

# PLM-driven content management

Aligning product design and technical publication support functions to ensure product launch success

## White Paper

By using product lifecycle management (PLM) to integrate today's engineering design and technical publications domains, companies can dramatically improve the way in which content is managed across the product lifecycle for all documentation. With this in mind, Siemens PLM Software provides Teamcenter® software technical publishing and advanced authoring and illustration tools to enable engineering design and technical publication groups to share information retained in different system repositories, re-use content as often as possible and automate functions and processes common to both domains.

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# Executive summary

The implementation of structured authoring initiatives and other technology advances has significantly improved the lifecycle associated with managing today's product and service documents – especially with respect to reducing production time and managing resources effectively. However, additional progress can be made by recognizing the intersecting relationships between engineering and technical publishing and capitalizing on their synergy to improve multiple business processes, including:

- Content authoring
- Content editing/updating
- Document publishing
- Graphics management
- Document translation
- Multipurpose content management

To gain these additional improvements, many of today's most innovative companies are using product lifecycle management to integrate their engineering design and technical publications domains at multiple levels by:

- Sharing information retained in multiple systems
- Re-using product and service content
- Automating functions and processes common to both domains

Teamcenter software provides a PLM-driven environment that streamlines technical publication processes with dynamic publishing techniques. These streamlined processes enable technical documents to be developed in concert with the product development process.

Teamcenter content management capabilities address issues associated with traditional technical publication processes, including concerns that these processes:

- Take too much time
- Might not reflect the latest engineering changes
- Inhibit extensive re-use of content and graphics
- Require heroic efforts to meet document delivery and product ship dates
- Fail to meet multiple language requirements
- Fail to publish timely content in all required delivery formats

Many of these issues result from the fact that the content for engineering design and technical publications traditionally has resided in disparate and discrete authoring systems and organizational domains. Teamcenter technical publishing solutions overcome this isolation by providing workflow, version control and relationship management capabilities that link product documents with their associated parts in a product bill-of-materials (BOM).

PLM-driven content management directly relates Extensible Markup Language (XML) content instances to a product's parts and assemblies – thereby synchronizing the product and its documentation even when product changes arise. The relationship between product parts and content ensure that critical path documents that depend on engineering data flow will be completed without imposing unnecessary overhead (typically required when engineering and technical publication teams work with different systems in isolated environments).

In a PLM environment, the product definition is managed in one location – a logical repository that serves as the environment's authoritative information source regardless of configuration or whether manufacturing or as-sold BOMs are being referenced. Teamcenter-driven PLM environments provide a single logical authoritative source of product definitions and linked documents that can be manipulated by user-initiated workflow and data management capabilities to integrate engineering, manufacturing and technical publications.

## Keys to success

Companies can eliminate the isolation that separates technical publication groups from their engineering design/development counterparts by effectively using XML in both environments.

To facilitate effective collaboration, the technical publication group's system of choice and engineering design group's system of choice must use the same workflows and process automation environment.

Moving XML into an engineering environment – through the use of PLM-driven content management – is crucial to integrating the processes and information flows common to both environments, while at the same time delivering improved productivity and cost savings.

# Recent evolution of technical publications

Over the past two decades, engineering design and manufacturing have experienced sweeping technology changes. Working relationships between these two organizational domains have been integrated through the use of interdisciplinary engineering software that recognizes and capitalizes on intersecting roles that each domain plays in the product lifecycle.

