

# Documentation for aircraft maintenance based on Topic Maps

Kay Kadner SAP Research, Dresden, Germany kay.kadner@sap.com

SNOW - FP6/2003/IST/2

David Roussel EADS Corporate Research Center, Toulouse, France david.roussel@eads.net

## Outline

• Introduction



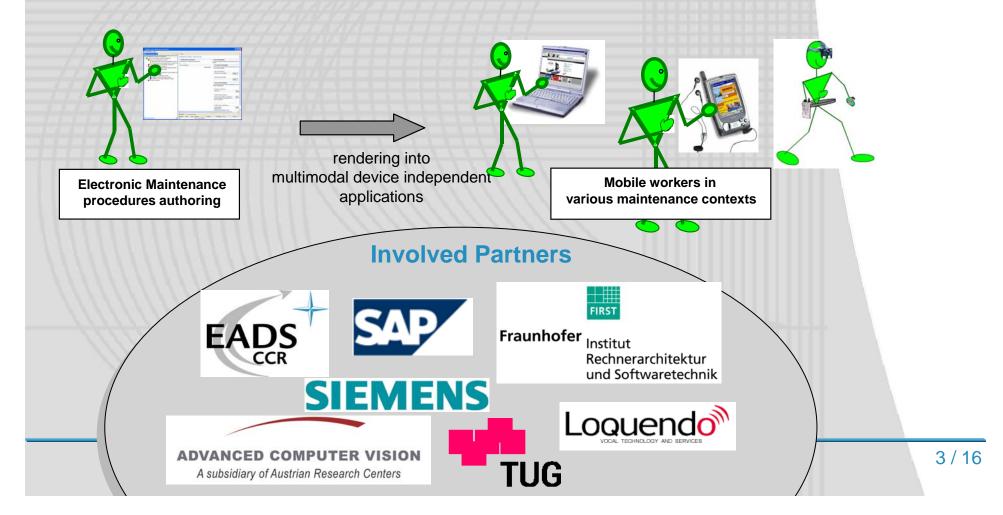
- SNOW Authoring tool features

- Semantic enrichments
- Descriptors for rendering
- First feedbacks on benefits (field assessment)
- Conclusion ... about Topic Maps through S1000D Glasses



# SNOW

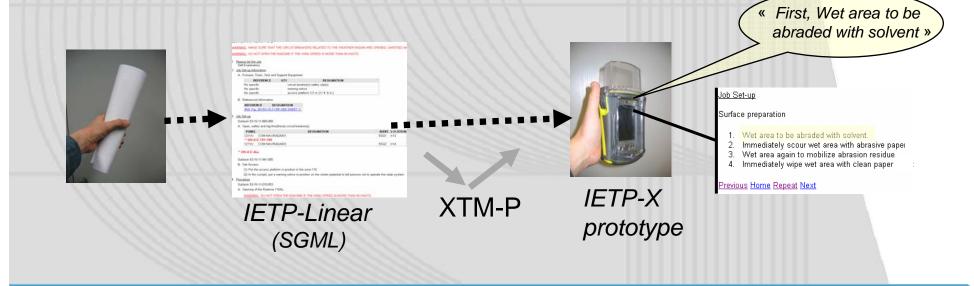
- Perform various maintenance operations with the best adapted multimodal mobile devices
- Author the documentation for this



## **Topic Maps standard inside SNOW**

[XTM 1.0] norm is used in a specific way (= XTM-P) to describe maintenance procedures considering :

- Interactive Electronic Technical Publication (IETP) structured world
- Content formalization Versus multiple designations for a same "entity"
- Decomposition into interactions (i.e. traceability requirement)
- Adaptation to various output modalities and devices



