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## Grouping the Ungrouped-A study to identify groups in DSL's

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### Abstract

This study is a compilation of groups identified under domain specific languages. This compilation encompasses different types of domain specific languages which are sorted in to groups based on their publications. These groups are then sub divided into more groups based on the nature of publications identified in each group. The identified studies presented in each group are then ranked based on their citation index to provide an easier access to the most cited publication in each group.

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### Keywords:

Tools;  
Extensions;  
Languages;  
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Mapping study;

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### 1. Introduction

A domain specific language can be defined as a software language which is developed and specialized for that particular domain [1]. Domain specific languages can also be defined as those programming languages which are intended for solving problems related to a particular domain [3][4][5]. Domain specific languages are declarative in nature, are more usable than general purpose languages, have a systematic re use, and are more productive, maintainable and flexible making them the most opted for languages [2].

Developing and providing tools and editors to support DSL's greatly help their usability [1]. Without having a proper methodology and support tools for the DSL's the cost of using them could be very high, fetching one no/ little savings [2]. Hence we try to identify the tools, experiences, and support to the

### 2. Research Method

To group the literature a search on the literature was conducted. This search was conducted in two steps. To identify the different types of languages in DSL's, a search was conducted in IEEE. To conduct this search, several keywords related to Domain specific languages were identified and a search string was formulated combining these keywords: Domain Specific Languages, Aspect Oriented, Modelling etc

This search resulted in 1992 hits. After excluding and including papers on the criteria discussed below and removing the duplicates, 1284 papers were identified these were categorized into 6 categories based on their publications.

In the step two, based on the different keywords identified earlier related to the domain specific languages, a search strings were formed for each language identified. These search strings were employed on databases such as the IEEE, bearing the inclusion and exclusion criteria in mind. These results in obtaining selected studies; these selected studies were then grouped into clusters based on the similarities found. This grouping was done by reading the titles and abstracts, when the title is relevant yet does not provide an idea, abstract is read. When the abstract is unclear and does not provide a clear picture the introduction is also read. This results in groups of languages, which are sorted in the order of their citations. The most cited paper is place on top of the list so as to have an easy access.

#### **Inclusion / Exclusion criteria:**

In order have a very small and limited number of studies to group, we chose to adopt the following inclusion and exclusion criteria.

- Exclude summaries of conferences and symposium, exclude proceedings of conferences.
- Exclude editorials on grouped topics.
- Include papers describing models, environments, tools, experiences etc

## **2. Type of Domain specific Languages:**

Conducting the literature review resulted in the identification of 6 types of domain specific languages. They are as follows

### **Domain specific Visual languages**

Domain specific languages are those categories of languages in DSL's which provide a visual programming interface. This allows an expert in the domain to make use of this visual interface to create applications in that particular domain. A total of 20 DSVL's were identified the results were placed in List 1a) in appendix.

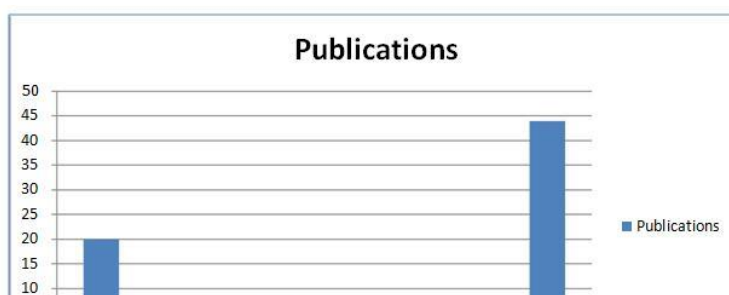
### **Domain Specific Modeling languages**

A domain specific modeling language is a language developed, used or built to represent the semantics and constructs which are required for defining the models involved in Model Driven development. A total of 44 DSML's were identified the results were placed in List 6(a) in appendix.

### **Domain Specific Embedded Language**

It is one kind of a domain specific language which can be embedded in a general purpose language, which borrows common languages features and adds those features that are not present [8]. A total of 4 DSEL's were identified the results were placed in List 5a) in appendix.

