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AN OVERVIEW OF THE DOCUMENT STYLE SEMANTICS AND SPECIFICATION LANGUAGE and the MIL-M-28001A OUTPUT SPECIFICATION

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- ABSTRACT -

This paper was written to compare functional similarities between the Document Style Semantics and Specification Language (DSSSL) and the Output Specification (Appendix B) of MIL-M-28001A. The Office Systems Engineering (OSE) Group at the National Institute of Standards and Technology (NIST) was tasked by the Computer-aided Acquisition and Logistic Support (CALS) Evaluation and Integration Office (E&IO) to explore the functional capabilities between DSSSL and the Output Specification (OS).

The purpose of this paper is to provide a brief overview of the functional similarities between the OS and DSSSL. It is envisioned that when DSSSL becomes an International Standard (IS), it will assume the responsibilities of the Output Specification and be referenced by MIL-M-28001A. Therefore, an initial examination of each standard's capabilities is warranted. This paper is intended for persons with some working knowledge of the Standard Generalized Markup Language (SGML) and minimal knowledge of DSSSL and OS. It is not intended to provide a detailed examination of an application of these two standards. This task is left for a later date since DSSSL is still undergoing change. Instead, a higher level examination will be performed to initially determine if the functionality of the Output Specification is also provided by the Document Style Semantics and Specification Language.

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1. INTRODUCTION

This paper was written to compare functional similarities between the Document Style Semantics and Specification Language (DSSSL) [1] and the Output Specification (Appendix B) of MIL-M-28001A [2].

The Office Systems Engineering (OSE) Group at the National Institute of Standards and Technology (NIST) was tasked by the Computer-aided Acquisition and Logistic Support (CALS) Evaluation and Integration (E&IO) Office to explore the functional capabilities between DSSSL and the Output Specification (OS). *MIL-M-28001, Technical Manuals: Markup Requirements and Generic Style Specification for Electronic Printed Output and Exchange of Text,* was originally published in February, 1988. At the time of publication, the Output Specification was not included within the specification since it was not deemed fully functional. While work was underway on MIL-M-28001A, a substantial effort was in progress to complete the Output Specification for publication with Revision A. Many individuals from government and private industry worked to modify and expand the original Output Specification. It was understood that for MIL-M-28001A to be successful, it had to contain a flexible and fully functional Output Specification (OS).

At the same time that the OS work was underway, work was proceeding on developing a standardized formatter. After some time, this work was dropped in favor of the current approach which allows various formatter implementations to accept DSSSL specifications through the use of a translator function. Many of the same people who worked on the OS began to lend their talent to the DSSSL effort.

It was envisioned that DSSSL would serve as the OS, however, DSSSL was still undergoing development. Therefore, the Formatting Output Specification Instance (FOSI) was developed and included in MIL-M-28001A.

2. PURPOSE

The purpose of this paper is to provide a brief overview of the functional similarities between the OS and DSSSL. It is envisioned that when DSSSL becomes an International Standard (IS), it will assume the responsibilities of the Output Specification and be referenced by MIL-M-28001A. Therefore, an initial examination of each standards capabilities is warranted.

3. SCOPE

This paper is intended for persons with some working knowledge of SGML and minimal knowledge of DSSSL and OS. It is not intended to provide a detailed examination of an application of these two standards. This task is left for a later date since DSSSL is still undergoing change. Instead, a higher level examination will be performed to initially determine if the functionality of the Output Specification is also provided by the Document Style Semantics and Specification Language.

4. OVERVIEW

The following subsections highlight the purpose of each standard and provide brief overviews. A glossary of terms used in this paper is provided in Section Nine.

4.1 DSSSL Overview

The objective of the DSSSL Standard is to provide a format and rigorous means of expressing the range of document production specifications, including high quality typography, required by the graphic arts industry. The production specifications will be expressed using standardized basic semantics or combinations to allow users to specify the formatting characteristics during the composition, pagination, and imposition of the document process. The semantics of DSSSL include a document architecture presentation style and other document processing specifications, typically associated with traditional text processing languages. DSSSL also incorporates a Specification Language which describes how to apply DSSSL semantics to SGML documents.