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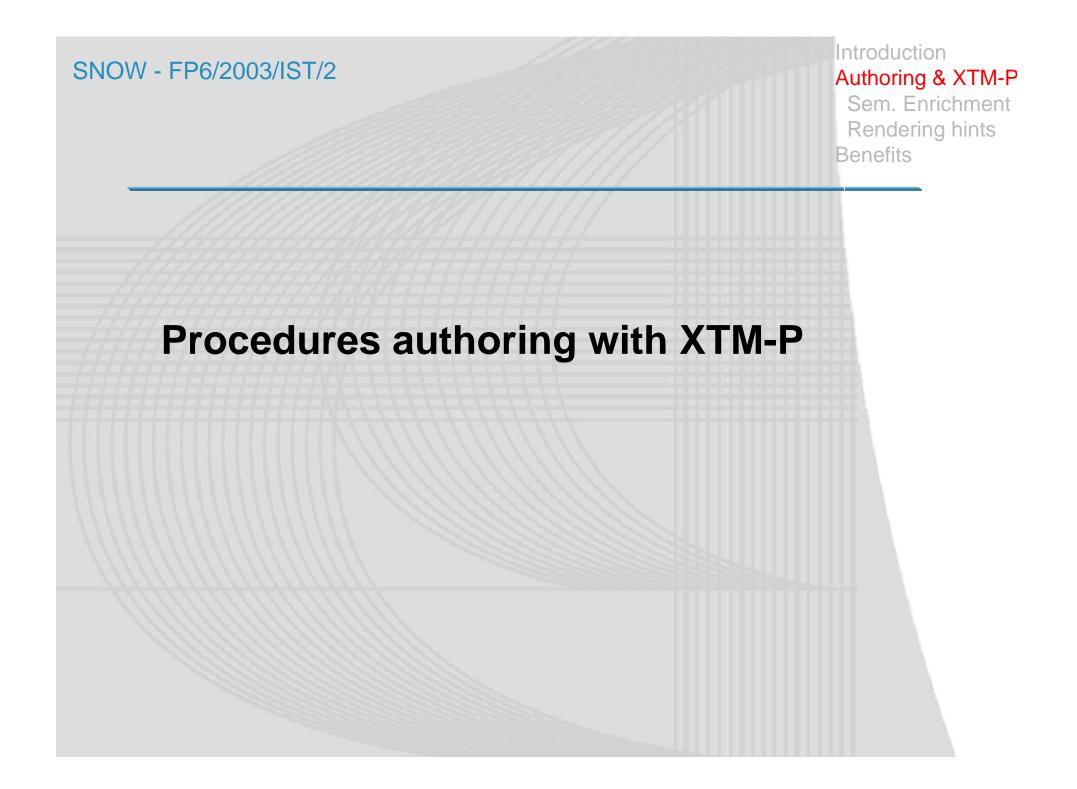
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#### Introduction

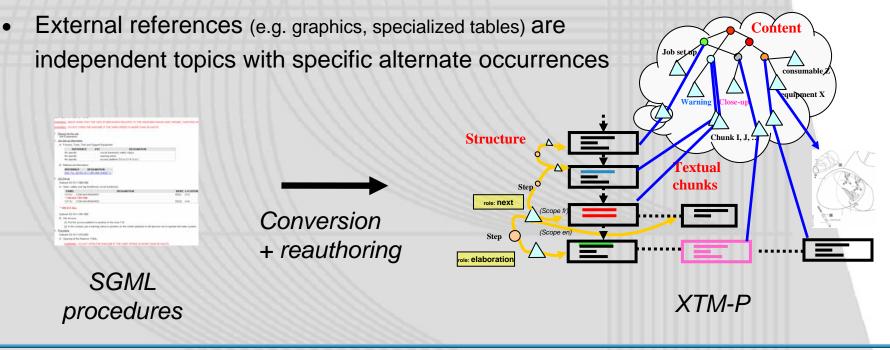
Authoring & XTM-P Sem. Enrichment Rendering hints Benefits

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## XTM for procedures (XTM-P): basic ideas

- TM supports both the contents description and structure description through a set of predefined subjects and templates
- Textual contents are granular enough to be included into the TM constructs
- (Then) the layout is optimized by coupling TM attributes and styling

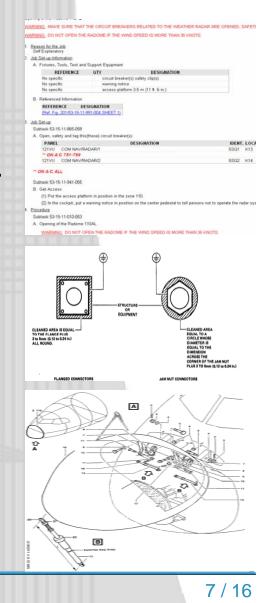


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## Structured content description: required primitives, templates, ...