It is one kind of a domain specific language which can be embedded in a general purpose language, which borrows common languages features and adds those features that are not present [8]. A total of 4 DSEL's were identified the results were placed in List 5a) in appendix.



### Domain Specific Aspect Languages

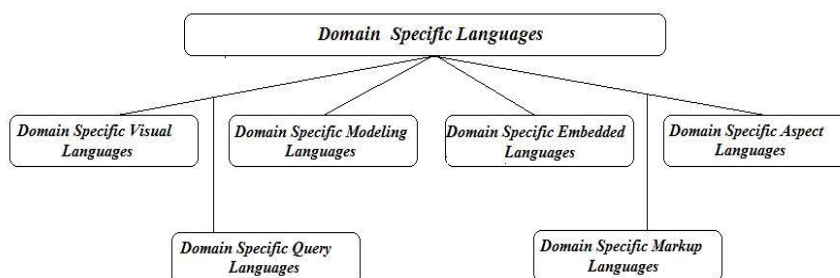
These domain specific aspect languages provide abstractions for implementing aspects in a declarative manner for that particular domain [10]. A total of 6 DSAL's were identified the results were placed in List 4a) in appendix.

### Domain Specific Query Languages

This domain specific query language is a DSL, which is built to write queries for retrieving information for that particular domain [9]. A total of 7 DSQL's were identified the results were placed in List 1a) in appendix.

### Domain Specific Mark up Languages

A domain specific markup language is one sort of markup languages which consists of dedicated tags to capture the semantics of that particular domain [11]. A total of 3 DSMuL's were identified the results were placed in List 3a) in appendix.



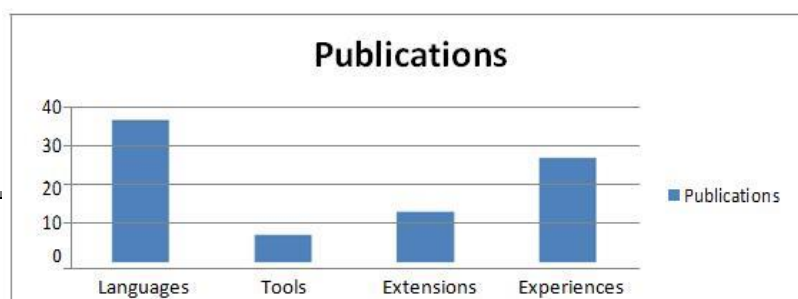
## 4) Nature of the publications:

### Publications defining Domain specific language

This group contains those publications which talk about the domain specification languages. Different domain specific visual languages are group under this section. A total of 37 publications were grouped under this section.

### Domain specific language based tools/ tool support

This group contains the publications which offer tool support to domain specific languages, also domain specific visual languages are grouped under this cluster. A total of 7 publications were grouped under this section



**Publication extending or using the domain specific languages**

This group contains those publications which extend or define a language for domain specific visual languages. A total of 13 publications were grouped under this section..

**Publication evaluating or stating the experience with DSL**

This group contains only those publications which describe how the domain specific visual languages. work when they are put to use. A total of 27 publications were grouped under this section.

**5. Results and Analysis**

The result of the literature study and mapping provided identification of some interesting patterns in the mapping. There are two new sub-groups with a publication each under the category of domain specific visual languages.

