GRIPS

Introduction

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Impressum

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1. Advantages of GRIPS

Internet companies such as Google, Microsoft, and Wolfram already tap into the huge potential of semantically linked information models. Since the end of 2012, Google search results not only include list of websites but also additional relevant and useful information related to the object of the search in the form of a knowledge graph – information such as company contact info, location on a map, stock rate, name of CEO, etc. Likewise, STAR Group's GRIPS (Global Real-time Information Processing System) enables similar intelligent processing capabilities by linking related information objects. By supporting geographically distributed and multilingual authoring of structured and linked information units, GRIPS not only supports the creation of product knowledge, but enables semantically linked knowledge management on all business-critical objects. This benefits product communication as well as marketing, sales, after sales, and your customer.

- **Improving after sales work efficiency and reducing costs through flexible work processes:** Most after sales maintenance, diagnostic and repair processes are rigid because the supporting information is rigid: maintenance plans are static instead of dynamic, diagnostic and troubleshooting guides are prescriptive rather than situation-based, and repair instructions do not allow for optimized coordination of work steps. This "one size fits all" approach not only wastes resources such as time and material, but also increases the customer's cost of ownership. Supportive information is rigid because it is written by technical writers with a specific target scenario, target document, and target audience in mind. GRIPS makes information production and usage flexible by enabling the engineering of semantic information units which can be dynamically compiled and repurposed on demand for specific use cases and contexts. The result is highly relevant, efficient, dynamic instructions that support situation specific troubleshooting processes, dynamic maintenance plans, and optimized repair instructions. This reduces preparation steps, expensive materials and tools, and time and costs all which lead to increased customer satisfaction.

- **Enhanced re-use, standardization, cost reduction, and quality of information production:** The semantic approach improves the efficiency of capturing information. Many information units can be re-used and do not have to be entered again. The system's authoring support works in a precise domain context, such that information units can be efficiently identified and referenced. This enhances re-use, content standardization, and the consistency and quality of all information products. The enhanced re-use level reduces the number of newly authored information units which reduces not only authoring costs but also translation costs for each target language as existing translations of re-used information units are re-used as well.

- **Improved sustainability and protection of investments:** Based on the product-centric, domain-based, stable, detailed, and granular semantic information modeling and management, future requirements can be satisfied without having to restructure or migrate the content base or add new metadata to existing information units. In the near future, it is quite possible that technicians will perform installation and maintenance tasks while wearing smart glasses. To support this, GRIPS can manage 3D product information along with product orientation information and models such as view, angle, rotation, etc. Using these models, installation and maintenance instructions can be positioned at the right location and orientation in the field of vision of the smart glasses. GRIPS already supports 3D models and linking of additional information (e.g. torque, tools, etc.) to product components. Supporting smart glasses would simply require the implementation of a new publishing channel.

- **Scalability, seamless integration, and product information logistics support:**
  GRIPS' optimal balance between server and client-side processing results in low network load and excellent scalability. Through information exchange standards – both generic (e.g. XML, XSLT, DITA) and domain-specific (e.g. IGES for CAD, ODX/ OTX for diagnostics) – GRIPS provides seamless integration into existing business system environments. The product-centric approach in combination with two-way communication support (publishing and feedback) enables end-to-end coverage of the entire product information logistics from R&D / development / engineering, production to marketing, sales, after sales, customer service and support.

- **Product lifecycle collaboration support with shorter cycle times:**
  Today's product information creation happens in siloes. Product marketing, engineering, production, sales, training, and after sales each create their own separate siloes of information, frequently duplicating existing content from other departments. On the other hand, GRIPS facilitates collaboration among different departments throughout the product lifecycle. GRIPS supports multilingual, distributed content creation and includes a controlled and efficient translation and localization process that provides accurate and timely translations whenever sub-sets of information are released. Starting content creation work early and in parallel with the main product engineering process reduces the overall product launch process. With this approach, only a few remaining pieces of information have to be gathered and translated at the end of the product development process.

- **Automatic synchronization and distributed governance for accurate information:**
  Content origination and creation is not restricted to authoring in GRIPS. Content can originate from and be automatically synchronized with PLM, CAD, PPS, and software/firmware development systems through a controlled change management process whenever new content and data it is released in those systems. GRIPS enables distributed content governance that supports organizational and geographically distributed ownership of different segments and subsections of the product lifecycle information (e.g. troubleshooting and diagnostics information can be owned by after sales and product specifications and technical details like torque by engineering). This ensures information is up-to-date and accurate.