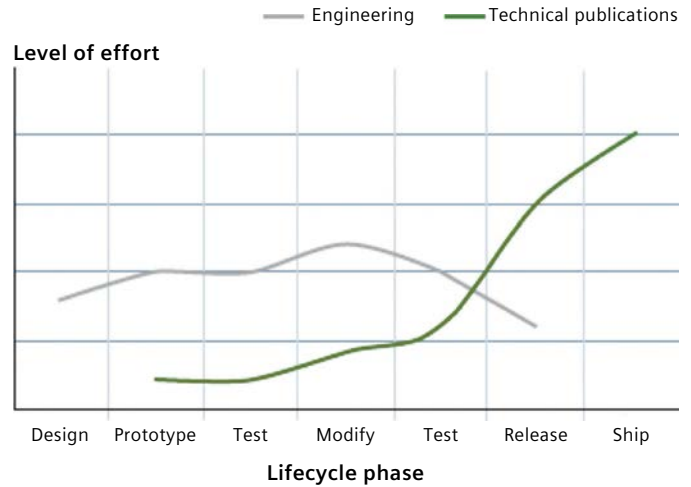
Product lifecycle management has driven these initiatives by providing the domains with a common platform for effectively integrating otherwise isolated information assets and streamlining cross-discipline tasks throughout the enterprise. This integration has enabled companies to accelerate their product development cycles, improve product assembly and target their product designs to highly selective market segments. Equally important, these changes have increased the need for more product support documentation while raising its level of complexity.

## Role of technical publications

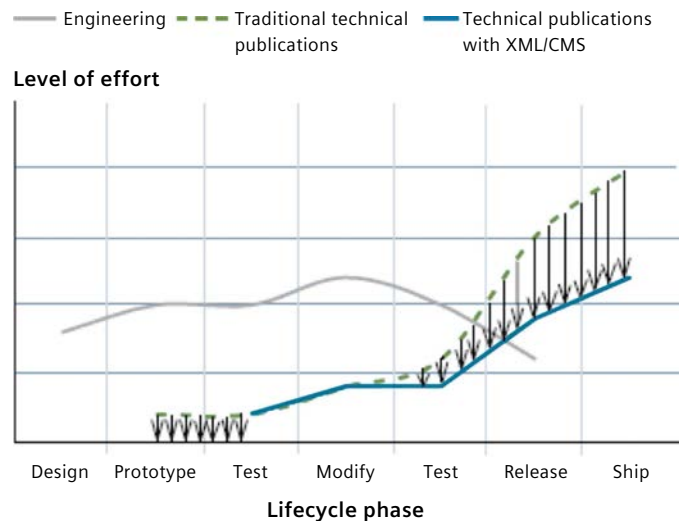
The need to support more complex product documentation has raised new challenges for today's technical publication groups, including the need to:

- Develop content to support a variety of documentation deliverables, including traditional hardcopy manuals, compact disc-based publications and online documents in both page-based and interactive formats
- Simultaneously publish documents in multiple languages to support today's global marketplace
- Release product and service documentation on time (when the product is ready to ship) while accommodating distributed teams that need access to current versions of the same content
- Accurately reflect late-breaking engineering changes in document content, even when these changes occur within days of the product ship date
- Avoid heroic publication production efforts that incur overtime costs, which in turn jeopardize the product's profit margins

The accompanying diagram illustrates the traditional relationship between engineering design and technical publications during the product lifecycle.



Traditional relationships between engineering design and technical publications in the product lifecycle.



Influence of structured content on the relationship between technical publishing and engineering design.

### Facing the last hurdle

Historically, technical publications groups have been viewed as the last hurdle in product development innovation. While publication services and deliverables remain on the critical path to product shipping, engineering design decisions and engineering change orders (ECOs) are still managed outside the technical publications system and its related workflow.

To reduce the time lag between product release and the document ship date, most publication groups start document development early in the product design cycle. As a result, technical publication groups engage in significant rework as the product design is repeatedly refined.

In essence, technical publication is still largely a follow-on process. While providing a necessary function, technical publications groups are generally isolated from other disciplines in the product lifecycle. They invariably use separate automation systems and often rely on nonintegrated processes to handle change notices that materialize late in the product lifecycle.

However, diverse development paths no longer offer sufficient justification for keeping engineering design and technical publications in separate computing environments. Today's common change management processes and the configuration management capabilities of PLM now provide companies with a holistic environment for managing both product and documentation development. This holistic environment is especially adept at reducing the risk of inconsistent or out-of-date technical documentation while shortening the length and complexity of the publications cycle.