DSSSL is a standardized technique for associating formatting information with the logical elements of a document. DSSSL is designed to specify the processing of documents conforming to SGML and for use with documents structured as a hierarchy of logical elements. The relationship of logical elements is expressed as an SGML Document Type Definition (DTD). DSSSL enables formatting descriptions to be associated with these logical elements to produce a formatted document for presentation.

4.2 Output Specification Overview

MIL-M-28001A establishes the requirements for the digital data form of page-oriented technical publications. Data prepared in conformance to MIL-M-28001A will facilitate the automated storage, retrieval, interchange, and processing of technical documents from heterogeneous data sources. The requirements set forth by MIL-M-28001A include:

a. procedures and symbology for markup of unformatted text in accordance with the Standard Generalized Markup Language (SGML),

b. SGML compatible codes that will support encoding of a technical publication to specific format requirements applicable to technical manuals, and

c. output processing requirements that will format a conforming SGML source file to the style and format requirements of the appropriate Formatting Output Specification Instance (FOSI) based on the Output Specification (OS).

The OS provides a set of formatting characteristic values used to rigorously describe composition processing functions to be performed on the elements of a text document to provide the format style required by a functional specification. A FOSI delivered with the document must contain values for characteristics for every tag used in the document type declaration. These values must be specified for every context in which the tag and its attributes have a unique formatting requirement.

5. DESCRIPTION OF THE STANDARDS

The following subsections describe each standard in more detail.

5.1 Description of DSSSL

The Document Style Semantics and Specification Language (DSSSL) is a standardized technique for associating formatting information with the logical elements of a document. DSSSL is intended for use with documents structured as a hierarchy of logical elements of a document. For the purpose of describing the concepts of DSSSL, SGML terminology is used. The relationship of logical elements is expressed as an SGML Document Type Definition. SGML does not standardize the set of logical elements, their meaning, or their presentation and appearance. This duty is performed by the application. DSSSL enables formatting descriptions to be associated with these non-standard logical elements to produce a formatted document for presentation.

Conceptually, the DSSSL model has two distinct processes: a General Language Transformation Process and Semantic-Specific Process. These two processes and their associated components are illustrated in Figure 1. The shaded areas represent components particular to a specific semantic processor. The heavy dark line represents the flow of information through the various functions into a specific formatter. Some of the information flows with the source file while other portions do not. Initially, DSSSL focused on formatting with the Semantic-Specific Processor, but the model was made consistent for other types of processes such as document assembly and database load and abstract. The General Language Transformation Process may be used with any type of Semantic-Specific Processor or it may be used alone.

