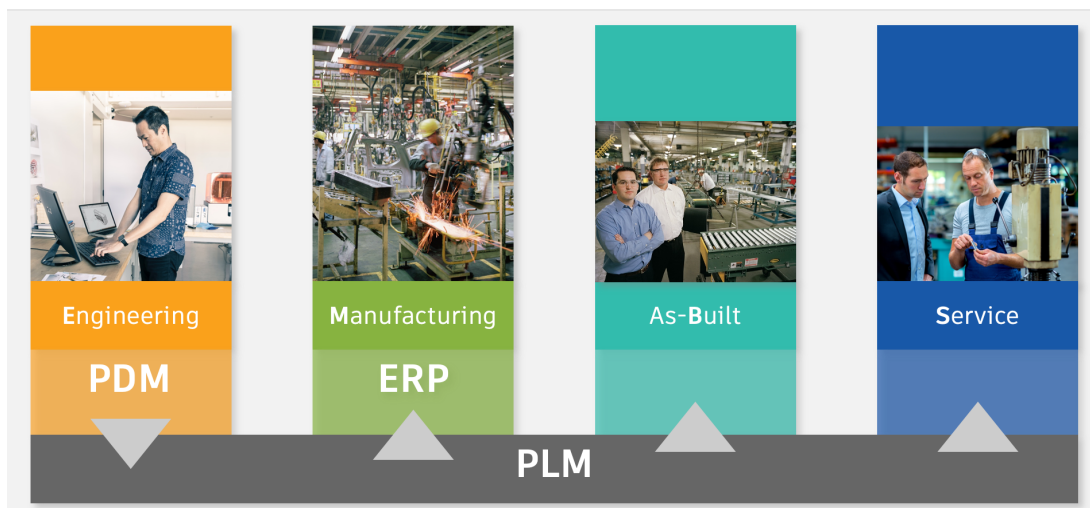
This challenge can be addressed by establishing a PLM system in the backend which is connected to existing data management solutions (like PDM and ERP) and accessible to all stakeholders as single source of truth for product data. This helps to improve the alignment of Bill of Materials tremendously:

- Error prone manual data entries get replaced by automatic data transfers that happen in background automatically

- There is only one single item master data with release information that is accessible to anyone

- BOMs are connected and reuse data of preceding business processes

- The integrated change management can reveal impact of changes to downstream BOMs and handle a proper implementation of changes from Engineering through Services
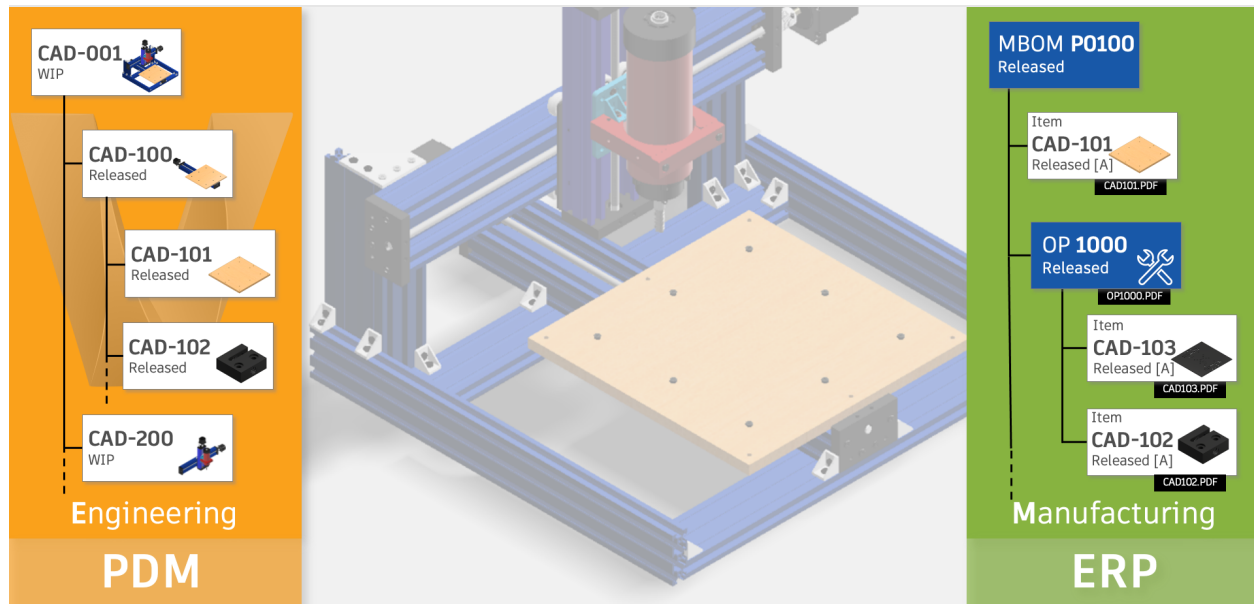
The initial transition from Engineering to Manufacturing has to be managed by all manufacturing companies and is most probably the most challenging: wrong data leads directly to additional cost and waste in manufacturing. Also, both structures get created in parallel and are impacted by continuous change.