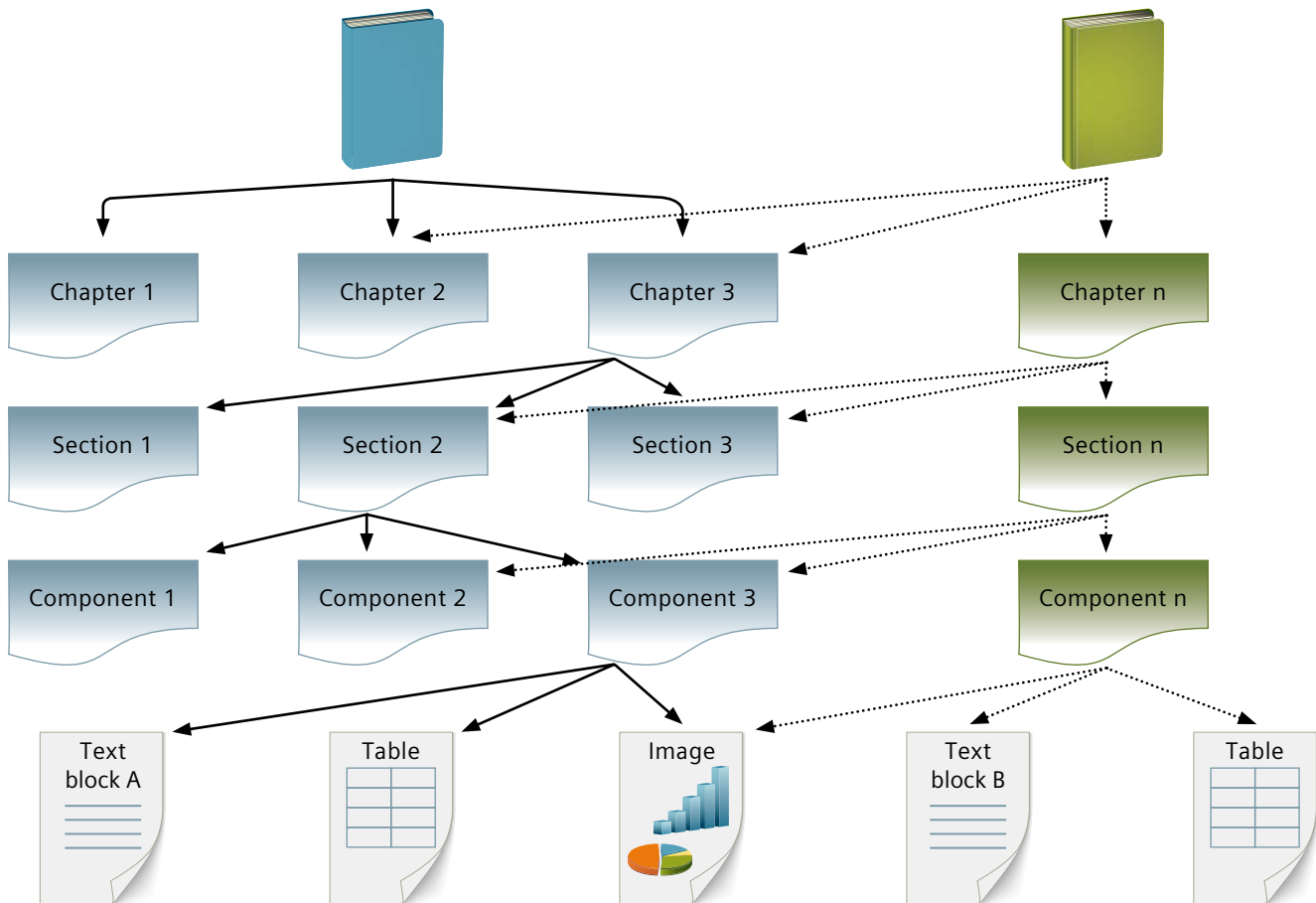
# Commonality between product and documentation lifecycles

## Technical review/feedback process

During the past two decades, significant technology improvements have enabled multiple disciplines in the product lifecycle to work together more effectively. Engineering data management and standards for metadata management have improved communications between engineering teams and shortened the engineering production cycle. Content technologies and their related standards have enabled publication groups to quickly and consistently produce higher volumes of technical documents – as well as facilitate content exchange with business partners and government oversight groups without the need for rework.