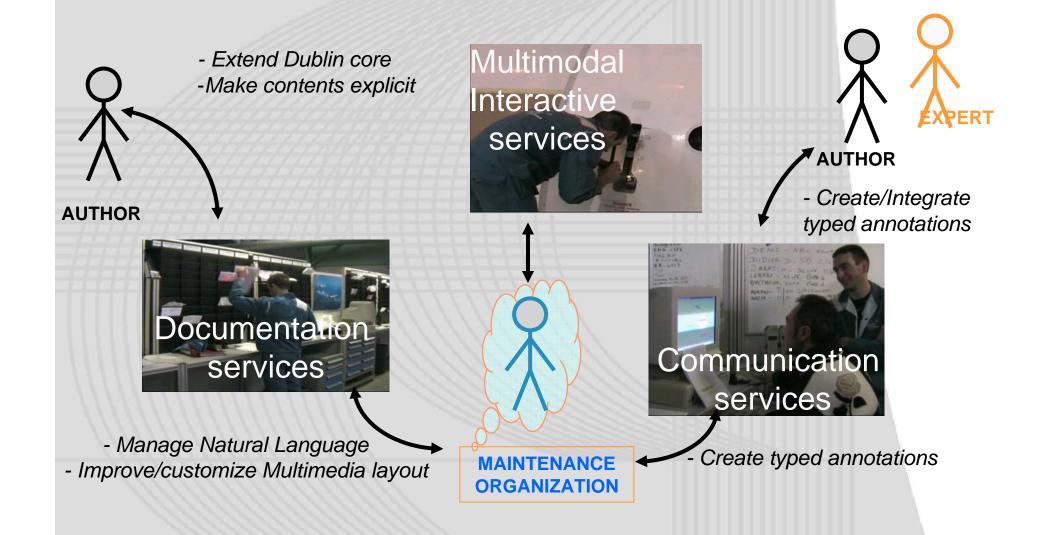
- Metadata: Dublin core, aircraft technical parts ...
- Status: Note, warning, caution, ...
- Organization:
  - Job setup info, Job setup, Procedure, Job close up, ...
- Associated references:
  - Equipment, tool, consumable, graphic, ...
- Hierarchical relationships:
  - Phase, step, instruction, ...
- "TBD" relationships (underspecified in the S1000D)
  - A graphic can be self-commented, or identify an equipment part mentioned outside
  - A note can give an important condition for a task or a local background for an instruction



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## **SNOW services & Authoring environment**

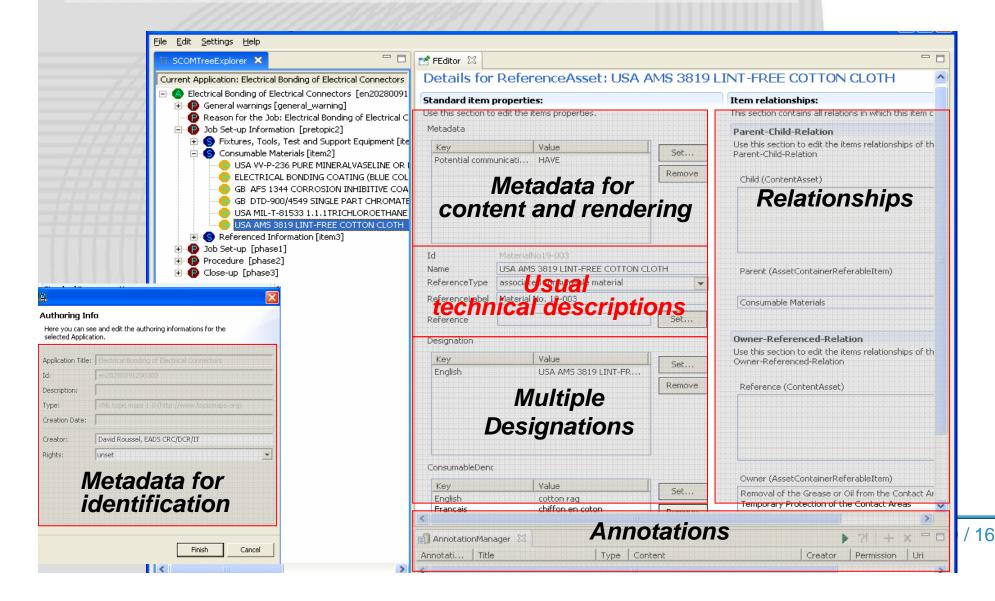


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## **SNOW Authoring tool**

Our prototype adopts a hierarchy of phases, steps and instructions to author maintenance procedures and hides the topic map machinery



