

C99 Parser User Guide
 Matt Wette
 June 2019
 <<<<<< HEAD
 With NYACC Version 3.01.1
 =====
 With NYACC Version 3.01.0
 >>>>>> dev-3.01

Introduction

This is a manual for the C99 parser provided with NYACC. It is a LALR(1) based parser written in Scheme as implemented in Guile. The grammar can be examined by looking at the source code in the file `nyacc/lang/c99/mach.scm`. The parser has been used to generate object code (see <https://www.gnu.org/software/mes/>) but it has options to make it useful for processing C code in other ways. For example, the FFI Helper included with NYACC uses the parser to generate FFI (foreign function interface) code for many C libraries. It does this by parsing the associated C header files.

`parse-c99 [options]` [Procedure]
 where options are

`#:cpp-defs defs-list`
defs-list is a list of strings where each string is of the form *NAME* or *NAME=VALUE*.

`#:inc-dirs dir-list`
dir-list is a list of strings of paths to look for directories.

`#:inc-help helpers`
helpers is an a-list where keys are include files (e.g., `"stdint.h"`) and the value is a list of type aliases or CPP define (e.g., `"foo_t" "FOO_MAX=3"`). The default helper is `c99-def-help` (see below).

`#:mode mode`
mode is one literal `'code`, `'file`, or `'decl`. The default mode is `'code`.

`#:debug bool`
 If *bool* evaluates to true, print productions as they are reduced.

This will parse the content taken from the current input port until end if input is reached. A parse tree in the form of an SXML expression is returned. See below for the syntax. This needs to be explained in some detail. `tdd = typedef dict: ((("<time>" time_t) ... ("<unistd.h>" ...))` Default mode is `'code`.

```
(with-input-from-file "abc.c"
  (parse-c #:cpp-defs '("ABC=123"))
          #:inc-dirs '(("." "./incs" "/usr/include"))
          #:inc-help (append '("myinc.h" "foo_t" "bar_t") c99-std-help)
          #:mode 'file))
```

Note: for `file` mode user still needs to make sure CPP conditional expressions can be fully evaluated, which may mean adding compiler generated defines (e.g., using `gen-cpp-defs`).

Include Helpers

The C99 parsers can use “include helpers”. This allows files to be parsed without reading full include files. The user provides typenames (types defined using `typedef`) and defines. The syntax for the include-helper optional argument to the parsers is

```
(define my-inc-helper
  '(("foo.h" "foo_t" "ABC=123" "SUM(X,Y)=((X)+(Y))")
    ("bar.h" "bar_t" "DEF=456" "MAX(X,Y)=((X)>(Y)?(X):(Y))")))
```

The special helper `"__builtin"` will be “included” automatically at the start of parsing. This allows one to generate definitions for compiler builtins like `__builtin_va_list`.

```
(define inc-helper
  '("__builtin" "__builtin_va_list=void*")))
```

If no inc-helper is provided, the default is `c99-def-help`, which is defined (in the module `(nyacc lang c99 util)`) as

```
(define c99-def-help
  '("__builtin"
    "__builtin_va_list=void*"
    "__inline__=inline" "__inline=__inline__"
    "__restrict__=restrict" "__restrict=__restrict__"
    "__signed__=signed" "__signed=__signed__"
    "asm(X)=__asm__(X)" "__asm(X)=__asm__(X)"
    "__attribute(X)=__attribute__(X)"
    "__volatile__=volatile" "__volatile=__volatile__"
    "__extension__=" "__extension=__extension__"
    "asm=__asm__" "__asm=__asm__"
    "__attribute(X)=__attribute__(X)")))
```

The module `(nyacc lang c99 util)` also defines `c99-std-help`, which includes the above and typedefs and CPP defines for many standard includes (e.g., `alloca.h`, `limits.h`). See the source `nyacc/lang/c99/util.scm` for more detail.

Misc Items

The special symbol `C99_ANY` can be used for symbols which you don’t want to define. In the parser will handle this as `XXX`

Stuff

Note on CPP replacement text: IIRC, C99 will remove comments from CPP statements before processing. I preserve this and remove inside the CPP parser.

The Unit Parser

TALK ABOUT `fixed-width-int-names`

`parse-c99` [`#:cpp-defs` *def-a-list*] [`#:inc-dirs` *dir-list*] [`#:mode` *mode*] [`#:debug` *bool*] [`code` | `file`] [`debug` *bool*] [Procedure]

This needs to be explained in some detail. Default mode is `'code'`.

```
(with-input-from-file "abc.c"
  (parse-c #:cpp-defs '("ABC=123"))
    #:inc-dirs (append '("./incs") c99-std-dict)
    #:inc-help '(("myinc.h" "foo_t" "bar_t"))
    #:mode 'file))
```

Modes

There are several modes for parsing which affect the way the C preprocessor statements are handled, and how the parse tree is generated. The following list explains the intent behind these parsing modes. Later we mention some fine points.

- *code* mode (the default) In this mode, the preprocessor works like a normal C compiler. The preprocessor statements are evaluated as they are read and macros in the code are expanded as they are read.
- *decl* mode This mode is intended to be used for tools which want to extract the declarations and definitions which are explicit in a file, but allow access to declarations and definitions in included files.
- *file* mode is intended to be used for tools which want to transform C files somehow. For example, one could parse a file and remove all comments. This will keep the CPP structure at the top level. Preprocessor statements at the top level are not evaluated. Note: There is a change in versions starting with 0.77.0. In these all defines required for evaluating CPP expressions in if-then have to be resolved.

Options are as follows

`#:cpp-defs`

This is a list of define strings (e.g., `'("ABC=123")`).

`#:inc-dirs`

This is an ordered list of directories to search for include files.

`#:inc-help`

This is an a-list of include helpers, where keys are the include file or path (e.g., `sys/types.h`).

`#:mode`

This is the mode: `'code`, `'decl` or `'file`. The default is `'code`.

`#:xdef?`

This is a predicate function to determine whether to expand a definition (used in file mode). See below.

Note: The user needs to define `"__has_include(X)=__has_include__(X)"` to enable has-include; `"__has_include=__has_include__"` will not work. (Should I worry that it does not?)

`name mode => #t | #f`

[xdef?]

Given string *name* and *mode* indicate whether the parser should expand using CPP defines. The default is `(lambda(name mode) (eqv? mode 'code))`.

Expression Parser

To be documented.

Copying

Permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License, Version 1.3 or any later version published by the Free Software Foundation; with no Invariant Sections, no Front-Cover Texts, and no Back-Cover Texts. A copy of the license is included with the distribution as COPYING.DOC.

The Free Documentation License is included in the Guile Reference Manual. It is included with the NYACC source as COPYING.DOC.