Back to School and learn some (more) grammar…

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Premise: a 'reasonable understanding' of modern parsing techniques and tools can lead to sensible and elegant solutions to a class of problems that otherwise remain out of reach. For a number of reasons the ANTLR tool is prescribed as the obvious front-runner in such scenarios.

General Problem

Many programming tasks are ultimately about manipulating data. That is, some combination of reading data, translating or modifying data, interpreting data, or writing data. For instance:

- reading an XML file;
- writing a JSON file;
- compiling a C++ program;
- interpreting a Python script.

'Under the hood' there is commonality in how these problems are tackled, regardless of whether it is 'data' or 'code' that is being processed. In essence ***well structure content*** is being manipulated.

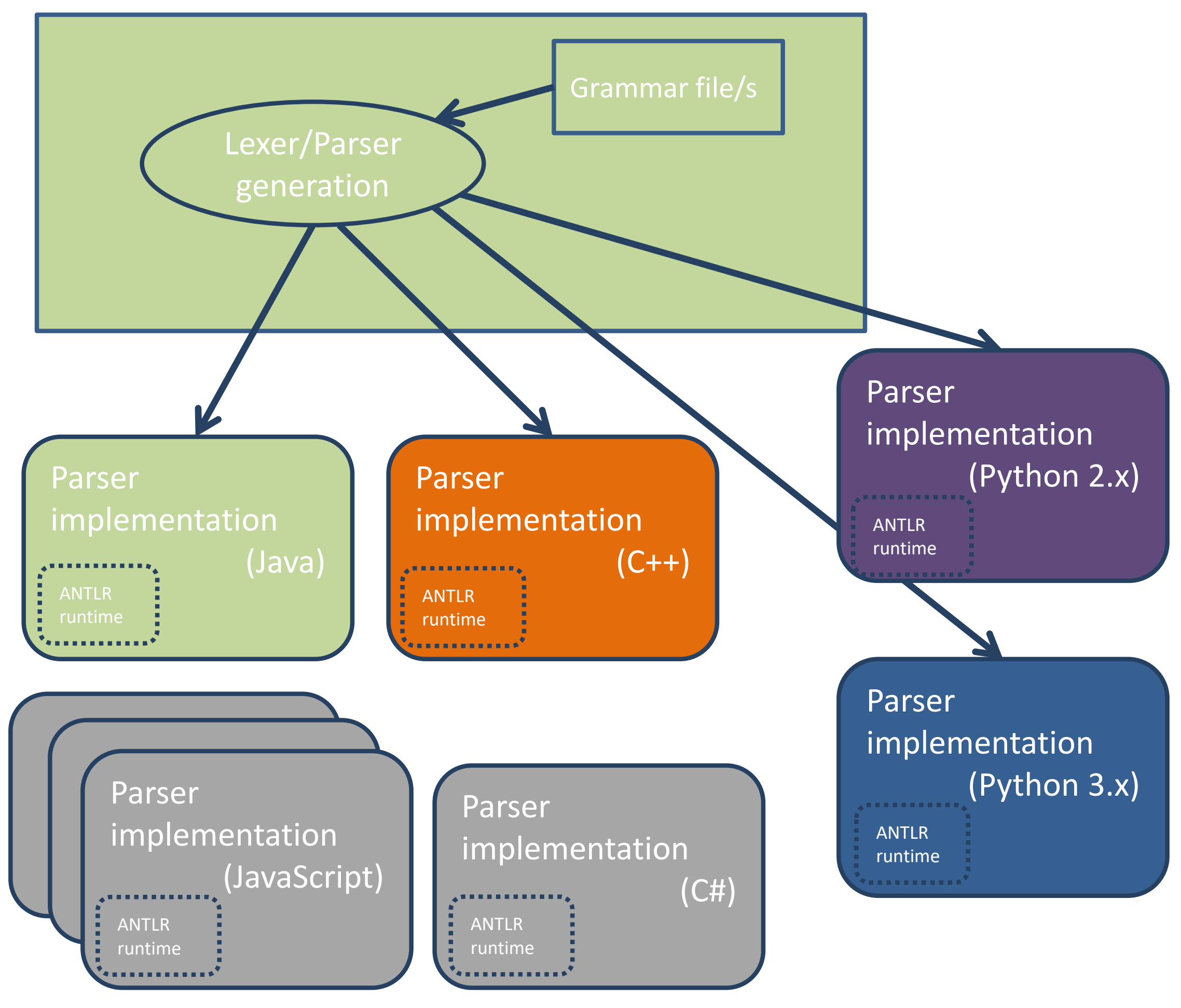
A parsing approach

Assuming there is some degree of structure to the content then a parsing approach might be fruitful. 20-30 years ago this would be the domain for the parsing experts. At that time you would either write your own parser or use the tooling available at the time:

- UNIX Lex and Yacc.
- Or more recently the GNU variants Flex and Bison.

