DM820
Advanced Topics in
Programming Languages

Peter Schneider-Kamp

petersk@imada.sdu.dk

http://imada.sdu.dk/~petersk/DM820/

DOMAIN SPECIFIC LANGUAGES

Many Different Domains

- Databases:
  - SQL, PL/SQL, PL/pgSQL, …
  - not PL/Python, PL/Perl, PL/TCL, PL/Ruby, …
- Mathematics & Science:
  - Maple, Matlab, Mathematica, …
  - not Numpy, Scipy, Sage, …
- Hardware: VHDL, Verilog, …
- Parsing: Yacc, SableCC, ANTLR, JavaCC, …
- Graphics: POV, SVG, …
- Graphs: Graphviz, …
- Sound: Csound, …

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Characteristics

- No common features
- Usually expressed in plain text
- Special parsers and compilers / interpreters needed
- Available language constructs depending on domain
- Often embedded into host application or as application input
- Often NOT turing-complete

Applicability

- Cost-benefit analysis
- Often needed when users are NOT programmers
- Also make sense when expressivity very high
- Make only sense for recurring tasks

Example: PL/pgSQL

- Domain specific language for database interaction
- Procedural programming mixed with queries and updates
- Extends possibilities of SQL
- Advantages w.r.t. SQL:
  - Modularity, identifiers, loops, error handling, …
- Advantages w.r.t. traditional database adapters:
  - Improved performance (executed on server, no communication overhead with repeated SQL statements)
  - Code reuse (stored procedures available to all clients)
  - Portable (no dependence on client platform)
- Disadvantages:
  - No user interaction possible

Hands-On

- Using regular expressions to check text
- Generating data
- Aggregating data
- Memoizing function values

Example: Csound

- Domain specific language for sound generation & processing

- Works on audio streams as "variables"

- Basic units are instruments and tables

- Contains many sources and sinks:
  - Oscillators
  - Sound card input / output
  - Sound file input / output
  - FFT-based convolution
  - …

- Used as backend of many software synthesizers

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Hands-On

- Single Oscillator for sine wave
- Attack-Decay envelope
- Chorusing
- Soundin
- Room "correction"