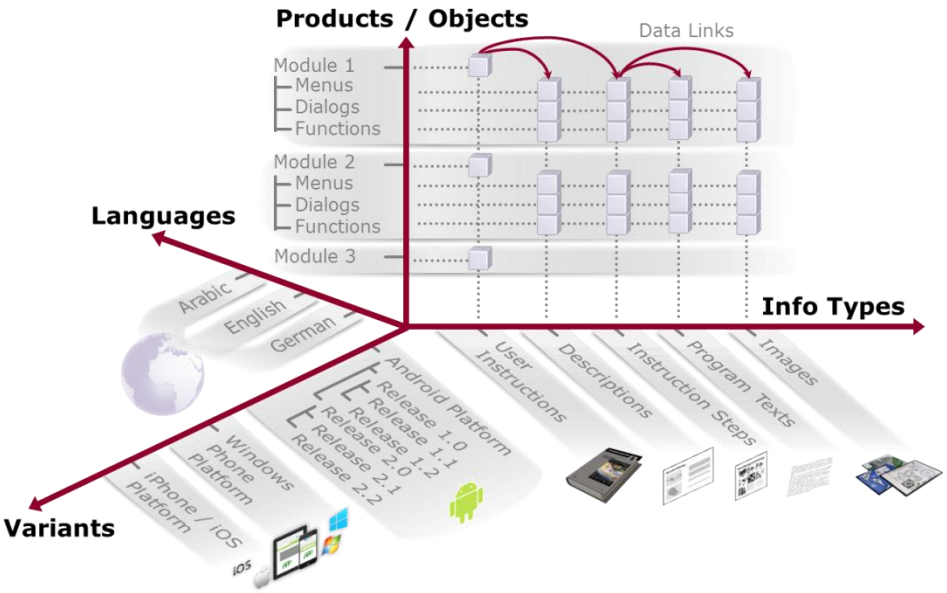
- **Semantic – meaning driven – authoring support and automatic processing:**
  In addition to modeling information structures, GRIPS also supports the modeling of relationships and dependencies among product components, variants, and product families. The granularity of modeling can be down to micro components of a product. As all information is captured in a specific semantic context (product, variant, info type, and language), all context-dependent metadata and attributes (e.g. product or variant name and description, components and relationships) are automatically provided to the author and stored with the information. The semantic context not only facilitates interpretation of the information by humans, but makes information discoverable and interpretable by machines – a prerequisite for further automation of information processing.

- **Causal links between functions and hardware for more efficient troubleshooting:**
  The information model supports capturing of the logical and physical relationships between functional systems (e.g. brake system) and the hardware components (e.g. ABS sensor, brake pads, etc.) supporting the functional system. Causal links are a prerequisite to providing accurate, context sensitive and efficient diagnostics and troubleshooting support.

2. Semantic single sourcing

Structured authoring has become the standard in technical writing. Since its inception in the 1960s, numerous methods (functional design, information mapping, etc.), standards (DITA, ASD S1000D, etc.) and systems have emerged and been established on the market. The key to success lies in the modeling of different information types, which serve as the basis for information categorization. The goal is to store and manage each piece of information only once. This approach is called "single sourcing". STAR has further developed the methods of structured authoring and principles of single sourcing to the concept of semantic single sourcing and has implemented this in the ground-breaking GRIPS semantic content management system.

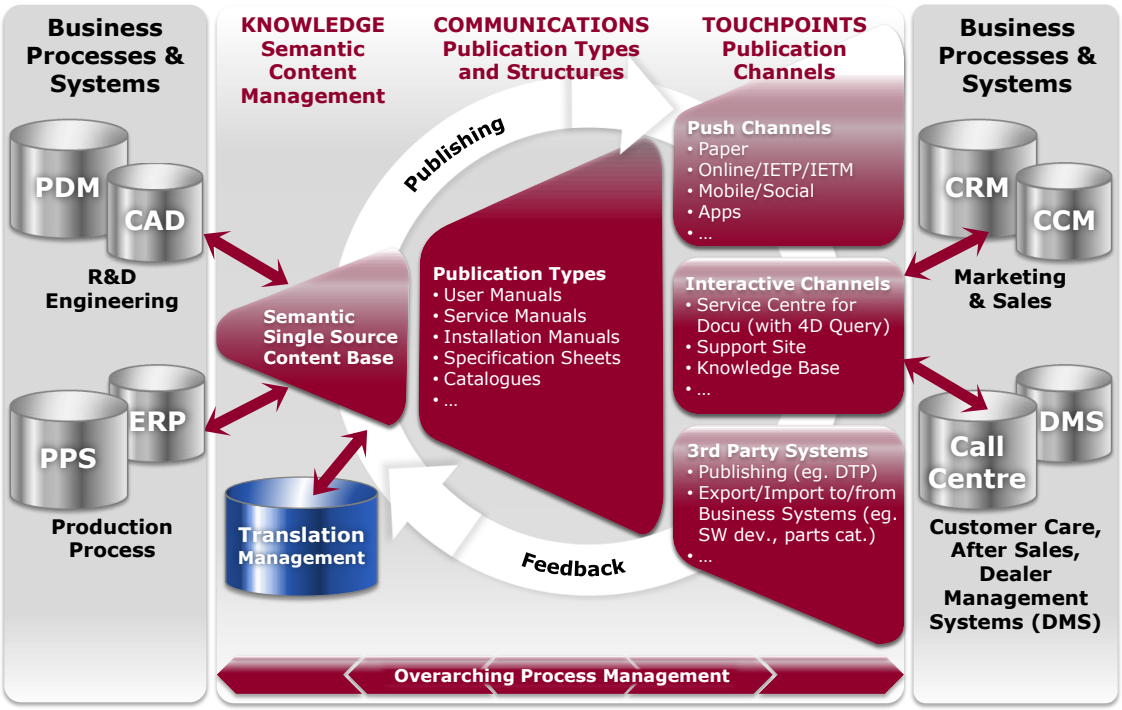
The concept of the semantic single sourcing draws upon approaches, methods, and standards of structured authoring of categorized information types and augments them with three additional categories: the product / object category to describe objects and their components / modules; the variant category for product variants; and the language category for structuring content and foreign languages. As it is captured, a content / information unit[1] is related to an entry in each of the four categories; it can then reference other information units via data links. The picture below illustrates the four categories using a highly simplified structure for capturing and managing content for mobile phone apps.