A close look at the publishing process and documentation lifecycle reveals similarities and dependencies with today's engineering processes and the product lifecycle. Technical publication groups have direct ties to the engineering design discipline in at least three ways:

- Source material
- Parts data and its related descriptive content
- Technical review/feedback process



Typical parts and assemblies for a technical document.

**Functional system requirements**

Technical writers deal with the same complex parts and assembly constructs as their engineering counterparts. A series of related technical publications is comprised of reusable parts (content and graphics) that can be assembled into documents, such as training materials, illustrated parts catalogs and operation manuals. By looking closely at these manuals, it is easy to see common graphics, operational procedures and descriptive paragraphs.

Graphics often are used in a product’s support documents as well as in documents that describe the product’s related configurations. For example, the steps and graphics that describe a carburetor’s maintenance procedure might also appear in the owner’s manual for a particular model of coupe or sedan offered by the same automaker. To support these models, an engineer must be able to track the assemblies where the carburetor is used, while a technical writer must be able to track all documents where the carburetor is described.

Expanding on this example, the coupe owner’s manual might include a cover photo of the coupe, while the sedan’s owner’s manual might include a photo of the sedan. Each manual’s text content will be different depending on whether the automobile in question is a two-door or four-door model. This configuration-sensitive content has metadata that classifies the content as being appropriate for a specific document. In essence, this metadata is applied to the content’s parts to indicate when it should be added to the document’s assembly, in much the same way that a physical product’s

parts and assemblies are managed in an engineering-driven product data management (PDM) environment.

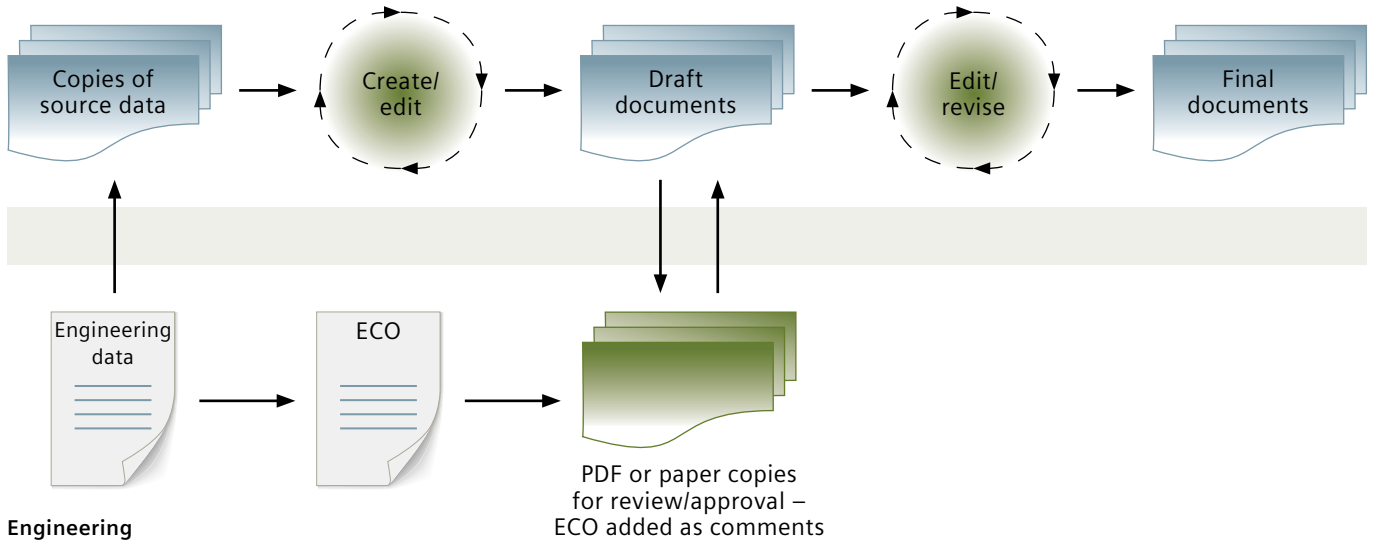
Both the engineering and technical publications environments use repository software to meet the product’s state and lifecycle tracking/reporting requirements. Both environments need to manage access rights. Both need to track contributor changes to the parts and assemblies that they manage. Both need to manage risk and facilitate information technology (IT) efficiency by reducing redundant or duplicate parts and providing a consistent product view.