Well that was a long time ago and computer language parsing theory and the associated tooling has progressed considerably since then. Enter some of the modern day alternatives: for example: ANTLR; Boost Spirit; Xtext.

The author is particularly interested in ANTLR since its developer (Terence Parr) has work in the field of language parsing for the last ~25 years and ANTLR is the tangible outcome of that effort. Digging further into the alternatives typically points back to ANTLR as a common reference. And Xtext even makes direct use of an older ANTLR version (3.X) internally.

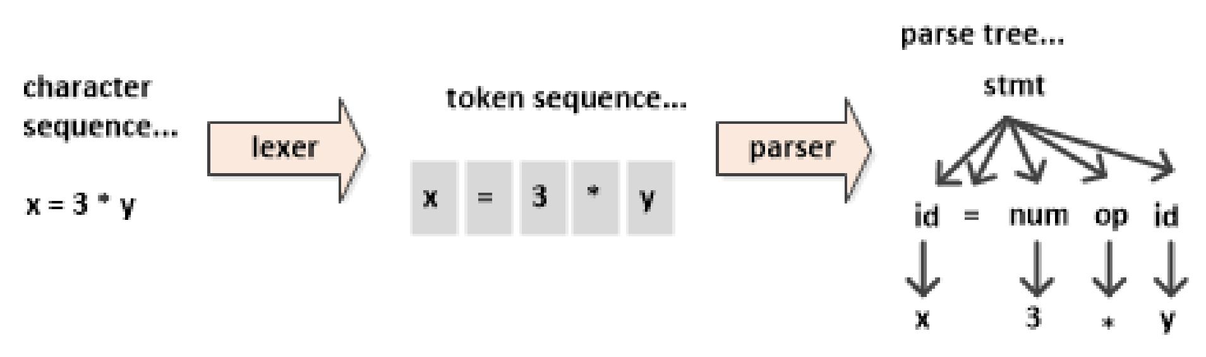

Grammar file/s
Lexer/Parser generation
Parser implementation (Java)
ANTLR runtime
Parser implementation (C++)
ANTLR runtime
Parser implementation (Python 2.x)
ANTLR runtime
Parser implementation (Python 3.x)
ANTLR runtime
Parser implementation (JavaScript)
ANTLR runtime
Parser implementation (C#)
ANTLR runtime

ANTLR: core and infrastructure

- *Grammars for many languages.*
- *Deployment in multiple languages.*
- *Active maintenance and online user community.*
- *Interactive plugin for IntelliJ IDEA.*

Parsing via ANTLR

ANTLR supports deployment in different target languages including Java, C++, and Python allowing it to be embedded in a custom application. There are also ANTLR grammars defined for many languages: Java; Python; C; C++; JSON; xml; mysql; idl etc.



