Managing Design Families with Teamcenter

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TranscenData
A Business of International TechneGroup Incorporated
5303 DuPont Circle
Milford, OH 45150

Please send comments on this document to pbh@iti-global.com.

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Introduction

CAD systems provide many sophisticated capabilities for managing design information.

- Families of parts and assemblies (parts with common characteristics but many variations)
    - These are what we are terming "Design Families"
- Orientation sets for assemblies (doors open and closed, flexible items)
- Display of items in assemblies
- Standard Hardware and parts

In some cases the software includes utilities to manage that data and control the presentation to the user independent of any PDM/PLM tools.

From a data management point of view, we need to look at the purpose behind these tools and what product development processes interaction model is affected by these design tools.

This paper will explore various options around the management of the data that are used to store families of design options.

Concepts of Design Families

Design families are a useful tool in many CAD systems. A diverse set of parameters can be varied between configured models to enable a design to respond to base changes in the design. A bolt is one of the simplest examples. The overall length and the thread length are common variables. But you might change suppliers and find that the thickness of the head had changed from 3mm to 2.5mm. By changing one parameter, the entire family can be updated.

From a management point of view, the key concept is that all of this information is captured in a single file. If you have defined a family of 5mm diameter bolts, all of them are defined in that one file. If you want to make changes to any one configuration, you need access to that single master file.

Design families can also include assemblies. And the complexity of the interaction between families of parts and families of assemblies can get very complicated. Again, keep in mind that all of the members of an assembly family are maintained in a single file.

Customer Release Processes

Companies develop bills of materials for engineering and manufacturing (EBOM and MBOM). In the case of design families, the MBOM contains only a specific part number associated with a single configuration in the engineering world. When a bolt is included in the MBOM and managed by the ERP system, the concept of it being part of a design family is not of interest. It is important to understand that ERP systems (and PLM systems like Teamcenter) manage discrete items that correspond to final deliverable items. Many times the handoff between Engineering and ERP/Manufacturing is a PDF file (one for each released specific part or assembly).

This disconnect between the CAD tools and the rest of the customer process is caused by the difference between capturing relationships between information and encapsulating information. The CAD systems design families are encapsulated in a proprietary file; PLM systems create relationships as desired between information. Often, the CAD systems use Excel spreadsheets to visualize the parameters for each family member and permit an alternate editing tool.

Design Ownership & Workflow

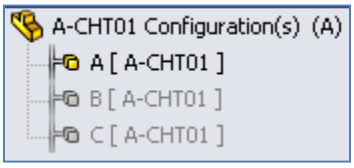
PLM Systems provide very elaborate control systems and workflows to be put into place for discrete items (a file or document). A single person at a time can gain access to an item for modification. In the case of container management (like a Teamcenter Item), different users may be able to access and change different data or attributes at the same time.

As you can imagine, if all of the members of a design family are locked up in a single CAD file, this limits the modification options available for the users.

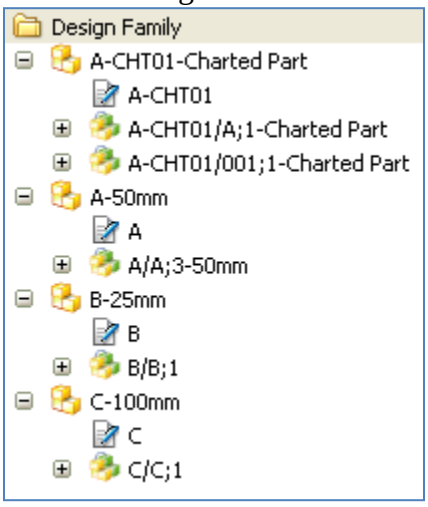
Teamcenter (working with SWIM and IPEM) provides a model to bridge this gap between the single file of the CAD system and the discrete item management of business.

SWIM and IPEM create Teamcenter items to store the metadata and provide an endpoint for the necessary links needed by the rest of the business.

As an example:



Shows a master document (A-CHT01) that contains 3 unique configurations. When this is checked into Teamcenter, we see the following:



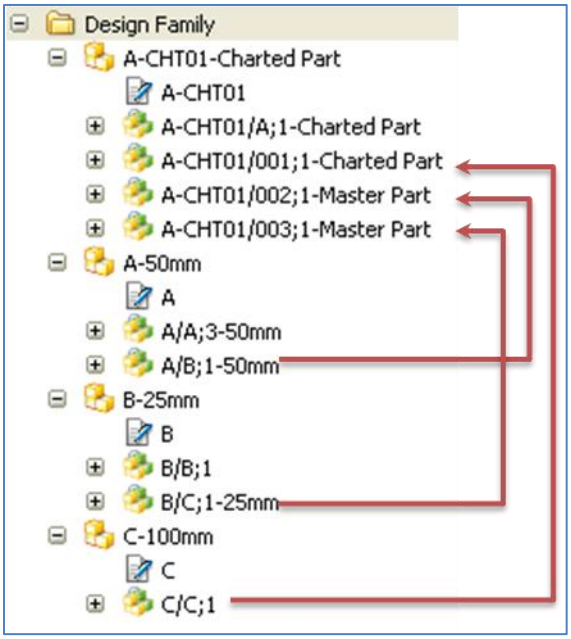
As you can see, from the Teamcenter point of view, these are all discrete items with their own metadata, revisions, and states. However, only the item A-CHT01 actually has an associated CAD dataset.