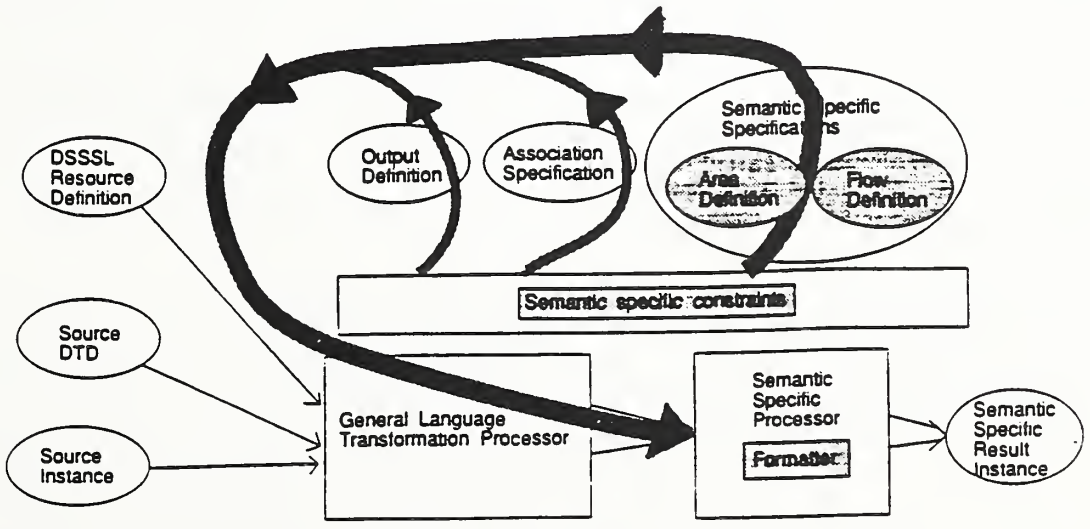

Figure 1. DSSSL Conceptual Model

5.1.1 The General Language Transformation Process

The General Language Transformation Process (GLTP) transforms an SGML source document into a conceptual output instance under the control of the Association Specification and the Output Definition. The conceptual output instance is then input to the Semantic-Specific Process. Other possible output from the GLTP may be suitable for loading into a database or use in a source document from portions existing on a file system or as the result of a database query.

In the General Language Transformation Process, formatting descriptions may be associated with explicit elements in the SGML source document structure through the Association Specification or may be attached to other parts of the DSSSL specification. The formatting descriptions, specified syntactically in the Association Specification, are passed through to the Semantic-Specific Processor (SSP) to control the semantic-specific process.

Additionally, DSSSL has the capability of associating formatting descriptions with the following items that are not specifically identified as logical elements in a document or in its DTD:

- Combinations of elements,
- Elements with user-specific relationships to elements other than those of the DTD,
- Particular sequences of content, and
- Particular components of content.

5.1.2 Semantic-Specific Processor

The Semantic Specific Processor (SSP) transforms a source document instance into a Semantic-Specific Result Instance (SSRI) under the control of the Output Definition, the Association Specification, and the Semantic-Specific Specifications. Initially, the focus of DSSSL is on formatting which includes the Area Definition, Flow Definition, and a set of weighted constraints that are defined in terms of DSSSL properties and attributes. DSSSL does not concern itself with the form of the Semantic-Specific Result Instance. However, the elements which comprise this instance are areas created by the formatter to receive content. The term "formatting" when used by DSSSL includes any of the following combinations:

- the transformation process that applies presentation styles to source document content and determines its position on the output medium,
- the selection and reordering of content in the output document with respect to its position in the source document,
- the inclusion of material not explicitly present in the source document, such as the generation of new material that can be dependent on functional combinations of aspects of the source and output instances, and
- the exclusion of material from the source document in the output document.

Spatial building blocks termed "Areas" are used to define the visual appearance of a formatted document. The application designer is allowed to name the areas with meanings relevant to the particular application. DSSSL was conceived with the idea that certain aspects of formatting such as layout, hyphenation, and line breaking would be defined in general terms rather than specific algorithms. This would allow the system receiving the source document to incorporate any means to perform these functions as long as it did so within the required area constraints.

5.2 Description of the Output Specification

The Output Specification presents a method for interchanging formatting requirements for military documents whose source files are tagged according to Document Type Definitions developed in accordance with MIL-M-28001A. The OS allows for divergent receiving processing systems to unambiguously interpret the style and formatting intent of the sending system, such that by combining the tagged source file with the appropriate Formatting Output Specification Instance, the resulting publication will preserve the information content of the original with similar presentation.

The OS is designed for use with all military specifications for technical documents. A specific DTD interprets the content and structural requirements of a particular functional specification while a specific FOSI interprets the style and formatting requirements of the functional specification. The OS describes the rules for creating all FOSIs to be included in or delivered in accordance with MIL-M-28001A as well as the interchange format to be used.