"Positioning" each information unit in an exact context of product / object, variant, information type, and language establishes the meaning of each information unit. Based on the four categories, GRIPS implements efficient and sustainable semantic content management across product, variant, and country / language boundaries. The semantic representation increases re-use, reduces costs, makes it future-proof and enables machine-based information discovery, interpretation, and processing.

[1] Information unit: A unit of meaning (semantic closure) to answer a question.

3. Authoring and information processing model



The GRIPS authoring and information processing model[2] distinguishes three Layers of information processing and works bi-directionally:

- **Semantic content base layer:**
  Information units and their references (links) are captured in the context of product, variant, and authoring language. Each information unit automatically "inherits" the complete set of existing properties, rules, and relationships that facilitate and reduce authoring efforts. Information units are captured, content checked, released and translated where needed regardless of publication / document type and channel. The overall authoring process can be accelerated by working in parallel on independent information units with different release statuses. The product-centric representation also facilitates exchange / synchronization of content with R&D, engineering, software development, production and suppliers. The GRIPS content base is available with two alternative information models: the generic semantic information model (IRIS) and the specialized ASD S1000D standard model for aerospace and defense, train and ship building.

- **Publication / document types and structures layer:**
  Content and publication structures are defined for each type of publication / document / communication. This is achieved by hierarchically linking information units from the GRIPS content base. The publication structure is generic and not yet specialized according to the requirements and restrictions of particular publication channels. Therefore, it is well-suited for channel-independent content reviews.

[2] Authoring Model: Consists of information, process and role models for information development and management.

- **Publishing channels layer:**
  The rule-based channel-specific publishing, including layout and formatting, is performed for paper, online, mobile, and business system exchange channels. Push channels (with targeted audience and distribution) as well as interactive channels and export / import channels to and from business systems (e.g. to InDesign, dealer management systems, electronic parts catalogs, or from/to DITA solutions) are enabled. The information logistics can therefore be easily extended by new and future channels to support new customer touch points.

- **Two-way communication:**
  GRIPS not only publishes (outputs) information, but can also receive input, qualified feedback, and usage statistics from users or systems and link it to the appropriate information units. This enables continuous improvement of the information and process quality as well as organizational learning.

- **Translation and localization management:**
  Each information unit has a defined authoring language and contains links to the corresponding translations in all target languages required for a project. GRIPS automatically manages packaging and export of updated information units to a translation management system or provider and import after translation. A translation package exported by GRIPS provides very detailed (semantic) context information for each information unit which not only facilitates human translation, but also improves performance and quality of machine translation. Localization of measurement units is done automatically by GRIPS and does not require manual efforts.

4. Managing semantic content

4.1. GRIPS Matrix

The GRIPS Matrix is the central navigation and management tool for creating, browsing and updating semantic structures and content as well as for managing information links. GRIPS Matrix supports the following functions:

- **Configuration of the address range for database management**
  The database is managed transparently for all users in four dimensions: information type, product component, product variant and language. These four dimensions define an address range in which the user can easily navigate within the database. The user can also assign status information to the managed information units indicating the status of the content in the information units (see also 5.4.)

- **Configuration and management of address rights**
  In the GRIPS Matrix, permissions can be set up to grant access to specific address ranges to user groups or individual users.