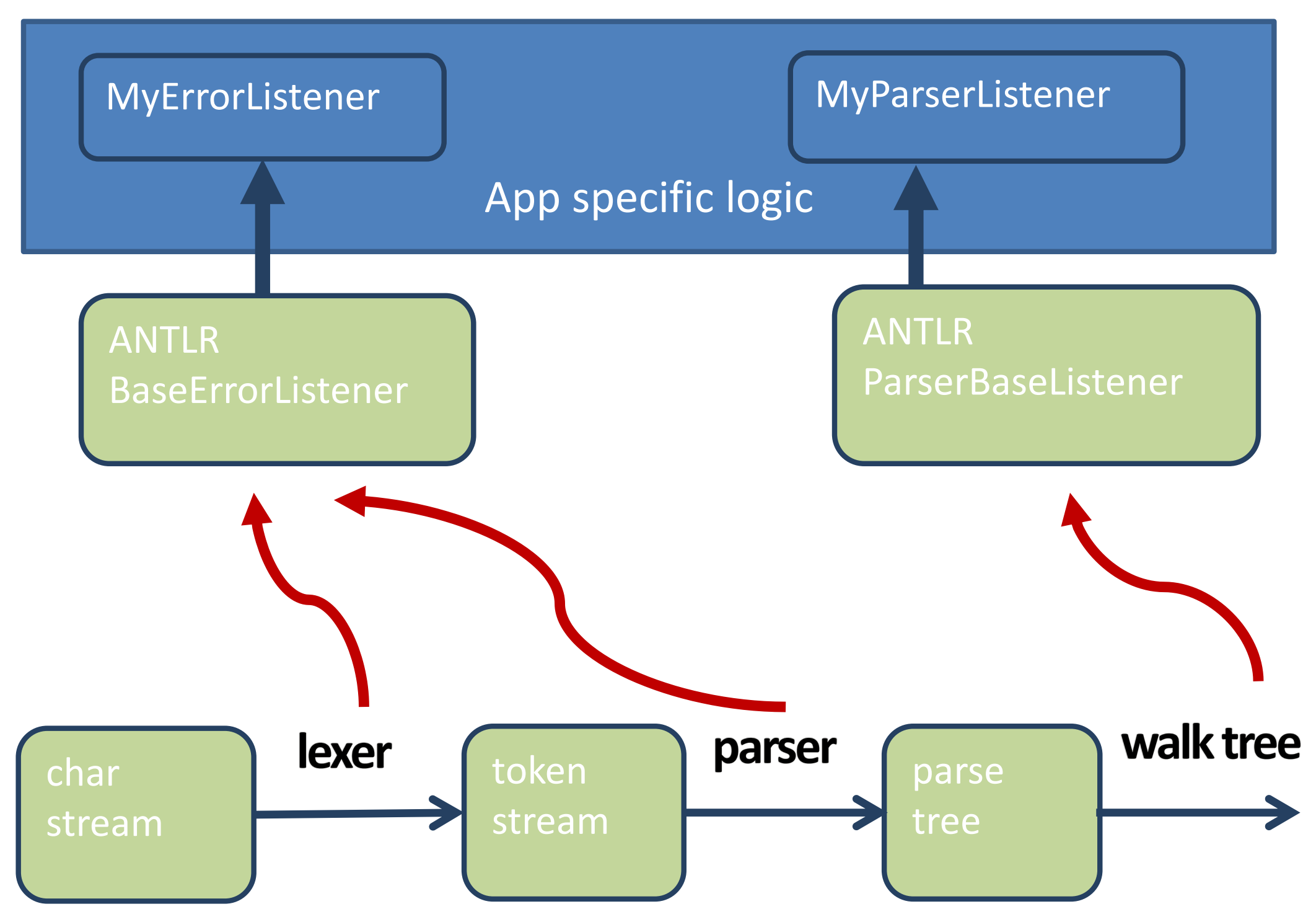
ANTLR 4.X and Xtext

Some colleagues have successfully used Xtext. Great! The reason this route was/is not pursued by the author?

- Xtext uses ANTLR 3.X which does not support direct left recursion (Java grammar is 172 rules in 3.X, 91 in 4.X).
- ANTLR has a larger and more active community.

