The Digital Thread

Explicit and Implicit Linking of Service Content to Product Design

The Digital Thread and Service Content

The Digital Thread for a product enables enterprises to effectively communicate bi-directionally up and down stream of where the product is in its lifecycle. This connects the product data from engineering design and product lifecycle management to manufacturing instructions, supply chain management, service information and instructions, on to service histories and customer events.

The PTC Service Parts Information and Instructions solution in Windchill® supports the Digital Thread. Unlike traditional content architectures, where engineering data is stored in a PLM system while service documentation is stored in a file system or a separate CMS, Windchill can aggregate information created by the different teams working on a product along its life cycle. Since engineering, manufacturing and service objects are managed together, Windchill can maintain implicit and explicit links between them.

Engineering content that is managed in Windchill can be used directly as input to service information. For example, the Engineering Bill of Materials (eBOM) can be transformed to a Service Bill of Materials (sBOM). This sBOM is then used in the creation of Parts Lists for Illustrated Parts Catalogs. The 3D geometry from the eBOM is used to create appropriate 3D Illustrations for the interactive Parts Catalog or is transformed to 2D Illustrations for a PDF version of the Parts Catalog. For organizations that have a Manufacturing Bill of Materials (mBOM), that can also be used as the input to the sBOM.


Service authoring with integral change management

For service content, the associativity of design data and service content that the digital thread provides allows for impact analysis and change management. If the product design changes, the engineer can query for what in the service content must also change. The change can be communicated to the content writers who are responsible for the affected content. Also, if a customer provides feedback on the service content, the information can be relayed back to the designers.

Connections from the design to the service content can be implicit or explicit. There are reasons why an organization may choose one or the other, or both.

Link creation: Implicit

Implicit links are automatically created in the Windchill Service Parts Information and Instructions solution. Parts Lists are ordered lists of parts with metadata. The Service Parts Information and Instructions solution stores the Parts Lists and the textual content in an organization called an Information Structure. When a change is made to any Part in a Parts list, there is an implicit connection to all the content objects that are in the same Group of the Information Structure. The Information Architect does not need to create an explicit connection; the association is made based on the similar content area. All textual topics and Illustrations that are in the same Information Structure Group as the Parts List will be associated to the Parts of the Parts list.
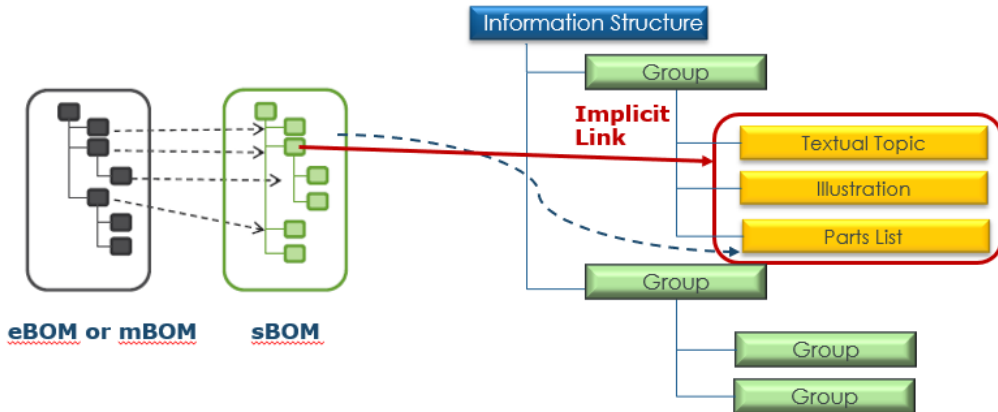
Implicit link based on Parts List content in an Information Group

A similar implicit link is created when an Illustration that was created from a Parts List is directly included in the Information Structure Group. This implicit link also goes from the part of the original BOM to all the content in the Information Structure Group.
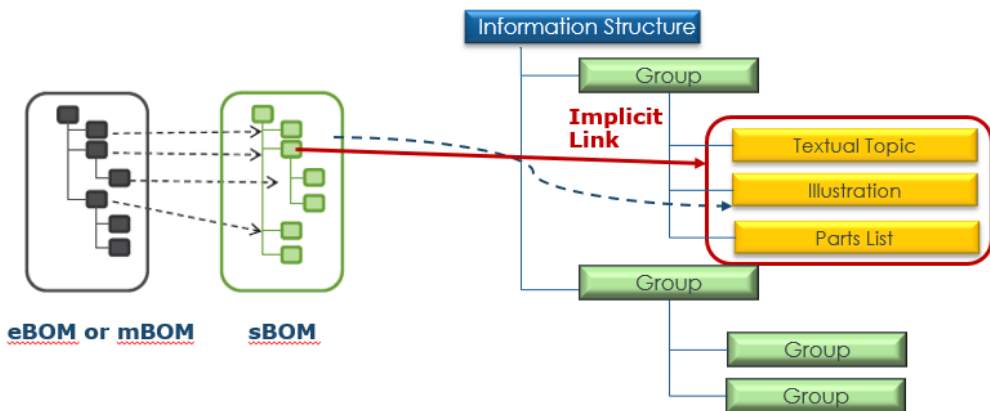
Implicit link based on Illustration content in an Information Group