Certain basic concepts necessary for understanding the OS are described in the following sections:

- Characteristics, and
- Element-in-Context.

The application design must have a working knowledge of what "characteristics" are and what kinds of values they may assume, and what an "element-in-context" is and how it is specified.

5.2.1 Characteristics

A characteristic is a specification of a particular formatting property a logical element is expected to have. In a FOSI, every characteristic has a value that specifies in some manner how the processing system should treat the associated content. Characteristics are descriptions of the format of a document rather than commands that tell a formatting system what to do. There are two basic types of characteristics: Composition and Pagination.

Composition characteristics define how a particular element should be treated. Composition characteristics are grouped into the following functional areas:

- Text characteristics -- which generally apply to all elements,

- Graphic characteristics -- which apply specifically to graphics, and
- Table characteristics -- which apply only to elements of a table or chart.

Pagination characteristics define how a page is created independent of the content of the page. Pagination characteristics differ from composition characteristics in that where composition characteristics are attached to logical elements, pagination characteristics are applied to the areas on a page within which logical elements are placed.

5.2.2 Elements in Context

In a FOSI, characteristics must be specified for each element in every context in which the element will be used. For each context in which the formatting system will use the element, there must be information associated with that element to tell the formatting system what to do. This information can take various forms. The Generic Identifier is a unique name that identifies an element. The Context of the element specifies in which context the element will appear. "Occurrence" is the order of appearance of this element-in-context in relation to other elements of the same type.

5.2.3 Inheritance and Defaulting

Inheritance and defaulting are the mechanisms for allowing characteristic values to be derived from values that have already been assigned. Inheritance allows for characteristics to take on the values in effect for the element-in-context's parent element. Defaulting allows for characteristics to take on the values assigned to the document element or a previously defined environment.

6. COMPARISON OF THE STANDARDS

In the previous sections, the components of each standard have been independently described. The following subsections will try to examine more closely the relative similarities of these components and their similar functions.

6.1 Hierarchical Structure

Within DSSSL, the Output Definition defines the hierarchical structure of the elements of the conceptual output instance. It is an SGML DTD. In the case of formatting, the Output Definition (OD) expresses the relationship of the virtual areas while its elements are used to generate content in various combinations. By comparison, the Output Specification utilizes a DTD to provide a rigorous formalization of the characteristics' functionality presented in the previous section. The characteristics are represented as elements in the DTD.

Another component of the DSSSL General Language Transformation Process is the Association Specification (AS). The AS provides a map between the source structure and the output structure. It may also contain attributes defined within DSSSL and

processed by the formatter. The components of the AS consist of the location model and an output target mode. Another name for the latter is the General Language Output Model (GLOM). The location model consists of elements, portions of elements, and their associated attributes. The location model describes the following:

- the relationships between the parent-child-sibling elements,
- context sensitive addressing such as parentage, sibling relationships, and "wild cards," and
- attribute value sensitive addressing such as restrictions placed on elements due to their attribute value, i.e. security.

These different addressing criteria can be mixed together yielding complex formulations.

Similarly, within the OS, the FOSI provides somewhat the same function. The FOSI assigns formatting values to the different elements within the source SGML document. The FOSI has the responsibility of assigning a value for each and every possible combination of elements within the source document. Inheritance is not allowed within the FOSI.

Within MIL-M-28001A, two types of DTDs are specified. The source document is accompanied by a DTD if the document structure does not adhere to one described by the Conforming DTD in MIL-M-28001A. That is a DTD that describes a technical manual conforming to MIL-M-38784B. If the source document does conform to MIL-M-38784B, then it is not necessary to transmit the source document with a DTD. This DTD may have within it Processing Instructions (PIs) which are special, application specific instructions that are added to the source document to control the output format. This SGML feature is discouraged by MIL-M-28001A but not disallowed. The second DTD that is offered in MIL-M-28001A is listed in the Output Specification. This Document Type Definition defines the structure of the FOSI.