### Shared multimedia typed annotations of procedures

- To report trouble to remote experts or technical writers
- To manage potential feedbacks related to intensions of communication
- To alert on procedure's modifications (by technical writers)
- To personalize procedures (maintenance company context)
  - by additional information merged with the target "topic"
  - independently from the regular procedure updates (by the manufacturer)



\_ 🗆 × Settings Help 🖵 🗖 📑 🛃 🖼 🖼 ation: Removal of the Radome - annotated-test 4 Details for Instruction: Remove the bolts (5) Removal of the Radome - annotated-test 4 [en53151100000100 General warnings [general\_warning] Standard item properties: Item relationships Warm Up for Removal of the Radome [pretopic1] Use this section to edit the items propertie This section contains Job Set-up Information [pretopic2] all relations in which Metadata this item can act as a S Fixtures, Tools, Test and Support Equipment [item1] partner Referenced Information [item2] Set. Job Set-up [phase1] Sorry, no relation to Procedure [phase2] Remove modify S Disconnection of the Component. [step6] Radome [ en53151199100200001] Disconnect the bonding leads (8). [d0e567] Remove the nuts (6), the bolts (10) and the washers(9). [d0e574] Let the honding leads (8) hand. [d0e579]. Disconnect the rods (13) from the hinge fittings (7) of the radome. [d0e584] d0.e665 S Inspection of the Radome Sling. [step7] Name Remove the bolts (5) Make sure that the SLING-RADOME (98D53103500000) is under tension. [d0e624] Removal of the Radome. [step8] MOVE THE RADOME CAREFULLY TO PREVENT DAMAGE TO THE RADAR [MOVETHERADOM Remove the cotter pins (2) and discard them. [d0e655] temove the nuts (3) with the washers (4). [d0e660] ove the bolts (5). [d0e665] we the radome (19) and install it in TROLLEY - RADOME (98D53103013000) . [d0e67] Removal of the Support Equipment [step9] Remove the SLING-RADOME (98D53103500000) . [d0e696] LogConsole 🗊 AnnotationManager 🔀 ■ ?! + X <sup>-</sup> □ Annotati... Title Type Content Creator Permission Uri See picture. Consist in one bolt above i... en531511000 holts (5) localiz private PICTURE en53151100 zoom on bo http://localhost:8888/Do private •

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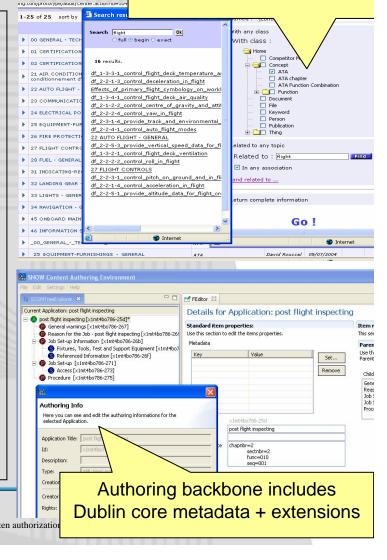
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### Authoring work with Dublin Core extensions

XTM-P combines several metadata set (instead of information codes) to improve computer-supported content reused.

Semantic add constraints on types and relationships for information retrieval

<topic id="en1-3-4-1-00121-1000-01-1"> .... <occurrence> </instanceOf> <topicRef xlink:href= "identification.xtm#function" /> </inst... < resourceData>1-3-2-1 </resourceData> </occurrence> <occurrence> <instanceOf> <topicRef xlink:href="identification.xtm#dc-title" /> </inst... <resourceData> flight deck ventilation inspecting </resourceData> </occurrence> <occurrence> <instanceOf> <topicRef xlink:href= "identification.xtm#file-ext" /> </instanceOf> <resourceData>-00121-1000</resourceData> TMRA 2006, October 11th This document is the property of SNOW consortium; no part of it shall be reproduced or transmitted without the express prior written authorization



# Content enrichment with explicit communication acts and typed relationships

<association id=" d0e574-en53151199100200001"> <instanceOf> <topicRef xlink:href="proc-templates.xtm#**Pragmatic-rel**"/></instanceOf> ... relation between *Graphic* **en53151199100200001** and *Instruction* **d0e574**... </association>