In addition, both environments require the following key functionalities:

- Workflow/lifecycle management
- Change management
- Security controls, including International Traffic in Arms Regulations (ITAR) and export control
- Project scheduling and program execution management
- Configuration management
- Relationship management
- Visualization
- Collaboration

In the best case, companies have traditionally provided these functionalities to their engineering design and technical publications groups through multiple repository applications – and in the worst case, through directory structures and generic tracking mechanisms that are manually maintained.

**Technical publishing**



*Typical product information flow between engineering and technical publications groups.*

### Source material

Output from logistics, mechanical and software engineering groups usually provide the source materials used by technical writers to create document content. In most cases, source material is thrown over the wall to the technical publications group so it can be reworked. Draft documents are created in the technical publications environment, where source materials can be revised, rewritten or copied/pasted into complete documents. Subsequently, these drafts are thrown back over the wall for technical review by the engineering group.

Concurrently – and in many cases, unbeknownst to the technical publications group – design changes take place in the engineering environment. These changes are provided to technical publications in the form of new/revised content or ECO copies. In turn, the technical writing team updates the in-process documentation accordingly.

### Relationship between data and content

There is a direct relationship between a product's parts and assemblies and the text and graphics that describe them within a technical document. This relationship is so close and complete that many publication groups use part numbers as the metadata for classifying their content.

The engineering design changes that affect mechanical, electrical and software components also drive the changes that are made against a technical document's content and graphics. In addition, although ECOs, their related discussions and authorizations/approvals are tracked in the product engineering and development environment, technical publication groups have a similar requirement to monitor and manage the annotations and approvals associated with a product's documentation content.

### Technical review/feedback

Usually, the responsibility for validating and verifying the content of a technical document falls to the engineering staff. To handle the review and feedback functions associated with the validation/verification process, engineering groups generally work with page-based displays or hardcopy documents.

Engineers sometimes review multiple configurations of the same document content in the same way they review designs that relate to multiple product configurations.



# Today's major improvement opportunities

Technology advances and the implementation of structured authoring have facilitated significant production time and resource management improvements with respect to creating technical document content. Additional progress can be made by capitalizing on the common relationship between engineering design and technical publications. Specifically, the engineering design and technical publication groups can be effectively integrated by:

- Sharing information retained in multiple systems
- Re-using product and service content
- Automating functions and processes common to both disciplines
- Generating document content directly from engineering source data

## Shared systems

Both the engineering design and technical publication environments have similar requirements for managing information in a shareable repository. In addition, engineering changes to the product design act as prompts for the technical publication group to initiate content changes against the product's related documentation.

Today's most innovative companies recognize that the publication process makes considerable contributions (in the form of both design and aftermarket documents) to the product lifecycle. Equally important, they realize that the parts and metadata that comprise these documents are directly related to – and often derived from – the product's traditionally defined parts.

Many companies are making the move to consolidate and reduce the hardware, software and legacy customizations that account for a large portion of their overhead spend.

By moving all of their product data into a single PLM environment and enabling entitled users from all disciplines to work with the same system, companies can reduce the number of systems they employ and cut their related overhead.

Similarly, a single PLM system improves cross-discipline communications while providing an integrated product definition that all product support teams can use to understand the impact of approved design changes. Equally important, take-to-market risk is reduced and time-to-market schedules are improved as companies no longer need to depend on isolated information silos, manually-maintained tracking

mechanisms or individual knowledge workers who may leave the company's workforce vulnerable when they leave the company or retire.