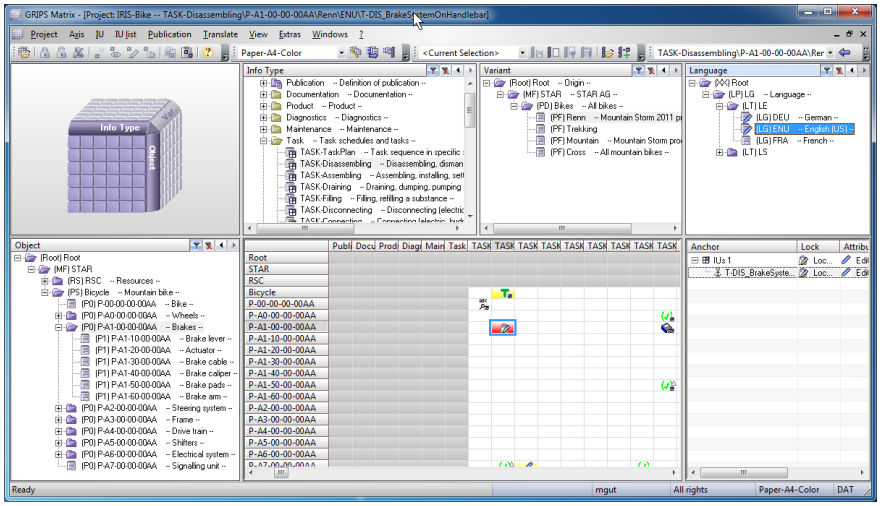
- **Searching the database**
  In the GRIPS Matrix, individual information units can be searched in the database by property or identified based on stored text.

- **Importing information units**
  Information units can be imported from the file system and stored in the matrix.

- **Translation process control**
  The entire translation process can be controlled, from translation planning (cost estimation) to assignment and insertion of delivered translations into the database.

- **Publishing process control**
  In the publishing process, all information units from the database that are necessary for publishing are compiled and converted into publication files which are used to create the paper layout, browser view, or files for data exchange.

- **Content base control**
  The GRIPS Matrix lets you view the most recently changed information units, content differences between two different edited versions of an information unit using file comparison software, and cross references for individual information units.

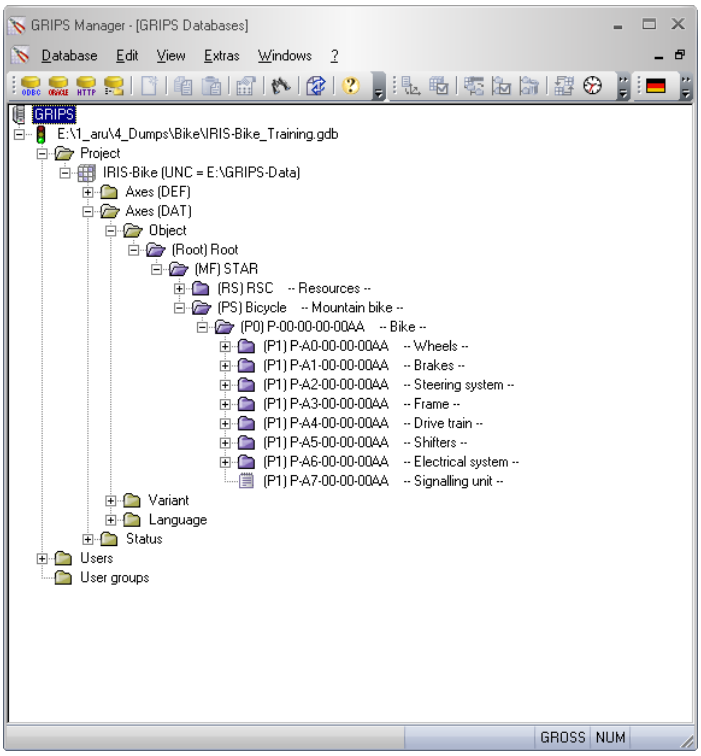


4.2. GRIPS Manager

The GRIPS Manager is the GRIPS database and project configuration and administration tool. It also performs the following functions:

- **Administration model configuration**
  The GRIPS Manager is used to configure the four-dimensional administration structure reflected in the coordinate axes of the GRIPS Matrix (see also 2 for a description of the four dimensions).
- **Status model configuration**
  The predefined statuses (e.g. “In process”, “Check content”, “Released”, etc.) for controlling the authoring process are defined in the GRIPS Manager.
- **User model configuration**
  Users, user groups and their basic rights are managed in the GRIPS Manager.
- **Content base monitoring**
  The GRIPS Manager can check the structure of the information units against the information type definition. It also verifies whether content links (data links) are valid and all files used are available.
- **GRIPS content base synchronization**
  Information units and properties can be managed across different GRIPS content bases in multiple locations and can be synchronized by the GRIPS Manager.

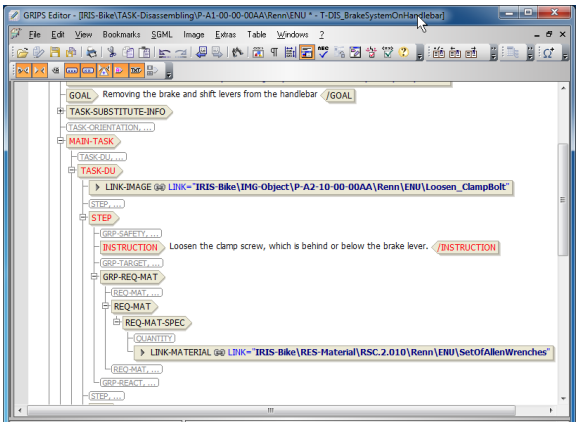
Below is a screenshot showing the GRIPS Manager with the Administration model configuration.