<topic id=" d0e574-en53151199100200001-reification">

<instanceOf> <topicRef xlink:href="proc-templates.xtm#associated-graphic"/> </inst...</td><subjectIdentity> <subjectIndicatorRef xlink:href="#d0e574-en53151199100200001"/></sub...</td>

<basename> the nuts number 6 are behind in the middle of the radome </basename>
</topic>

		E SCOMTreeExplorer	×	📽 FEdtor 🗶			-	
Ext	Extensible typology of communication acts to make explicit the intended role of each		Current Application: Removal of the Radome Gurent Application: Removal of the Radome [rest] General warning] Use for Removal of the Radome [prept] Use for Removal of the Radome [prept] Use for Removal of the Radome [remot] Use for Removal of the Radome [remot]		Details for ReferenceAsset: ref. en53151199100200001			
					properties: o edit the items properties.	Item relationships: This section contains all relations in		
					Key Value Set		Owner-Referenced-Relation Use this section to edit the items r	
tc			ref. en53151101000100 [_en53151101000100] Redome Sinc [_en53151199100100001] ref. en53151199100200001 [_en53151199100200001] SSQC [_121W1] ref. en53151199100200001 [_en53151199100200001]		Potential communicati HAVE			
						Remove	Reference (ContentAsset)	
Int								
	information		ection of the Component. [step6]					
			Move THE RADORE CAREFULLY TO RERVENT DAMAGE TO THE I      Description of the body location of the system of		Id         _en53151199100200001           Name         ref. en53151199100200001           ReferenceType         associated graphic           ReferenceLabel         en5315119010020001			
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							Remove the nuts (6), the bolts Let the bonding leads (8) hang	
4			hect the rods (13) from the hinge fittings (7) of the radom of the Radome Sling. [step7]	Reference	_ref_en53151100000100/402.1_ 15 11 991 002 Radome.png	53_ Set	Disconnect the rods (13) from t	
	Relationship betwee	n a note	ure that the SLING-RADOME (98D53103500000) is under	Designation				
		the Support Equipment [step9]		🏭 Map Entry Dialog			ent-Child-Relation this section to edit the items	
	and a given instruc				Please enter the key and the value for the new map entry. Select Key: English		nt-Child-Relation	
							Id (ContentAsset)	
	enriched with an al	lemale		Select Value:				
	description							
A	accomption					OK Can		

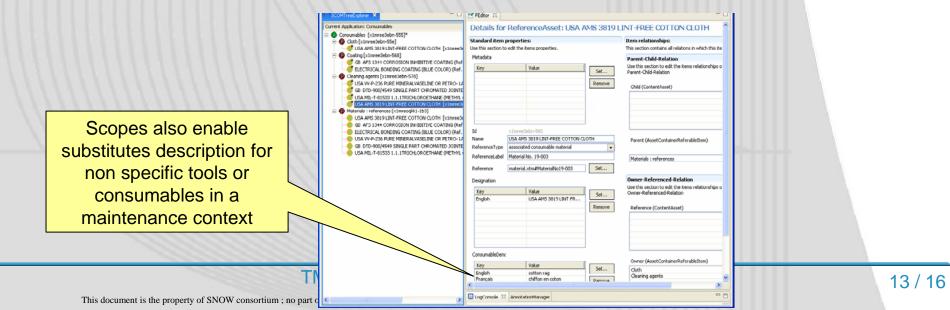
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# Content Management with multiple designations taking into multicultural aspects

<topic id="\_accessplatform2m6ft7in"> <instanceOf> <topicRef xlink:href="proc-templates.xtm#reference"/> </instanceOf> <baseName> <scope> <topicRef xlink:href="**PSIs.xtm#en**"/> <topicRef xlink:href="**proc-templates.xtm#designation**"/> </scope> <baseNameString> **access platform of 6 ft. 7 in**. </baseNameString> </baseName> <baseName> <baseName> <scope> <topicRef xlink:href="PSIs.xtm#fr"/> <topicRef xlink:href="PSIs.xtm#fr"/> <topicRef xlink:href="PSIs.xtm#fr"/> <topicRef xlink:href="proc-templates.xtm#designation"/> </scope> <baseNameString> **élévateur de 2 m** </baseNameString> </baseName> </baseName>



Authoring & XTM-P Sem. Enrichment Rendering hints

Benefits

Introduction

### Content adaptation relying on rendering hints

Rendering Hints are special metadata for rendering, which

- cannot be derived from the semantic descriptions (e.g. scalability).
- improve the layout quality according end-user usability criteria or preferences (e.g. importance).