**Domain Specific Visual Languages**

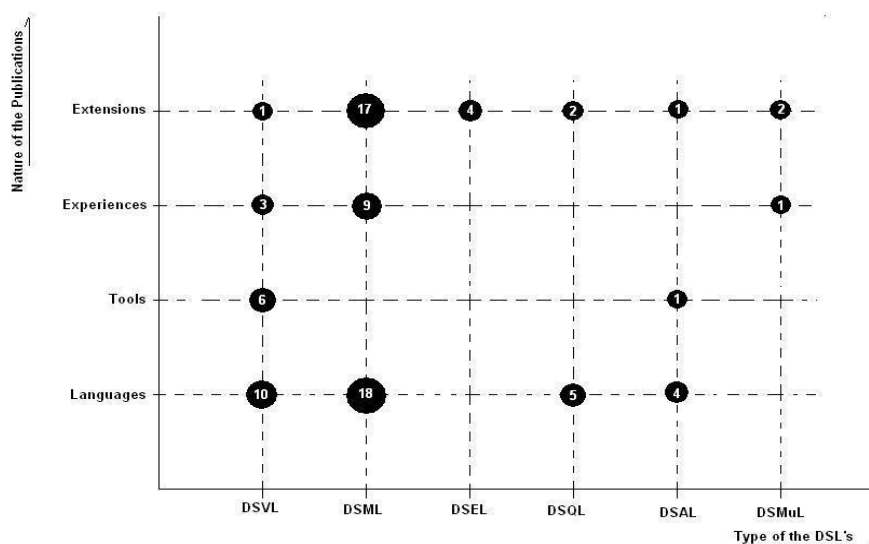
**Domain specific Visual Query Language**

Towards a full implementation of a robust solution of a domain specific visual query language for HEP physics analysis

**Domain specific visual modeling language**

Model-Driven Development of Context-aware Adaptive Learning Systems.

Domain specific modeling languages are the most worked area in this field with a highest number of publications and selected studies.



**4. Conclusion**

Through this report, an identification of groups under domain specific languages is done by conducting a literature review and prioritizing the publications based on their citation index. A total of 6 domain specific languages are identified and are grouped on the nature of publications which are clustered into four groups. All groups identified are disjoint in nature, so as to reduce the number of overlaps in publications and to provide a clear picture of the groups. Future work can be carried out in this area by validating the identified results.

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## APPENDIX

1a) List of papers selected for DSVL's -20/ 190  
In the order of citations

1. 5SGraph demo: a graphical modeling tool for digital libraries.
2. Domain model translation using graph transformations
3. A domain specific visual language for design and coordination of supply networks.
4. A domain-specific visual language for report writing using Microsoft DSL tools
5. A visual language and environment for EDI message translation
6. A Domain-Specific Language for Model Coupling
7. Generating Web Services for Statistical Survey Packages from Domain-specific Visual Languages
8. Critic Authoring Templates for Specifying Domain-Specific Visual Language Tool Critics
9. Supporting Generic Sketching-Based Input of Diagrams in a Domain-Specific Visual Language Meta- Tool
10. The Domain-Specific Language Monaco and its Visual Interactive Programming Environment
11. Marama
12. Template-based critic authoring for domain-specific visual language tools
13. MaramaTatau: Extending a Domain Specific Visual Language Meta Tool with a Declarative Constraint Mechanism
14. Visual language framework for LISA
15. A visual query language for HEP analysis
16. Generating Domain-Specific Visual Language Editors from High-level Tool Specifications
17. Towards a full implementation of a robust solution of a domain specific visual query language for HEP physics analysis
18. Applying Template Meta-Programming Techniques for a Domain-Specific Visual Language--An Industrial Experience Report
19. A Generic Visual Critic Authoring Tool
20. Obstacles and opportunities with using visual and domain-specific languages in scientific programming

1b) Groups

1. Domain specific visual languages
2. Domain model translation using graph transformations
3. A visual language and environment for EDI message translation
4. A Domain-Specific Language for Model Coupling
5. A domain specific visual language for design and coordination of supply networks
6. A domain-specific visual language for report writing using Microsoft DSL tools
7. The Domain-Specific Language Monaco and its Visual Interactive Programming Environment
8. Marama
9. Visual language framework for LISA
  