5. Intelligent real-time authoring, review, publishing and integration

5.1. GRIPS Editor

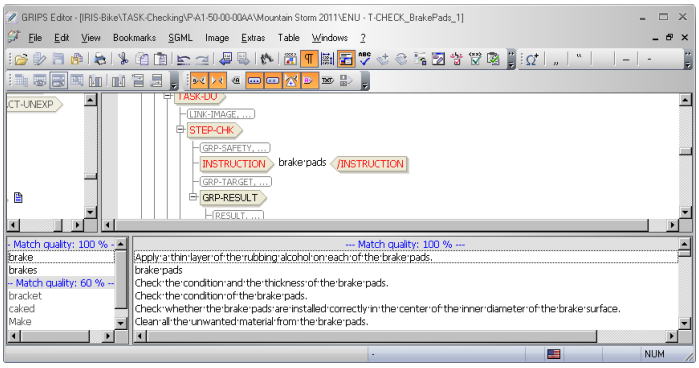
The GRIPS Editor is an integral part of the GRIPS software. It supports the editing of information units independent of document type and layout. The focus lies on content discovery and capturing guided by pre-defined structures from the GRIPS information model. The GRIPS Editor makes use of the following functionalities: display and navigation of structures; display and editing of content; linking among information units; MindReader suggestions; spell checking; preview of images and graphics. The screenshot below shows the GRIPS Editor.



The optional terminology checker (TermStar / WebTerm) can be used in the editor to recognize terms that should not be used and to suggest the preferred terms.

5.2. GRIPS MindReader

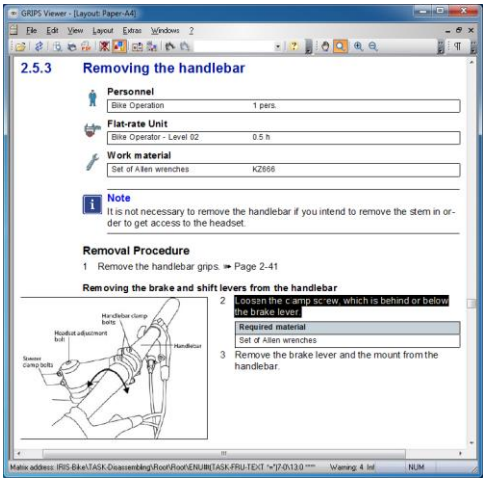
The GRIPS MindReader component enables intelligent real-time authoring support. MindReader indexes all previously captured and approved content and makes context-sensitive suggestions (including indication of match quality) during the writing process. Appropriate content suggestions can be copied with a click of the mouse. MindReader can also identify the corresponding information unit which contains the content suggested. The information unit as a whole can then be referenced – and hence re-used – with the added advantage that all translations available for that unit are also re-used. As all suggestions refer to approved and released content, only the correct content and terminology are being re-used. The image below shows the GRIPS Editor with the MindReader panel opened below the editing window.



In the example above, the author starts typing “brake pads” at the beginning of an instruction and MindReader suggests among others “Check the condition and the thickness of the brake pads.”

5.3. GRIPS Viewer

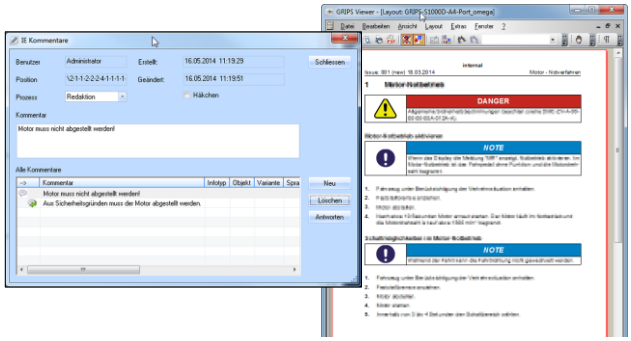
Like the GRIPS Editor, the GRIPS Viewer is also a standard component of the GRIPS software. It supports on-demand, real-time viewing of information units and entire documents in a specific print layout (xHTML viewing is done in a web browser). The viewer keeps track of the information units underlying each segment of content in the layout. The screenshot below shows the viewer with a layout view of the information unit from the screenshot shown in Section 5.1 above. Navigation works in both directions from the information unit to the layout view and from the layout view to the information unit (e.g. double clicking on the text highlighted below opens the GRIPS Editor with the view displayed in the screenshot in Section 5.1above).