#### <association >

```
<instanceOf > <topicRef xlink:href =" proc-templates.xtm#Pragmatic-rel " />
 </ instanceOf >
```

<scope > <topicRef xlink:href ="#non-breakable" /> </ scope >

<member >

... An instruction I and a graphic G ...

</association >

<topic id=" Bonding\_details ">

```
<instanceOf > < subjectIndicatorRef xlink:href ="# graphic " /> </ jr _.anceOf >
```

<occurrence >

```
<instanceOf > <topicRef xlink:href ="#small-size-scalable"/> </ instanceOf >
< resourceRef xlink:href =" Bonding details . tif " /> ...
```

13 SCOMTreeExplorer 23	al Flator (N	
Current Application: Assembly of Adhesive bonded brackets  Assembly of Adhesive bunded brackets  Reason for the 3x6 [Linus82077-78d]  Abody Step biformation [Linus22077-78]  Abody Step biformation [Linus22077-78]  Franketer (Linus82077-803]  Franketer (Linus82077-803)  Franketer (L	Details for ReferenceAsset: (Ref. Fig. 51) Standal em properties Use this section to dit the terms properties. Heidedia  Yey Yalue Map Entry Dialog. Please enter the lays and the value for the new map entry. Select lays: Non Penalative Mage contry Dialog. Please enter the lays and the value for the new map entry. Select Value Details Sociality Details Control Sociality Cott Control Con	Procedure     A. Fastener preparation     (Figure 1)     Solvent wipe the fast     2. Remove the peel ph     3. Apply the mixed add     B. Fickner location     (Figure 2)     1. Locate the future on th     fastener location cent     2. Press down on the oil     C. Attachment of fastener     (Figure 3)     1. Press down on the in     D. Fickner enroval     (Figure 4)     1. After the adhesive har     substrate.     2. Discard the future.     2. Close Up     A. Visual inspection of the reference.

Introduction Authoring & XTM-P Sem. Enrichment **Rendering hints** 

**Benefits** 

This graphic is necessary for instruction I and scalable.

(Figure 1) 1. Solvent wipe the fastener base.

fastener location centerlines

Remove the peel ply (1) from foam tape pads and discard.
 Apply the mixed adhesive to the fastener baseplate (2).
 Fixture location

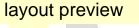
(Figure 3) 1. Press down on the inner body (1) of the fixture to actuate

NOTE: Visible adhesive spew must be surrounding bonded co

2. Press down on the outer body of the fixture (2) to adhere the foam tape to the surfac C. Attachment of fastener

(Figure 2) 1. Locate the fixture on the substrate using a template or by aligning the index marks on the fixture with the

(Figure 4) 1. After the adhesive has cured, remove the fixture by grasping with pliers (4) and pulling it off of the



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# **First evaluation of Benefits**

How Semantic data models – as illustrated by XTM-P – are perceived by samples of EADS technical documentation engineers

## Field assessment of benefits as causal attributions

Evaluation : YES/NO questionnaire filled by EADS technical data engineering groups about SNOW authoring approach relevance in their context

Dublin core extensions (kappa coef.=1)	efficient task identification	100 % yes
Metadata for adaptation (k=1)	efficient MM content	100
Typed annotations	<ul> <li>Annotation understanding</li> <li>prompt feedbacks</li> </ul>	100 80
(k = 0,85)	disambiguation	80
	avoid authoring errors	100
Explicit content (communication acts, typed relations)	adequate fragmentation	100
(k = 0.83)	Inform. intended role	80
	IETP quality	60
\////////////////////////////////////	avoid irrelevant details	100
Metadata for customization	personalization	80
(k = 0,77)	avoid unofficial. doc.	40
	natural designations	80
Natural language	regular translations	60
(k = 0,77)	multilingual resources	0

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## Conclusion

Structured procedural contents can be captured in TM terms. Topic Maps is perceived as a valuable standard for:

- Metadata set definition and combination for identification
- « Contextual » contents adaptation

#### Perspectives

- Extend technical documentation standards (S1000D Data modules header for technical contents e.g. tables).
- Rules and constraints to specify requirements on predefined subjects used in separated documents (S1000D Business rule for Technical Documentation exchange).
- Constraints on associations to guide editing and design robust information extractors.