10. A visual query language for HEP analysis

11. Towards a full implementation of a robust solution of a domain specific visual query language for HEP physics analysis
12. Domain specific visual language based tools/ tool support
13. 5SGraph demo: a graphical modeling tool for digital libraries
14. Supporting Generic Sketching-Based Input of Diagrams in a Domain-Specific Visual Language Meta- Tool
15. Generating Domain-Specific Visual Language Editors from High-level Tool Specifications
16. Generating Web Services for Statistical Survey Packages from Domain-specific Visual Languages
17. A Generic Visual Critic Authoring Tool
18. Template-based critic authoring for domain-specific visual language tools
19. Languages/ Models defining/ extending DSL's
20. MaramaTatau: Extending a Domain Specific Visual Language Meta Tool with a Declarative Constraint Mechanism
21. Support and experiences with DSL's
22. Obstacles and opportunities with using visual and domain-specific languages in scientific programming
23. Applying Template Meta-Programming Techniques for a Domain-Specific Visual Language—An Critic Authoring Templates for Specifying Domain-Specific Visual Language Tool Critics

#### **2a) List of papers selected for DSQL's -7/ 138**

1. SARI-SQL: Event Query Language for Event Analysis
2. A Domain-Specific Query Language for Information Services Mash-up
3. A Novel Neuron Data Model with Domain Specific Query Language
4. A Domain Specific Data Management Architecture for Protein Structure Data
5. A visual query language for HEP analysis
6. Towards a full implementation of a robust solution of a domain specific visual query language for HEP physics analysis
7. An Approach in Building a Chemical Compound Search Engine in Oracle Database

#### **2b) Groups Identified**

1. Domain specific Query languages
2. SARI-SQL: Event Query Language for Event Analysis
3. A Domain-Specific Query Language for Information Services Mash-up
4. A Domain Specific Data Management Architecture for Protein Structure Data
5. A visual query language for HEP analysis
6. Towards a full implementation of a robust solution of a domain specific visual query language for HEP physics analysis
7. Extending Domain specific Query languages
8. A Novel Neuron Data Model with Domain Specific Query Language
9. An Approach in Building a Chemical Compound Search Engine in Oracle Database

#### **3a) List of papers selected for DSMuL's -3/ 77**

1. Experience with ANSI C markup language for a cross-reference
2. Document-oriented software construction based on domain-specific markup languages
3. Exploiting Author-Designed Domain-Specific Descriptive Markup Languages in the Production of Learning Content

### **3b) Groups Identified**

1. Extending Domain specific markup languages
2. Experience with ANSI C markup language for a cross-reference
3. Document-oriented software construction based on domain-specific markup languages
4. Experiences with Domain specific languages
5. Exploiting Author-Designed Domain-Specific Descriptive Markup Languages in the Production of Learning Content

### **4a) List of papers selected for DSAL's -6/ 190**

1. Domain-specific aspect languages for modularizing crosscutting concerns in grammars
2. A tool for compiler construction based on aspect-oriented specifications
3. Infrastructure for domain-specific aspect languages: the relax case study
4. AGOL: An Aspect-Oriented Domain-Specific Language for MAS
5. Automating deployment planning with an aspect weaver
6. Towards aspect weaving applications

### **4b) Groups Identified**

1. Domain Specific Aspect Languages
2. AGOL: An Aspect-Oriented Domain-Specific Language for MAS
3. Automating deployment planning with an aspect weaver
4. Towards aspect weaving applications
5. Domain-specific aspect languages for modularising crosscutting concerns in grammars
6. Extending Domain Specific Aspect Languages
7. Infrastructure for domain-specific aspect languages: the relax case study
8. Tools supporting Domain Specific Aspect Languages
9. A tool for compiler construction based on aspect-oriented specifications

### **5a) List of papers selected for DSEL's 4/ 206**

1. Modular domain specific languages and tools
2. A Model-Based Approach to Families of Embedded Domain-Specific Languages
3. Algorithmic Skeletons within an Embedded Domain Specific Language for the CELL Processor
  
4. Enhanced testing of domain specific applications by automatic extraction of axioms from functional specifications



**5b) Groups Identified**

1. Extending Domain Specific Embedded Languages
2. Modular domain specific languages and tools
3. A Model-Based Approach to Families of Embedded Domain-Specific Languages
4. Algorithmic Skeletons within an Embedded Domain Specific Language for the CELL Processor
5. Enhanced testing of domain specific applications by automatic extraction of axioms from functional specifications