When using SWIM or IPEM to interact with this data (from the CAD users point of view) you are always presented with the master document along with any (or all) of the design family members that you would like to modify. Here is an example of that information:

Item ID/Rev-Item Name Tree View	Revision	Item Description	Document
A-CHT01/001-Charted Part	001	Master Part	
A/A-50mm	A	50mm	A-CHT01
B/B-25mm	B	25mm	A-CHT01
C/C-100mm	C	100mm	A-CHT01

The next step is to revise A, B, and C and preserve their definition for each Revision. Since all geometric and design family information is stored in A-CHT01, a revision of that part must be created to preserve the geometry of that revision of each member.

As an example, we have created a change in a dimension for each part.

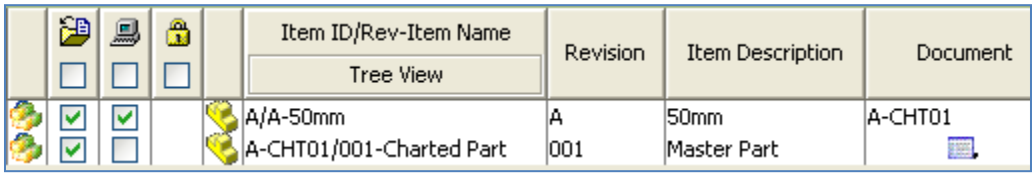


And for each specific revision of a design of A, B, or C, there is a corresponding revision of the Master part. Note that this is an extreme case. During most design cycles, all of the revisions of A, B, and C will often be tied to a single release of the master part. However, this approach will allow you to see the released version of an item by looking at the precise relationship.

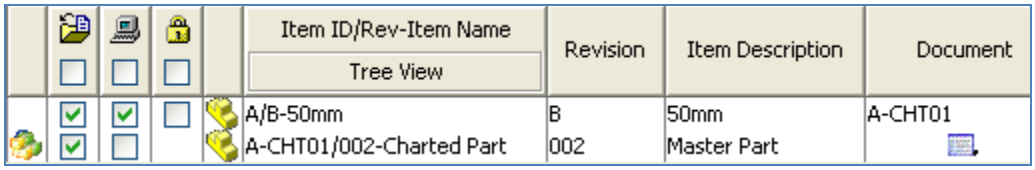
Revision Configuration: Precise; Any Status

Item ID/Rev-Item Name Tree View	Revision	Item Description	Document
A-CHT01/001-Charted Part	001	Master Part	
C/C-100mm	C	100mm	A-CHT01

In this example, revision 001 of the master part contains the correct geometry for Revision C of part C.

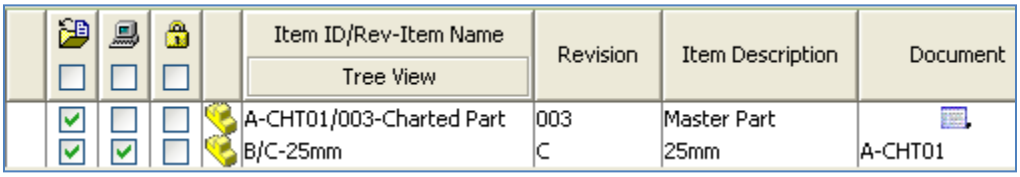


Item ID/Rev-Item Name Tree View	Revision	Item Description	Document
A/A-50mm	A	50mm	A-CHT01
A-CHT01/001-Charted Part	001	Master Part	



Item ID/Rev-Item Name Tree View	Revision	Item Description	Document
A/B-50mm	B	50mm	A-CHT01
A-CHT01/002-Charted Part	002	Master Part	

In these 2 examples, A/A is stored in A-CHT01/001 and A/B is stored in A-CHT01/002.



Item ID/Rev-Item Name Tree View	Revision	Item Description	Document
A-CHT01/003-Charted Part	003	Master Part	
B/C-25mm	C	25mm	A-CHT01

And with this final example, B/C is stored in the latest Revision A-CHT01/003.

Note that to make any modifications to a design alternative (A, B, or C) that the latest Revision of A-CHT01 must be checked out.

Also, any workflow that releases (or freezes as a status) A, B, or C or any combination of these, must also release a corresponding revision of the master part.