The process of transformation also is complex and impactful:

- Assemblies that were created during product design do not reflect the assembling process, so the components have to be reused and restructured

- Not all components being relevant for the design are relevant for manufacturing and vice versa

- The design structure does not contain all components necessary for the manufacturing process

- Some sub-assemblies and components get designed by Engineering, but are not relevant for the MBOM as they will get assembled externally

- If there is a change to the EBOM, the MBOM might have to be changed as well

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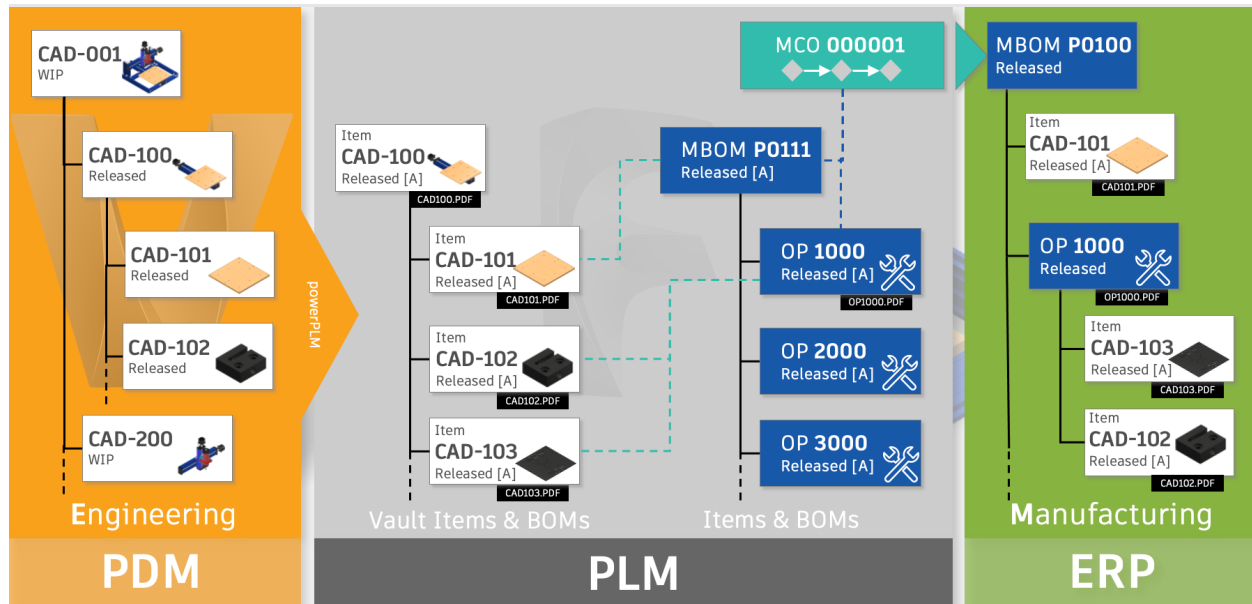
As an intermediate system, PLM can help to automate this BOM transformation process. It can receive the released Engineering Bill of Materials from PDM (e.g., Vault) and reuse this data to define the related manufacturing process.

The Autodesk Vault PLM solution is ready to support this process as it distinguishes between two different types of BOMs: **Vault Items** reflecting the design perspective derived from the design data and the generic **Items** being used to define the manufacturing components and processes that make the MBOM.