Also, when illustrations (traditional 2D, static or animated 3D) are created for service content such as product descriptions or maintenance procedures by leveraging product 3D representations from CAD, Windchill will automatically retain the implicit links between the objects.
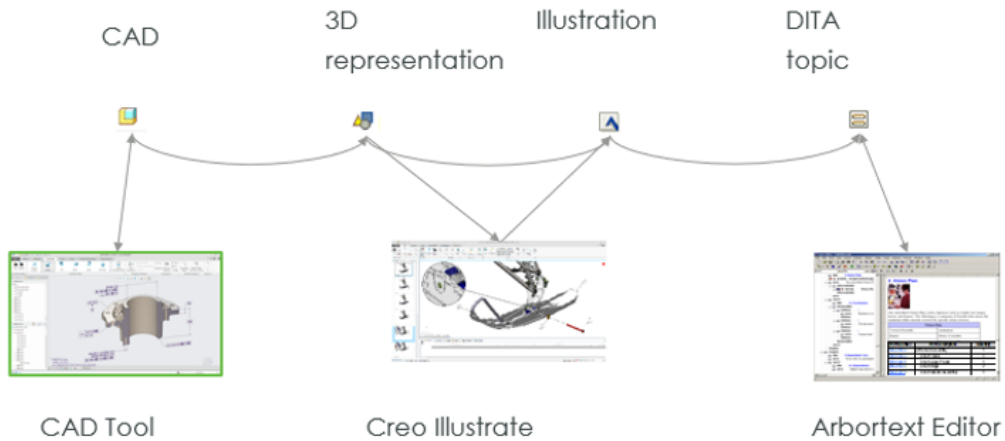
Illustration from CAD referenced in DITA topic

If the CAD data is modified, the downstream illustration objects will automatically be flagged as having an updated source, making it easily identifiable by Illustration managers as potentially requiring an update.


Image with Updated Source Indicator

Link creation: Explicit

It requires a manual process by the Information Architect to create explicit links. The Information Architect selects a specific Information Structure Group and a specific level of the Bill of Materials and creates a link between them. Explicit links can also be created from a BOM element to individual content items. This allows for more direct associations especially when there are many content items in each Information Structure Group. When the Information Architect has knowledge of both the product assembly and the organization of the content, the implicit links can be laser-focused on connecting the precise subsystem of the product to the content items that describe that subsystem.
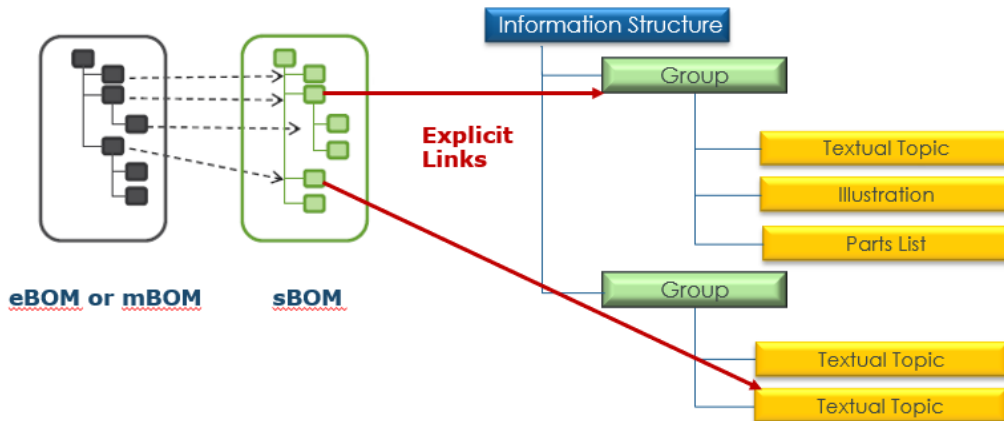

Explicit links from sBOM to service content

Change Analysis

The change analysis process differs when explicit links are created from when implicit links are used. Since explicit links go directly from a specific part of the BOM to individual topics or groups, an author that is reacting to an engineering change can focus more closely on the topics that are expected to be impacted by the change. The author can also subscribe to be notified when related parts are modified.