6.2 Page Layout

In the DSSSL specification within the Semantic-Specific Process, there are a number of components involved in formatting a page. These include the Area Definition, Flow Definition, Area Constraint Set, and Resource Definition. The Area Definition defines area templates which are models of rectangular portions of the presentation medium (page) into which the formatter pours the content. Within the Output Specification, the FOSI is responsible for defining a Page Model for each type of page to be generated. Both the Area Definition and the Page Model define the relationship amongst the different layout areas on a page. Each layout area consists of subordinate layout areas such as top and bottom margins areas or header and footer areas. How the content is poured into each layout area is defined within the Semantic-Specific Process of DSSSL as the Flow Definition. It maps the elements in the Output Instance into area templates and specifies the order in which they are filled. The constraint set provides additional rules concerning where and how the content should be split. The constraint set also provides a ranking of the attribute values for a particular area. The Resource Definition includes references to hyphenation dictionaries, color models, area breaking rule sets, and font reference lists.

The above functions are performed within the Output Specification by a number of characteristics. The Flowing Text Area Characteristic defines the area below the Header Area, above the Footer Area, and in between the Left and Right Margin Area. Various Composition Characteristics define the type of font, hyphenation, spacing (letter and word), text breaking rules, etc, that are to be followed while pouring text into a page area.

7. CONCLUSIONS

In the previous sections, each standard has been briefly examined and described. Within this section, several major issues will be addressed and conclusions presented based on NIST's knowledge of the standard and its current status.

7.1 Improvement and Complexity

One question that may come to mind when studying DSSSL is whether DSSSL provides an improvement over the Output Specification of *MIL-M-28001*. Specifically, is DSSSL an improvement over the FOSI. This is a rather general question with many facets. Improvement may have many meanings. It could be meant to imply capability, flexibility, or just simplification. It appears that DSSSL offers much more capability and flexibility than the FOSI in the Output Specification. DSSSL offers the user more flexibility concerning the manner in which character-to-glyph mapping is performed. This is a two step process of mapping a bit combination in the source document to a bit combination in the output document. Additionally, more capability and flexibility is offered in the areas of Flow Definitions, Coordinate Systems, and Color. The placement and positioning of bits on the page appear to be widely expanded over the capability of the FOSI. The coordinate system utilized in DSSSL is a conventional three dimensional Cartesian system. It also appears that color capabilities are greatly expanded within DSSSL. DSSSL offers similar color capabilities as the FOSI, such as foreground and background color, but also many additional color capabilities such as Opacity/Transparency, Clipping Masks, Shapes, Glyph Tables, etc.

With these additional capabilities come more overhead. That is to be expected. However, without constructing a precise example, it is difficult to predict whether the amount of additional overhead and capability is a linear relationship.

7.2 Translator Capability

On initial inspection, it appears that the capabilities offered in the FOSI of the Output Specification in *MIL-M-28001A* are also offered in DSSSL. Additionally, DSSSL seems to offer increased functionality along with additional overhead. Because DSSSL appears to offer all the capabilities of the FOSI, it does appear that a translator could be written to provide current FOSI users a migration path to DSSSL. However, this would be no small job for two reasons. First of all, the FOSI was never completely constructed in *MIL-M-28001A*. Therefore, the magnitude of a completed FOSI could be estimated to be an undertaking of enormous proportions. This estimate is based on the various attempts made in producing the FOSI. Each

attempt was revised downward due to the sheer size and complexity that had to be represented. Eventually, to meet the publication deadline of *MIL-M-28001A*, the production of the FOSI was scaled down to what are now called environments. It was stated in the publication that the environments were produced to provide a guideline for development of a FOSI. At the time of production, it was envisioned that the FOSI would be produced separately at a later date. Additionally, when the additional capabilities are accounted for in DSSSL, one can only speculate on the sheer size and complexity of this translator.