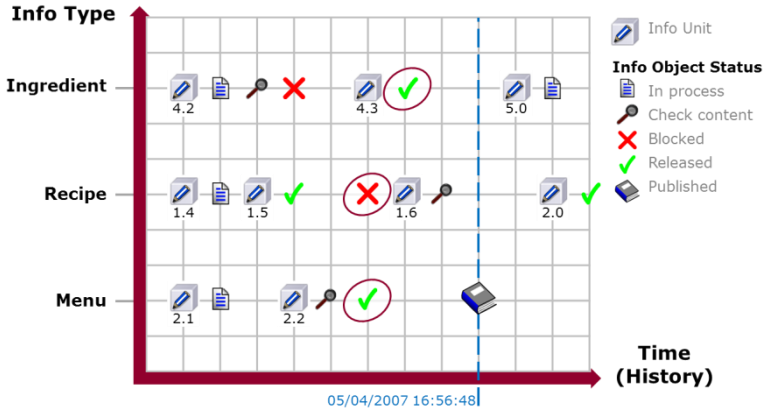
The viewer supports the layouts supported by the GRIPS publisher (see section 5.5) and also supports object oriented reviews as described in section 5.4 below.

5.4. Object-oriented review and release process

GRIPS provides an object-oriented commenting function to support content and document reviews, usability tests, and approval processes. When capturing a comment for text or a picture in the Viewer, GRIPS automatically allocates and stores the comment with the corresponding information unit in the content base (GRIPS Oct. 2014 Release, see picture below). This facilitates the authors' updates and changes. The search for and identification of information units corresponding to a commented content unit is not necessary. Comments from reviews of different document or publication types that re-use the same information unit can be considered and integrated in a single update. Therefore, the object-oriented commenting function increases the efficiency and consistency of the update and change management processes.



GRIPS controls the release process via its object oriented status model. Each information unit is versioned independently and passes different statuses which are recorded in its unique individual history. When an information unit is released ("released" status), it can enter a final publication. Draft publications (e.g. for previews) as in the example below can also include objects that have yet to be checked ("check content" status). The history mechanism supports the seamless tracking of the change history and previous statuses of each individual information unit.



5.5. GRIPS Publisher

The GRIPS Publisher is based on a very flexible multi-channel transformation engine which automatically transforms the GRIPS semantic structures and content into target structures and formats. The standard formats supported by the publisher are paper, PDF, xHTML (for web sites and Interactive Electronic Publications – IETP), and XML. In addition DITA and S1000D (incl. ShipDex, RailDex) are supported. In addition to transforming GRIPS structures into target formats, GRIPS Publisher uses customizable publishing rules which determine how a specific GRIPS structure is mapped and represented in the target format (e.g. if the time units for each work instruction of a repair process are summed-up in a total time at the start of the process description, if they are listed individually in a table at the start, or with each instruction). Publishing rules provide the necessary flexibility to produce a professional layout without any manual intervention.

5.6. GRIPS Planning & Reporting (Cockpit & Dashboard)

Planning and monitoring of publication projects is handled in GRIPS Cockpit. GRIPS Cockpit supports the planning of publication projects within the GRIPS Matrix and monitors their progress. The planning information used for this purpose is saved as information units in the GRIPS content base. The Cockpit information model contains the following four main info types:

- *Cockpit projects* contain planning information such as planned start and end dates, responsible person, cost center, and assigned publications
- *Publications* describe a specific publication type with its target languages and other planning information
- *Change requests* describe a necessary change of the content for one or more publications
- *Tasks* contain user instructions to perform a change request.

The GRIPS Dashboard is a configurable reporting tool producing reports on status, progress and details of a publication project.

5.7. GRIPS Data Exchange Interface

The GRIPS data exchange interface is a generic transformation mechanism that supports any source and target publication format and channel. Outputs can be produced for common marketing and sales platforms as well as for call center and after sales systems.

Inputs in any source format can be imported and converted to GRIPS semantic structures (e.g. imports from PLM, PPS, and software/firmware development platforms). GRIPS provides excellent support for integration with software/firmware development: software resources like program texts and graphical user interface (GUI) components can be synchronized automatically with the software development platform and managed in the GRIPS content base. GRIPS then takes care of the correct terminology, translation and localization into all target languages for all software resources.

There is also a standard data exchange interface for importing and displaying 3D models from Dassault Enovia/3DVia. Hence, the GRIPS data exchange interface is a powerful and flexible data exchange mechanism. In addition to integration via data exchange, GRIPS can be tightly integrated into any system environment through its API (see section 5.8 below).