When an engineer changes a part, he or she can generate an impact analysis report of all service content that is explicitly linked to that part. The links can also be used by the Windchill collector when a Change Request is created so the Request can include all related service content.
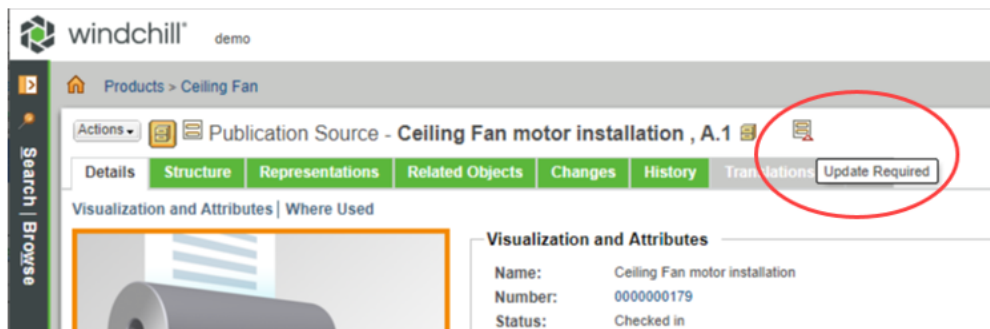
Publication topic with Update Required indicator

On the other hand, with implicit linking, any of the parts of the Parts list may have changed and those changes may affect any of the topics or Illustrations in the Information Structure Group. The author will need to review any parts that have changed, and then check all the content in the Group to determine what may need to be updated.
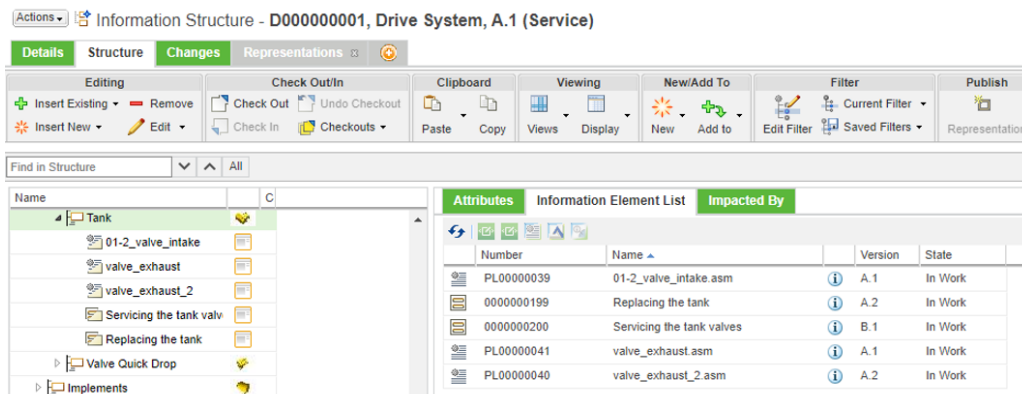
Information Element List of an Information Group

Explicit links also support end user feedback more easily. If an end user reports a comment on a topic that should be relayed to the engineer, having an explicit link from that content to the engineering data enables the feedback channel. With implicit links, the content may be linked to many different BOM items and it is more difficult to direct the feedback.

Use of Implicit and Explicit Links

Different organizations will benefit from using implicit versus explicit linking. A knowledgeable Information Architect can create targeted links to better focus authors on items that are relevant to product changes. Authors can add metadata in the content to assist the Information Architect. For instance, when the content is first created, information about the relevant product assemblies can be included in the content metadata.

However, for complex products the implicit links will work better because they are automatic and do not require detailed knowledge of both the content and the design. The extra time required for impact analysis is acceptable since there was no up-front analysis required.

Some organizations may choose to use both implicit and explicit linking for associations. If a change is made to the engineering design, first an explicit link is followed. If there is no explicit link, then the implicit link is used to identify content that is related to the change. Whichever method, or combination of methods is used, the Digital Thread improves the content by providing associativity to multiple aspects of the product lifecycle.

Further, in addition to linking objects together, Windchill also improves relationships and communication between teams in different departments, as they are sharing the same work environment that contains a unique repository of reference data. Teams easily access the same product 3D representation, product status, and history. This, plus a common change management process, allows teams to collaborate more quickly and easily at each step of the product life cycle.

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