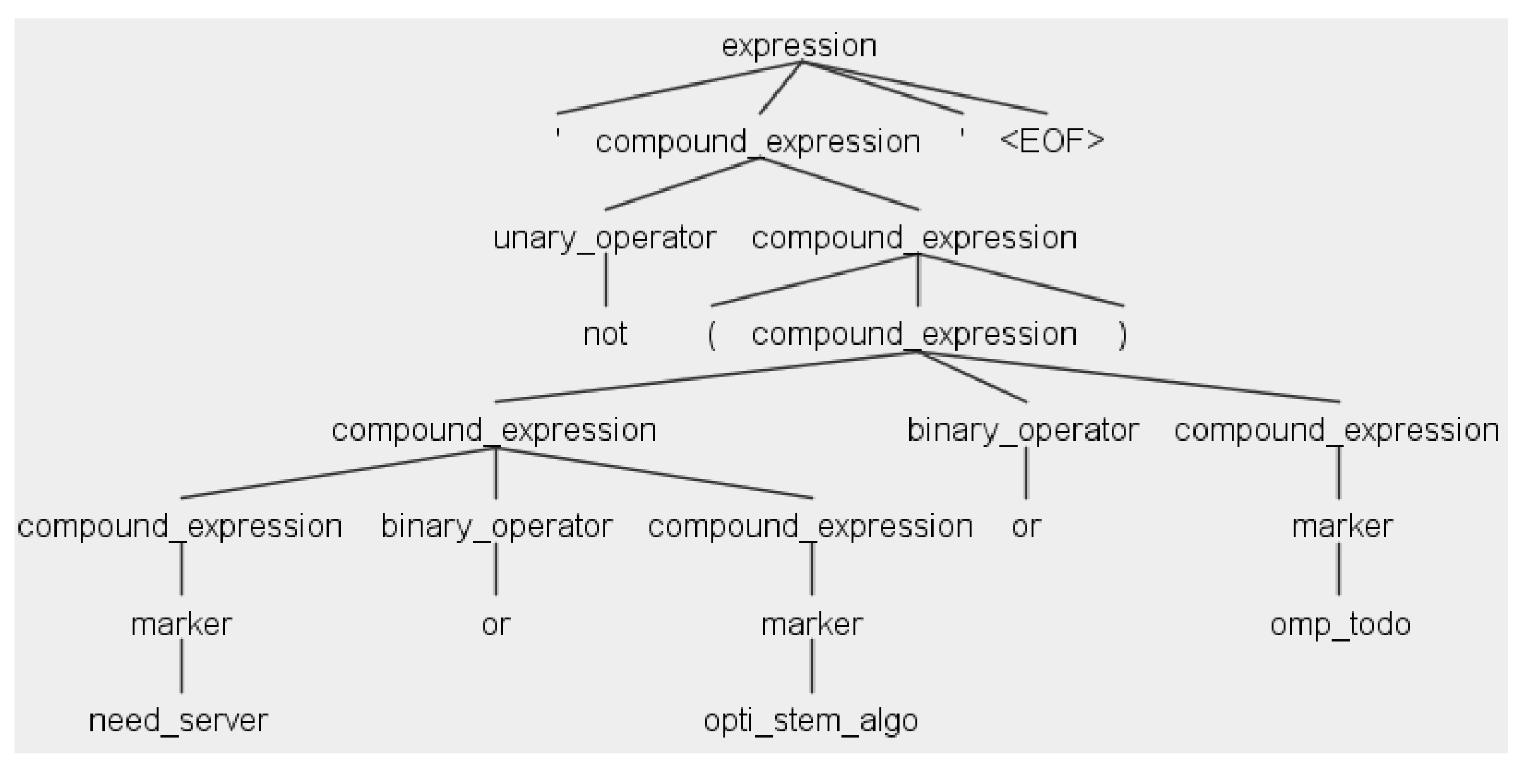
Clean Design

4.X provides a clean separation of the 'parsing code' and the 'application code' that uses it. The generated implementation for a particular grammar allows code for both the Listener and Visitor design styles to be adopted. This is an option that is selected during code generation.



Usages and Examples

- Python 2.X syntax checker (used manually but can be easily integrated into Jenkins overnight build/test runs).
- Python Unit test code template generation (insight into how refactoring tools work).
- FDT log file analyzer (helps clarify what to do in the lexer and what to do in the parser).
- PyTest expression parser. An example to show the basic principles, including implementation in Java; Python 2.X; and C++ 11.



Conclusions

Some familiarity with modern parsing techniques and their associated tooling opens the door to solving a class of problems that might otherwise be out of reach. It also removes the mystery behind such trends as DSLs and projectional editing.

As a Software Engineer these are skills that some may find useful.