Considering these two issues and the fact that an actual example has not been produced to date using DSSSL, it is impossible to determine the complexity and capabilities of DSSSL. The only manner in which to judge the relative amount of overhead would be to construct similar examples using DSSSL and the FOSI. This would be a very enlightening comparison. Then a judgement could be rendered concerning the extra capabilities of DSSSL and whether they would be worth the added overhead.

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[2] *MIL-M-28001A - Technical Manuals: Markup Requirements and Generic Style Specification for Electronic Printed Output and Exchange of Text, July 1990.*

[3] *ISO 8879: Information Processing - Text and Office Systems - Standard Generalized Markup Language (SGML),* International Organization for Standardization, 1986.

9. GLOSSARY

Area Definition	A collection of area templates that include the area name, area type, area constraint set, and the area hierarchy.
attribute (SGML)	A characteristic quality of an element, other than type or content.
concrete syntax	A binding of the abstract syntax to particular delimiter characters, quantities, markup declaration names, etc.
content	The information conveyed by the document, other than the structural information, and it is intended for human perception.
document type declaration (DTD)	A markup declaration that contains the formal specification of a document type definition.
document type definition	Rules, determined by an application, that apply SGML to the markup of documents of a particular type. A document type definition includes a formal specification, expressed in a document type declaration, of the element types, element relationships and attributes, and references that can be represented by markup. It thereby defines the vocabulary of the markup for which SGML defines the syntax.
element	A component of the hierarchical structure defined by a document type definition; it is identified in a document instance by descriptive markup, usually a start-tag and an end-tag.
entity	A collection of characters that can be referenced as a unit.
Flow Definition	A collection of flow rules. A flow rule maps a General Language Output Model into an Area Template Selector.
formatted form	A form of representation of a document that allows the presentation of the document as intended by the originator and that does not support editing and (re)formatting.
General Language Output Model (GLOM)	Specifies a set of patterns that are used to determine the location in the conceptual output instance into which content may be mapped.

General Language Output Location Model (GLOLM)	Specifies a set of patterns for addressing locations in the conceptual output instance. When the semantic processor is a formatter, it is a location model of the virtual areas and is part of the Flow Definition.
General Language Transformation Process (GLTP)	Transforms a source document (document type declaration and instance) into a conceptual output instance that is input to the Semantic-Specific Process under the control of the Association Specification and the Output Definition.
General Language Transformation Process Specification (GLTPS)	Either a Language Declaration, a Declaration, an Output Definition, and an Association Specification; or a reference to a named set of those constructs.
Location Model (LM)	Specifies a set of patterns for addressing locations.
logical structure	(1) The result of dividing and subdividing the content of a document into increasingly smaller parts, on the basis of the human-perceptible meaning of the content, for example, into chapters, sections, or paragraphs. (2) All logical objects and associated content portions representing the logical hierarchy of a document.
Output Definition (OD)	A document type declaration in accordance with ISO 8879.
Semantic-Specific Process (SSP)	Transforms a document instance under the control of the Output Definition, the Association Specification, and Semantic-Specific Specifications.
Semantic-Specific Process Specification	Either the Semantic-Specific Language Declaration, the Semantic-Specific Declaration, the Semantic-Specific Resource Definition, the Semantic-Specific Transformation Definitions; or a reference to a named set of these constructs.

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This paper was written to compare functional similarities between the Document Style Semantics and Specification Language (DSSSL) and the Output Specification (Appendix B) of MIL-M-28001A. The Office Systems Engineering (OSE) Group at the National Institute of Standards and Technology (NIST) was tasked by the Computer-aided Acquisition and Logistic Support (CALS) Evaluation and Integration Office (E&IO) to explore the functional capabilities between DSSSL and the Output Specification (OS).

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12. KEY WORDS (6 TO 12 ENTRIES; ALPHABETICAL ORDER; CAPITALIZE ONLY PROPER NAMES; AND SEPARATE KEY WORDS BY SEMICOLONS)

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