The transformation is supported by integrated Change Management processes that take into account the impact of changes to the design on the manufacturing process. They are also used to transfer the MBOM upon approval to ERP automatically to prevent error prone manual data transfers.

Overall, the process gets automated as much as possible.
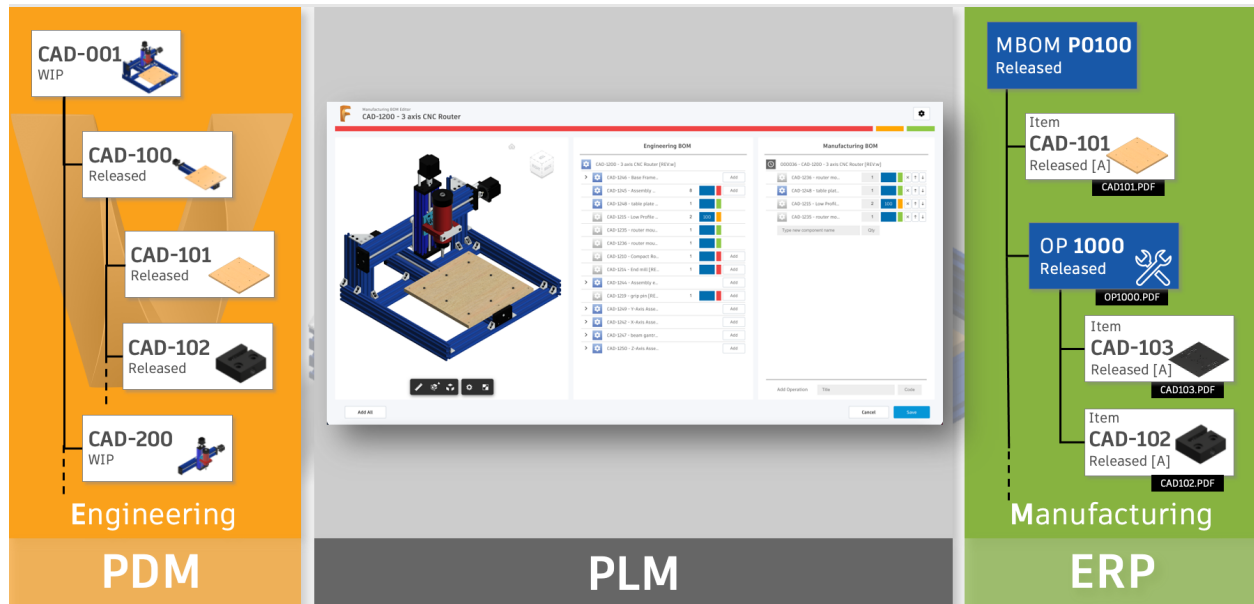
To further enhance and optimize this transition process, a custom user interface has been created by the Autodesk Technical Sales Specialists team. This user interface addresses the given business process challenge and was built on top of the standard Vault PLM solution offering. This user interface supports the users in the BOM transition process in multiple ways:

1) It reuses BOM data that has been created in Vault already, including its viewable

2) BOM and viewer are connected to easily choose relevant components

3) Color codes indicate the usage of designed components in the MBOM

4) This color code also is available in the viewer

5) Users can filter by status (only show items missing or items not matching in quantity)

6) A mapping of quantities is provided to keep the structures in sync

7) Re-grouping of components is easy with the addition of operations

8) Operation codes can be used to automatically assign components to the right operation

9) Manufacturing items can be added easily to the structure

While this is not a standard product, its concept, technology and POC version can be reused to tailor it for a customer's needs. The integration to Vault as well as the required data schema and approval processes however are provided out of the box with Vault PLM.

Solution Architecture

All of this is based on standard data & process management solutions offered by Autodesk. It uses Vault PLM, the combined offering of Vault Professional with Fusion 360 Manage. These solutions get connected by using a standard connector provided by coolOrange. The data and process schemas of both solutions got enriched to enable immediate connections of both solutions.

On top of this, the team added a customer user interface that got developed in node.js and which connects to Fusion 360 Manage by using its open REST APIs and Forge services.

With this approach, all data is still in control of Fusion 360 Manage, its processes and permission control. The user interface only displays the given information in an easier way and uses the APIs to push the result back to PLM in the end.