**6a) List of papers identified DSML's 44/567**

1. A Lightweight Approach for Domain-Specific Modeling Languages Design
2. Measuring and Reducing Modeling Effort in Domain-Specific Modeling Languages with Examples
3. Modeling Interface Definition Language Extensions (IDL3+) Using Domain-Specific Modeling Languages
4. A formal definition of the structural semantics of Domain-Specific Modeling languages
5. Generation of Simulation Views for Domain Specific Modeling Languages Based on the Eclipse Modeling Framework
6. Automated Domain-Specific Modeling Languages for Generating Framework-Based Applications
7. A UML-Based Domain Specific Modeling Language for the Availability Management Framework
8. Creating Domain-Specific Modeling Languages for Product Lines
9. Automated Software Defined Radio Deployment Using Domain Specific Modeling Languages
10. Towards a Domain-Specific Modeling Language for Customer Data Integration Workflow
11. TEMPLE - A domain specific language for modeling and solving staff scheduling problems
12. Evaluating the Expressiveness of Domain Specific Modeling Languages Using the Bunge-Wand-Weber Ontology
13. Systems integration of large scale autonomic systems using multiple domain specific modeling languages
14. Domain-specific modeling languages for configuring and evaluating enterprise DRE system quality of service
15. ContractCML - A Contract Aware Component Modeling Language
16. A Flexible Infrastructure for Multilevel Language Engineering
17. Composing domain-specific design environments
18. Simplification of Semantically-Rich Model Transformations through Generated Transformation Blocks
19. An approach of code generation based on Model Integrated Computing
20. Domain independent generative modeling
21. Quick fix generation for DSMLs

22. On metamodel composition
23. A Semantic Anchoring Infrastructure for the Design of Embedded Systems
  
24. Object modeling language for C4ISR capability requirement analysis
25. Model-Driven Development of Context-aware Adaptive Learning Systems In g dsvl and dsml
26. A DSML for Coordinating User-Centric Communication Services
27. Message Modeling for the Joint Architecture for Unmanned Systems (JAUS)
28. Are Domain-Specific Models Easier to Maintain Than UML Models?
29. A platform-independent component modeling language for distributed real -time and embedded systems
30. Modeling methodology for application development in petroleum industry
31. Developing Mobile Applications for Multiple Platforms
32. Enhancing Reusability of IMS LD Units of Learning: The e-LD Approach
33. Automated Middleware QoS Configuration Techniques using Model Transformations
34. Model-driven generative techniques for scalable performability analysis of distributed systems
35. Model-driven engineering of industrial process control applications
36. Modeling of Data Adaptable Reconfigurable Embedded Systems
37. Worst Practices for Domain-Specific Modeling
38. Integration of Multiagent Systems and Service Oriented Architectures in the Steel Industry
39. CoReL: Policy-Based and Model-Driven Regulatory Compliance Management
40. A Case Study on Semantic Unit Composition
41. Cross-Abstraction Functional Verification and Performance Analysis of Chip Multiprocessor Designs
42. Model-integrated mechatronics - toward a new paradigm in the development of manufacturing systems
43. Component-Based System Integration via (Meta)Model Composition
44. Advances in model-integrated computing

#### **6b) Groups identified**

1. Extending Domain specific Modeling Languages
2. A Lightweight Approach for Domain-Specific Modeling Languages Design
3. Modeling Interface Definition Language Extensions (IDL3+) Using Domain-Specific Modeling
4. Languages
5. Automated Domain-Specific Modeling Languages for Generating Framework-Based Applications
6. Automated Software Defined Radio Deployment Using Domain Specific Modeling Languages
7. Systems integration of large scale autonomic systems using multiple domain specific modeling languages
8. A Flexible Infrastructure for Multilevel Language Engineering

9. Composing domain-specific design environments On metamodel composition
10. Model-integrated mechatronics - toward a new paradigm in the development of manufacturing systems
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