## Content re-use

By combining the shared information capabilities required by both engineering and technical publications, today's companies are positioned to move closer to a true solution for re-using their product-related intellectual assets.

Manufacturing companies typically value part-centric information. Information is developed as the part passes from conception through refinement and testing, deployment, maintenance and obsolescence. As this happens, that information is incorporated into technical documentation. In theory, any information regarding a part should have a relationship to the part. In practice, engineering and publication teams copy, paste and rewrite that information several times over during the life of the part.

For example, suppose Ed from engineering has come up with the concept for an improved widget. Typically, he writes a proposal that includes the rationale and requirements for a new assembly. Then he gets approval to proceed. Given the nature of this process, Ed's company has text and product requirements that describe the assembly before Ed even begins the details of the design. Companies often store and manage this early information in a requirements management database (or lacking that, they may retain this information in Microsoft Word or Excel® files).

At this point, Ed might begin the design by creating, combining or copying and pasting numerous versions of computer-aided design (CAD) files. The design now has expanded to include parts that are contained or used by the assembly. For example, a larger engine component might contain or use Ed's new assembly. In addition, relationships between CAD, computer-aided engineering (CAE) and computer-aided manufacturing (CAM) files that support the manufacturing of the new part also can be created.

At this point, Larry from logistics joins the product development process by creating maintenance, repair and overhaul (MRO) information for the widget. This logistics support analysis record (LSAR) data, which is stored in yet another database, includes requirements and information about other factors, such as mean time between failure (MTBF) and data used internally by the service organization to plan how

and when to service or replace the part. At the same time, Larry also writes instructional maintenance procedures that include each procedure's related steps. In essence, Larry's work describes or supports the part. The company maintains the relationship between Ed's work and Larry's work by using the same part number when referring to the information they produce. As a best practice, this information should be stored in the same system.

Now, Arthur from technical publications gets involved in the product lifecycle. He is responsible for creating all of the consumer and services documentation that needs to be shipped with Ed's assembly. Arthur requests access to all of the information that has been created to date by Ed and Larry, including engineering diagrams, the manufacturing BOM and logistics information. At this point, Arthur might identify documentation from previous projects that relates to the parts in the assembly – and then start to work.

Typically, Arthur might copy and paste from other documents, rewrite content as needed, reorient certain illustrations and edit procedural steps to accommodate both new users and experienced users. When this is done, he will save all of this work in the technical publication group's information repository. After this, Arthur may generate a draft PDF and submit it to Ed and Larry for their review and approval. In many cases, Arthur will be informed that design changes have been made, which will require revisions to his document.