The resulting MBOM then can be pushed to an ERP system by Fusion 360 Manage's standard integration features and given change approval processes.
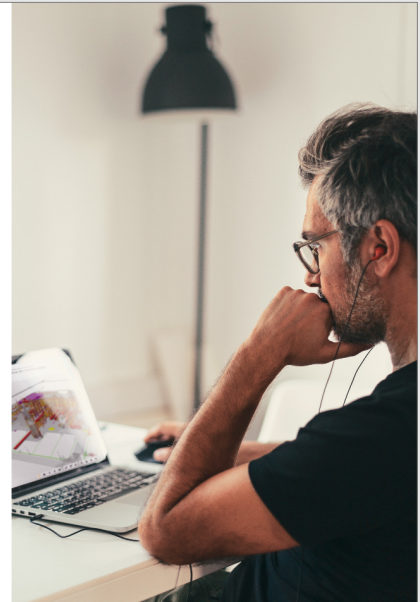
Solution Benefits

Why Vault PLM?

Standard Enterprise BOM Management
Standard Vault Connector
Fast deployment (cloud)
ONE Change Management
BOM Effectivity Management
Manage any BOM (As Built, As Maintained)
Ease of use
**Flexibility & Extensibility**

The solution presented in this AU class combines unique benefits: It offers a standard data & process management platform that can handle all data & references required and which is connected to existing engineering processes. At the same time, the custom element enables to provide a best-in-class usability and control of complexity for end users.

Solution Details
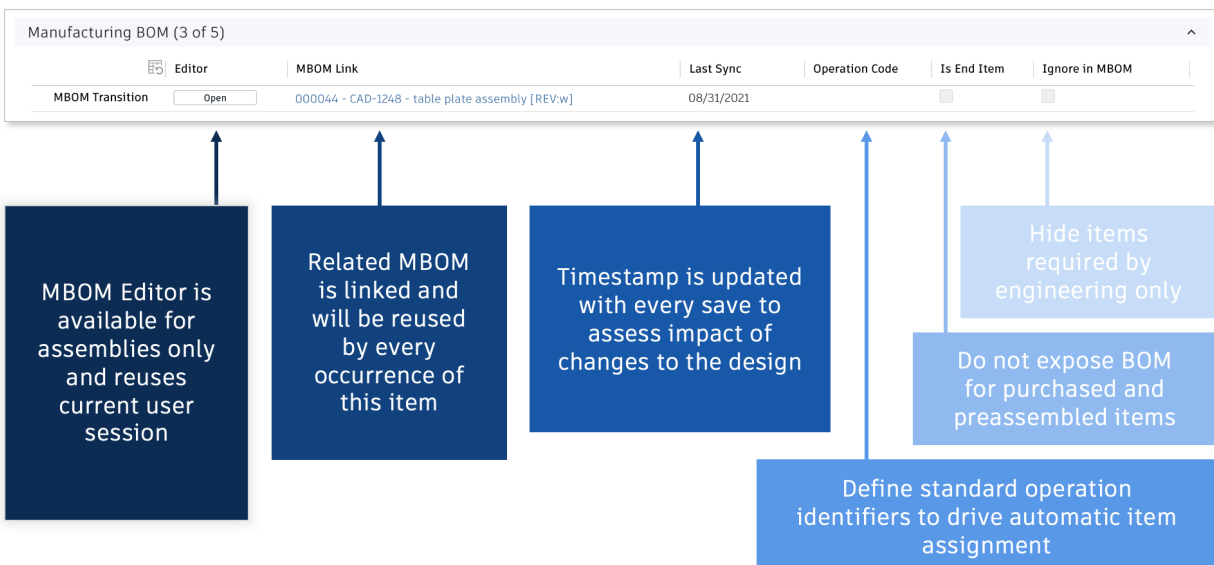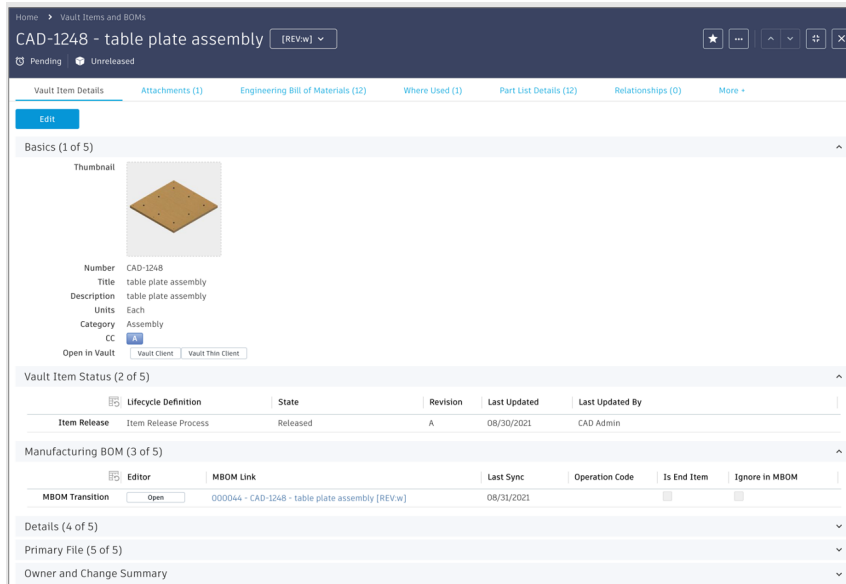
Managing the transition process is made easier with additional properties on the design elements provided by Vault in PLM. A new section 'Manufacturing BOM' provides direct access to the custom user interface, but also additional controls to navigate to the related MBOM, to review the last update date of the MBOM and also toggles to hide the given component or its EBOM when using the MBOM editor.