5.8. GRIPS API

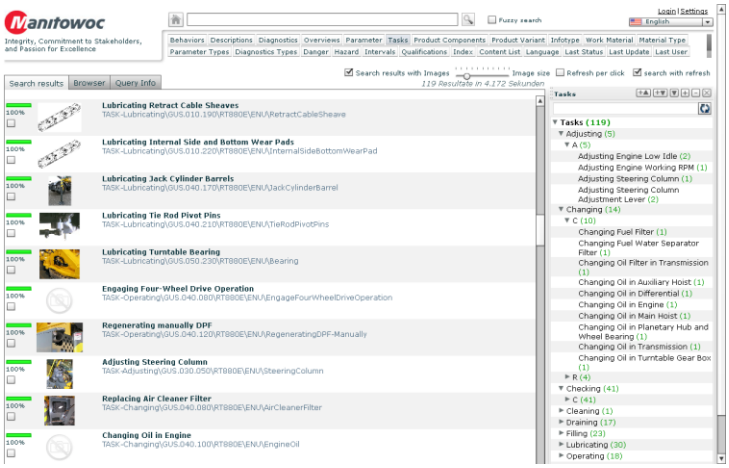
The GRIPS API is based on Microsoft .NET and includes the full functionality of the GRIPS server. All GRIPS components described in the sections above use the GRIPS API (this ensures that the API is always up-to-date and includes the newest functions and features). Using the API, entirely new front-ends to GRIPS can be developed and the semantic content management functionality provided by GRIPS can be utilized by other systems and platforms as well.

6. On demand dynamic content delivery and feedback

6.1. 4D Query information-mining environment

In many content management systems, information units are only directly accessible to the authors. All other stakeholders receive information only as publications in the form of user and service documents, online support, diagnostic sites, etc. Consequently, in those publications only questions anticipated by the authors are publicly addressed. All other questions and information needs are not addressed (e.g. Which parts can be replaced on this product? Which adjustment tasks can I perform on this product to maximize its performance?). The knowledge units[3] and thus the work of the authors yield only a fraction of their potential benefits.

Therefore, an information-mining environment has been developed for GRIPS: 4D Query. In 4D Query, users can run queries, filter, and navigate on an exported extract of the GRIPS content base. With 4D Query, questions and information needs that have not been anticipated by the authors can be answered. In the example below, technicians can use 4D Query for a particular product variant to list all possible work tasks related to making changes or adjustments to the machine.



The user interface of 4D Query can be adapted to the needs of a customer or group of users. The selection of a particular product component for a query or navigation step can also be supported using a graphical image of the bill of material of a product such that the user can visually and interactively explore the information space for that component: “What can I do with this component? How can I adjust it, maintain it, replace it? Which failure modes and functions relate to that component based on which causes, and how can I fix those malfunctions?”

With 4D Query, GRIPS becomes an information-mining environment and source of knowledge, which dynamically delivers user-specific answers for unanticipated and potentially complex questions on demand. The organizational knowledge accumulated in the semantic content base helps users with different skill levels and tasks to get answers to their questions, to learn, to increase productivity, enhance value, and to develop new organizational knowledge.

6.2. Distributed Collaboration

GRIPS supports collaboration of multinational, cross-disciplinary teams and synchronization of geographically distributed semantic content bases. Content can be authored concurrently in differ-

[3] Knowledge unit: Semantically linked information unit with closure of content and meaning.

ent authoring languages and the built-in translation support ensures that newly added content gets translated to all target languages.

6.3. Personalization

Due to its rich structure and granular semantic content management, GRIPS provides excellent personalization capabilities: content can be filtered against product configurations to insert or remove content in a publication depending on the exact configuration of a specific product for a specific customer. The applicability of content (like a work instruction) can be linked to a specific skill or qualification (like a field technician) and can be personalized or filtered by skill or qualification. Tools, materials (e.g. lubricants, screws, bolts, etc.), time and measurement units can be linked to content and be used as filter criteria (e.g. to produce a compilation of all work steps using a specific tool or material). The personalization capabilities of GRIPS are generic and can be used also for personalization by user profile – a process typically performed for personalized marketing communications.

Content referring to tools, material, time, and measurement units can be aggregated in GRIPS to produce tables showing all tools, material, and time required for a specific complex work procedure (see screenshot in 5.1 for a simple example). Since this aggregate information is not static and predefined in advance, but rather dynamically compiled on-demand at run-time, it can be used in both personalized product communications as well as for dynamically produced context specific information – for example an on demand maintenance plan for a specific vehicle (see example in section 7.1 below).

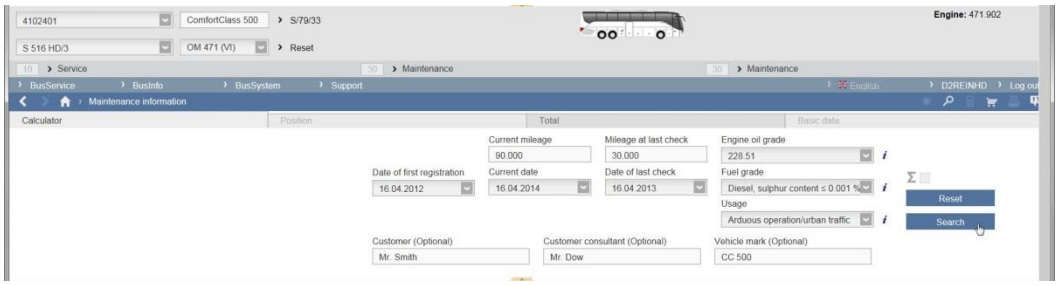
6.4. Feedback channel

GRIPS supports two-way communication. In addition to personalized and context sensitive publishing, feedback from end-users can also be captured (automatically or manually) and stored together with the information unit the feedback is related to. (As mentioned in section 5.3 on the GRIPS viewer, GRIPS provides a link to the underlying information unit for each output component.) Feedback can be used to continuously improve the content and its usefulness. It can also be used to gain information on which content has been used or applied most successfully in a specific situation. In interactive applications – like troubleshooting and diagnostics – this information improves the relevance and efficiency of the information provided.