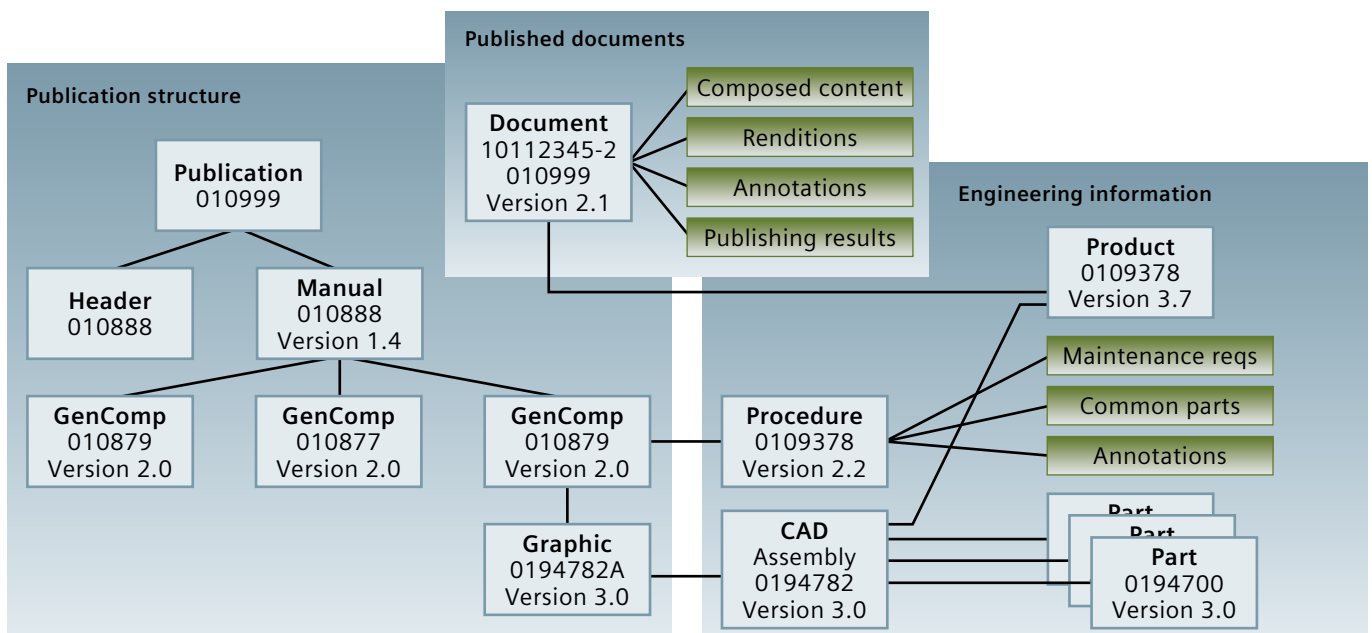
Before Arthur is done, he probably will have created several documentation versions that describe or support the part. Moreover, some of these versions might be a version of the

work previously done by Ed and Larry. Since traditional publication approaches do not link the documentation to its source data, publication teams often add time, cost and even risk (in the form of inaccurate or out-of-date content) to the process of producing technical support documentation.

This workflow could be significantly improved if engineering and technical publication team members were working in the same Teamcenter environment. Arthur could reference design data easily, using the visualization tools to understand the widget and its relationship to multiple systems. He could literally assemble and disassemble it in 3D while writing descriptions and procedural information. And he would only need to change or edit content that directly relates to new or changed product information.

A single PLM-driven repository with state-of-the-art illustration software would enable Arthur to identify – and for part- and procedure-specific content, to programmatically produce – new text and graphics whenever the engineering group updates the source CAD/CAE files.

Equally important, Arthur would receive automatic notification about what specific part or logistics information is affected by the design change. This notification capability is particularly valuable since it frees technical writers from having to research the design change and manually determine its impact. Instead, edits to the source data would be retained between ECOs, allowing Arthur to update the documentation with relevant content less frequently, but more accurately.



Relationship of engineering information and publication structure to published document.

**Functional and process automation**

Besides defining the relationships between all parts and all of the documentation that supports them, Teamcenter facilitates new possibilities for automation, including:

- Automated change impact notification (based on where-used queries)
- Rapid documentation for product variants (configuration-driven document builds)
- Incorporation of other engineering source materials

Assemblies and system configurations use and re-use the same parts. Teamcenter enables engineers and technical writers to determine by query what parts have changed and where those parts are referenced. In turn, this capability allows companies to establish an automated process for notifying engineering groups and technical publication groups about the impact of engineering changes on supporting documentation.

