CSSE 490 Model-Based Software Engineering: Domain Specific Language Introduction

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Plan for the Day

- Introduction to Domain Specific Language (DSL)
- Watch Martin Fowler clip on DSLs
- Plus/Delta for course
- DSL Reading Discussion (if time)
I bet you have already used some domain specific languages and you didn’t even realize it. Can you think of some languages you have used that are domain specific?

- Think for 15 seconds…
- Let’s talk… 😊
General Purpose Language (GPL)

- Turing complete
- Well understood and widely used
- Applicable to a wide range of problems

Examples
- C, C++
- Java, C#
- Fortran, PL/1, Haskell
- Smalltalk, Python…
GPL Strengths and Limitations

**Strengths**
- Excellent IDE support
- Lots of experienced developers
- Growth via libraries

**Limitations**
- Lack of abstractions
- Language growth is often not possible
- Can be very verbose
Domain Specific Language (DSL)

- Small language targeted at application domain
- Expressive in its domain
- Often declarative

Examples

- Textual: LaTeX, Graphical: Pic
- Declarative: HTML, Imperative: VHDL
- Document: SVG, Executable: Ant/Maven
- Compiled: yacc, Interpreted: SQL
- Embedded: LINQ of C#
- Diesel, Groovy, …
Some more Specific DSL Definitions

A domain-specific language is a:

- language designed to provide a notation tailored toward an application domain, and is based only on the relevant concepts and features of that domain

- programming language or executable specification language that offers, through appropriate notations and abstractions, expressive power focused on, and usually restricted to, a particular problem domain

- small, usually declarative, language expressive over the distinguishing characteristics of a set of programs in a particular problem domain
DSL Strengths and Limitations

**Strengths**
- Tailored to domain
- Expressive and easy to use
- Little languages, little maintenance, increased productivity
- Communication with domain experts

**Limitations**
- Extra investment
  - Language engineering
  - Learning new language
- Weak IDE support
  - Editor, Debugger, Refactoring
- Migration can be hard
- Evolving into generality
More DSL Definitions (continued)

- Domain-specific description (DSD)
  - A program (specification, description, query, process, task, ...) written in a DSL

- Domain-specific processor (DSP)
  - A software tool for compiling, interpreting or analyzing domain-specific descriptions

As an analogy to general purpose languages
DSL ~ Java
DSD ~ Java source files
DSP ~ Java Compiler + Virtual Machine
DSL ARCHITECTURE
computer:
  processor:
    cores 2
    i386
  disk:
    size 150
  disk:
    size 75
    speed 7200
    sata

Processor p = new Processor
  (2, Processor.Type.i386);
Disk d1 = new Disk(150,
  Disk.UNKNOWN_SIZE,
  null);
Disk d2 = new Disk(75,
  7200,
  Disk.Interface.SATA);
return new Computer(p, d1,
  d2);
DSL Script

A language to build, configure or do in your domain

- Not necessary textual, could be graphical
- Might reuse syntax of host language
Semantic Model

An in-memory representation of the subject the DSL describes

- Sometimes this is the Abstract Syntax Tree (AST)
- Separates parser and generation
Generated Code

Executable representation of the DSL

- Evaluation during parsing
- Interpretation of semantic model
General DSL Development Activities

1. Identify problem **domain** of interest and gather the relevant **knowledge** in this domain
2. Capture domain knowledge in **semantic** notions and operations
3. Construct a **library** of **components** that implement the semantic notions and operations
4. Design a **DSL** that concisely describes applications in the domain
5. Develop a **compiler** (DSP) that translates **DSL** programs to a sequence of library calls
6. Write **DSL programs** (DSD) for all desired applications and compile them
Let’s watch Martin Fowler clip...

- What did Martin Fowler have to say about the usefulness of DSLs?
- What were some of the key elements of a DSL?
- How do DSLs get used today?
Help Me Help You

- Plus/Delta course evaluation on ANGEL

- Been doing some things that are new and want your impressions

- Please take 10 minutes to help me improve the course
Paper Discussion: DSL Paper

“When and How to Develop Domain-Specific Languages”

- What are the main thrusts of the paper?
- What are the controversial points and your positions?
- What did you get out of reading about Domain Specific Languages?
Homework and Milestone Reminders

- Continue Reading DSL Survey Paper…
  - Be prepared to discuss and even lead the discussion
  - Write a brief summary of observations on the paper

- Milestone 2: Establish a repository and structure for assembling components for your FacePamphlet application
  - Due by 11:55pm Friday, April 1st, 2011 (no foolin’!)