7. Highly efficient dynamic maintenance, repair, and diagnostics

7.1. Dynamic maintenance and repair

Typically, maintenance and service plans are static and not optimized for individual products. This can lead to a waste of scarce resources such as time, money, and materials. Not so in GRIPS. When maintenance plans, intervals, and materials are managed in GRIPS, you can produce dynamic maintenance plans and servicing strategies. Maintenance plans created in GRIPS take into account variables such as time and usage intensity (e.g. for a vehicle the mileage) since last service, quality of the consumables (e.g. oil and fuel quality) and operation conditions (usage profile). For example, a dynamic maintenance plan for a bus can vary greatly depending on how demanding the operational conditions are: touring cross-country being the least demanding while inter-urban service to arduous or city service being the most demanding on engines, brakes and body. The screenshot below shows a maintenance planning front-end used by a GRIPS customer for buses.



Maintenance information is dynamically compiled for different contexts. A bus might come in to a service station for just two hours and an individualized maintenance plan needs to be produced combining all maintenance steps which have high priority for this vehicle, require similar skills and tools, and for which the materials required are already in stock and do not have to be ordered. The dynamic maintenance capabilities of GRIPS are revolutionizing how maintenance is done. Instead of a predefined static, rigid, and expensive maintenance schedule, it is a product's individual configuration, history and current context (time vehicle is available for maintenance, budget for maintenance, etc.) that determines which maintenance tasks will be performed.

Similar to dynamic maintenance, repair information can also be dynamically produced and individualized in GRIPS. For example, when performing multiple repair steps after an automobile accident, a service technician can combine repair steps which all require (as pre-work) the car to be put on the lift or which all require a specific expensive tool (like a diagnostics device) which is available only once in the service station and is therefore in high demand. Dynamic maintenance and repair make an efficient use of scarce resources and increase customer satisfaction.

7.2. Dynamic diagnostics

Similar to maintenance, most diagnostics and troubleshooting routines today are statically generated. Diagnostic trees produced by Failure Mode Effect Analysis (FMEA) are defined by engineers or after sales specialists and do not take into consideration any contextual information like time, tools, shared preparation steps, etc., necessary to produce a more effective, relevant, and individualized diagnostic procedure on demand. GRIPS manages fault codes, symptoms, causes, links to repairs, and feedback from previous diagnostic sessions. Unlike other content management systems. GRIPS also manages the links to a model of the product's structural and functional breakdown as well as the links between components in the two models (e.g. how hardware and software components are related to support different breaking system functions like normal braking, manual brake, assisted braking with ABS/ESPS, etc.) Those functional and structural models are

then used to produce context sensitive and efficient diagnostic procedures. Moreover, feedback collected from many diagnostic sessions help to identify the most relevant diagnostic or trouble-shooting strategy for an actual problem.

8. GRIPS Key Differentiators

With its product-centric, semantic content management technology, GRIPS is a future proof, next generation information management platform. The GRIPS key differentiators are listed below.

GRIPS	Others
Product centric information structuring	Document centric structuring
Semantically linked meaningful information	Standard information per document type
New channels supported without re-creation	Info re-creation required to support new channels
Management of semantic content structures	Management of content chunks with metadata
Concurrent multilingual authoring/feedback	No concurrent authoring languages
Distributed content governance and monitoring	Single site content governance and monitoring
Rich support for translation/localization	Minimal translation/localization support
Two-way communication including feedback	One-way publishing support only
Personalized, on demand communications	Publishing of predefined information structures
Information discoverable and can be automatically processed by machines	Metadata approach limits auto processing
Seamless integration with development	Direct import of development info difficult
Auto syncing of software texts and GUI elements	Software resources not synced with documentation
Dynamic maintenance, repair and diagnostics	Static maintenance, repair and diagnostics info
Integrated, editor, viewer and publisher	Third party editors, viewers and publishers.
Direct navigation between layout and info unit	No transition between layout and info unit
Modeling of relationships between objects	Modeling of relationships between information
Causal links between hardware and functions	Separate handling of hardware and functions
Strong support for cyber-physical systems	Weak support for software/hardware systems
End-to-end product lifecycle coverage	Minimal support for engineering and after sales
Seamless synchronization with engineering and production due to product centric structure	Breaks between engineering and documentation logic due to document centric structure
Content creation in parallel and incremental with product development	Content creation postponed to end of development.
Semantic context proximity measure improves translation quality	No context proximity measure because of missing semantics
Highly granular single sourcing	Single sourcing based on content chunks