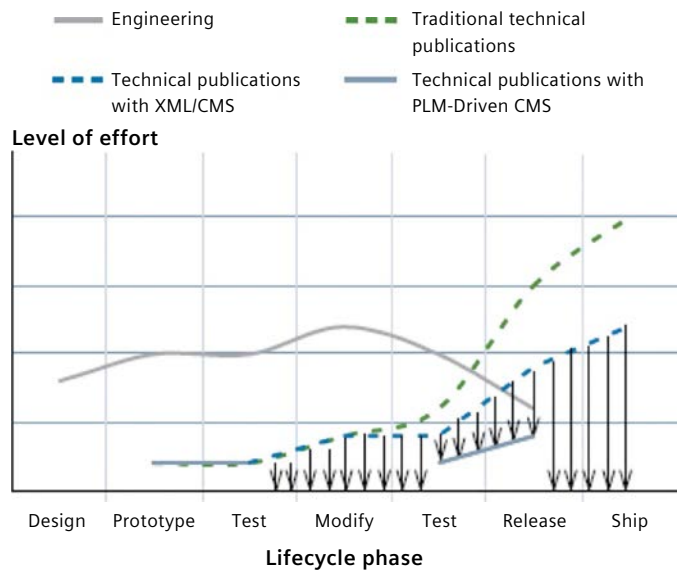
Teamcenter solutions allow publication groups to relate documentation content directly to part and assembly configurations – and store this information with appropriate metadata. This capability enables them to assemble customer-specific publication content. Documents can be built on the basis of part and assembly options, language or any other criteria that is relevant to today’s product management needs. These capabilities are especially valuable for facilitating the rapid publication of product variant documents.

Now, with Teamcenter technical publishing and the Cortona3D RapidAuthor authoring applications, companies can leverage their existing investment in the JT™ data format visualization files and bills-of-material and bills-of-process (BOP) data to generate drafts of part tables and procedural text and illustrations. Arthur and his fellow technical authors and illustrators would be able to edit those drafted document components directly, and build them into illustrated part catalogs and technical manuals.

Once the relationship between engineering data and technical documentation is established, companies can leverage Teamcenter to automatically incorporate other engineering source materials directly into documentation content. For example, part data can be imported directly into illustrated parts catalogs or maintenance procedures – with the extra bonus of programmatically identifying relevant illustrations immediately after engineering changes are identified.

The capability of Teamcenter to relate change impact to notifications about specific follow-on publication activities is especially valuable in publication environments that require the localization of product content.

Similarly, PLM-driven environments are adept at enabling publication groups to build documents that reflect customer-specific or release-specific configurations.



Targeted technical publication efforts restricted to product and engineering changes.

# Moving forward

## Conclusion

As long as product information is managed in discrete and disparate systems, companies face the risks of publishing inconsistent product documentation, delivering it late or incurring unnecessary costs across the publication cycle.

Shared environments that directly relate XML content instances to parts maximize their ability to re-use component designs and document topics. In these environments, information is created only once, at its source, and is re-used throughout the product lifecycle. The relationships between product parts and document content ensures the timely completion of critical-path documentation (which is dependent on engineering data flow) without imposing additional overhead that would otherwise arise from engineering and publications teams working in different systems.

With Teamcenter, the product definition is centrally managed by a repository that functions as the environment's authoritative information source. This central information source pertains to all product information regardless of which configurations or lifecycle states (for example, manufacturing or as-sold BOMs) are being referenced. The environment's shared workflow and data management schemes facilitate the implementation of systematic and repeatable processes.

By leveraging a PLM-driven environment, the Teamcenter technical publishing solution enables companies to manage their technical documentation in the same system they use to manage their product data. This Teamcenter solution supports multiple document type definition (DTD) and schema types, while providing modular options for specialized functionality required in the Darwin Information Typing Architecture (DITA) and S1000D standards.

The use of Teamcenter PLM XML BOM data and JT files further allows part catalog, part table and procedural content to be derived directly. In effect, technical authors and illustrators can programmatically draft text and illustrations that provide a new level of accuracy for both product context and configuration, and effective and accurate illustrations and animations.

## Siemens PLM Software

### Headquarters

Granite Park One  
5800 Granite Parkway  
Suite 600  
Plano, TX 75024  
USA  
+1 972 987 3000

### Americas

Granite Park One  
5800 Granite Parkway  
Suite 600  
Plano, TX 75024  
USA  
+1 314 264 8499

### Europe

Stephenson House  
Sir William Siemens Square  
Frimley, Camberley  
Surrey, GU16 8QD  
+44 (0) 1276 413200

### Asia-Pacific

Suites 4301-4302, 43/F  
AIA Kowloon Tower, Landmark East  
100 How Ming Street  
Kwun Tong, Kowloon  
Hong Kong  
+852 2230 3308

## About Siemens PLM Software

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