Possible Extensions
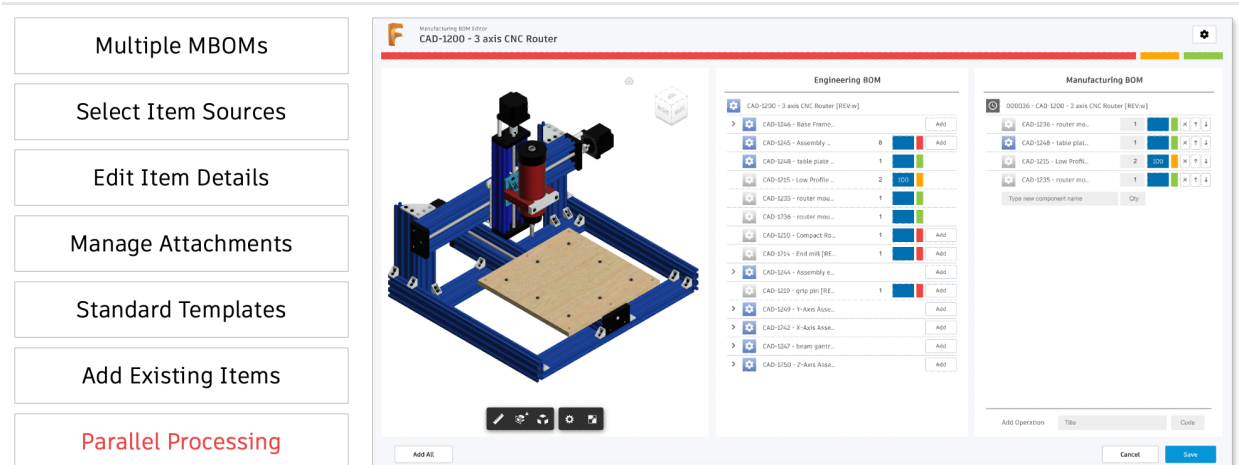
While this solution shows the potential, it is still a proof of concept only. However, it is built on top of a powerful framework offering a flexible data model and an open API. This allows to enrich this solution if needed and to support even more use cases:

- Handling of multiple Manufacturing Bill of Materials for different production facilities
- Integration of item sourcing information to even select the supplying source
- Management of item details to enrich the process information with more details
- This also includes management of attachments (e.g., to upload specific manufacturing sketches)
- The process overall could be standardized by applying templates
- Addition of manufacturing items currently does not support to reuse existing components as it lacks a component search & select feature
- As of now, all requests are triggered sequentially, not in parallel. This is impacting the performance badly and by sending multiple requests to the data management servers in parallel, the overall UI can become much more efficient to use