

AspeCt-oriented C (V 0.9)

Quick Reference

Terminology

ACC

ACC is ASPECT-ORIENTED C implemented by *acc*, the Aspect-oriented C Compiler.

aspect

Aspect encapsulate non-modular system concerns, like security policies, transaction support, synchronization concerns etcetera. ACC represents aspects as C files containing C declarations and statements, and ACC syntax, such as pointcuts and advice.

join point

A *join point* is a well-defined point in the execution context of a program. ACC supports *call*, *execution*, *set*, and *get* join points. A *call* join point is the point where a function is called. An *execution* join point is the point where a function is executed. A *set* join point is the point where a variable is assigned a value. A *get* join point is the point where a variable is read.

pointcut

A *pointcut* is a language extension representing one or more join points. ACC supports *primitive pointcuts*, *composite pointcuts*, and *named pointcuts*.

advice

An *advice* represents the code to be executed when a join point matches a pointcut defined inside the advice declaration. ACC supports the *before*, *after*, and *around* advice.

Pointcut

args(int, int)

The join points of calling and executing functions taking (int, int) as parameter type.

call(void foo(int))

The join points of calling function *foo*.

callp(void foo(int))

The join points of calling function *foo* by dereferencing a function pointer.

cflow(call(void foo(int, int)))

The join points under the control flow of calling function *foo*.

execution(void foo(int))

The join points of executing function *foo*.

get(char a)

The join points of reading variable *a*'s value.

infile("t1.mc")

The join points in the input file "t1.mc".

infunc(foo)

The join points inside *foo*'s function body.

pointcut MyPC(): call(void foo(int));

A named pointcut *MyPC()* representing the join points of calling function *foo*. *MyPC()* can be used as a pointcut.

result(int)

The join points of calling and executing functions whose return type is int.

set(char a)

The join points of writing to variable *a*.

call(void foo()) && infunc(main)

The join points of calling function *foo* inside function *main*.

call(void foo()) && ! infunc(main)

Calls of function *foo*, except those called inside *main*.

call(void foo()) || call(void bar())

Calls of either function *foo* or function *bar*.

call(void foo()) && cflow(call(void bar()))

Calls of function *foo* in the control flow of calling function *bar*.

general form

args(a list of types or identifiers)

[call|callp|execution](function-signature)

cflow(pointcut)

[get|set](variable-declaration)

infile("file name")

infunc(identifier)

pointcut pointcut-name (parameter-list):pointcut;

result(type or identifier)

pointcut-1 && pointcut-2

pointcut-1 || pointcut-2

! pointcut

(pointcut)

Wildcard Matching

call(i\$t f\$oo(in\$))

This represents any call to functions starting with "f" and ending in "oo", having a return type starting with "i" and ending in "t", and accepting one parameter having a type starting with "in," such as "int foo(int)" or "it f2oo(in)".

args(int, ..., char)

This represents any call or execution of functions accepting an int and a char as first and last parameters, such as "void foo(int, char)" or "int foo2(int, char*, char)".

call(int foo(int)) && infunc(foo2)

This represents any call of function "foo" inside functions whose name starts with "fo" and ends in "o2".

general form

"\$": matches any type identifier or any continuous length string, including the empty string.

"...": matches any length item list, including the empty list.

Advice

before ():execution(void foo (int)){... }

Advice code runs *before* the execution of function `foo`.

after `() : call(void foo (int)) { ... }`

Advice code runs *after* calling function `foo`.

int around `() : call(int foo (char)) { ... }`

Advice code runs *instead* of calling function `foo`.

before `(int a) : call(void foo (int)) $$ args(a) { ... }`

Advice code runs *before* calling function `foo`, and variable “a” holds the parameter value of function `foo` and can be used inside the advice code.

after `(int a) : call(int foo (void)) $$ result(a) { ... }`

Advice code runs *after* calling function `foo`, and variable “a” holds the return value of function `foo` and can be used inside the advice code.

before `(int a, int b) : cflow(call(void foo(int) && args(b))) && call(int foo2 (int)) && args(a) { ... }`

Advice code runs *before* calling function `foo2` in the control flow of calling function `foo`, and variable “a” holds the parameter value of function `foo2` and variable “b” holds the parameter value of function `foo`. Both “a” and “b” can be used inside the advice code.

general form

type-specifier_{opt} **before|after|around** (*parameter-type-list_{opt}*) : *pointcut*
{ *function-body* }

special identifiers inside advice body

this→arg(*integral-type-expression*)

A “void *” pointing to the address of the memory holding a parameter.

this→argsCount

The number of parameters.

this→argType(*integral-type-expression*)

A string representation of the type of a parameter.

this→fileName

A string representation of the source file name containing the matched join point.

this→funcName

A string representation of the caller function name of the matched join point.

this→kind

A string representation of the join point kind, either “call” or “execution”.

this→retType

A string representation of the return type.

this→targetName

A string representation of the callee function name of the matched join point.

prereturn(*integral-type-expression*)

Forces an immediate return to the parent function.

proceed()

Only used inside **around** advice. It takes the original value of the arguments, and calls or executes the original function.

Examples using special identifiers

```
void around(): call(int foo()) {
    printf(“%s %s in function %s of file %s”,
        this→kind,
        this→targetName,
        this→funcName,
        this→fileName);
    proceed();
    prereturn(2);
}
```

Static Crosscutting

ACC provides mechanism to support static crosscutting, such as the addition of members to structs and unions.

introduce() : *intype*(*struct X*) {

double b;

int d;

}

A member “double b” and “int d” is inserted at the *end* of the definition of type “struct X”.

general form

intype(*type-name*)

introduce () : *pointcuts* { *member-declarations* }

Exception Handling

ACC provides mechanism to throw and catch integer-based exceptions.

```
catch (int e) : try(call(int foo(int))) {
    printf(“catch an exception = %d\n”, e);
}
```

The advice catches an exception thrown in the control flow of calling function `foo`.

```
before () : call (int foo3(int)) {
    throw(3);
}
```

An exception with value “3” is thrown before calling function `foo3`.

general form

try (*pointcut-definition*).

catch (int e): *pointcuts* { *function-body* }

throw (*non-zero-integer-value*).

Example

The following is a reusable tracing aspect.

```
before(): call($ $(...)) && cflow(execution($
main(...))) {
    printf(“calling %s in function %s of file
%s \n”,this→targetName, this→funcName,
this→fileName);
```

```

if ( this->argsCount == 0 ) {
    printf(“no parameter \n”);
} else {
    for(int i = 1 ; i <= this->argsCount; i++) {
        printf(“arg[%d] = %s ”,
            i,
            this->argType(i));
    }
}
}
}

```

Using the ACC Compiler

use “tacc”

Suppose the above aspect is saved in file “a.acc”, and the core file (i.e., the file not containing ACC syntax) is “b.c”.

```
>tacc a.acc b.c
```

use “acc”

Suppose the above aspect is saved in file “a.acc”, and the core file (i.e., the file not containing ACC syntax) is save in “b.mc”.

1. Copy files to have .c suffix


```
>cp a.acc a_acc.c
>cp b.mc b_mc.c
```
2. Preprocess the files by a preprocessor, and save the output in files with the by the ACC compiler required suffixes. This step is necessary because gcc does not recognize the .acc and .mc suffix. However, if a preprocessor, like cpp, is not picky about the file suffix, this step could be skipped.


```
>gcc -E a_acc.c > a_acc.acc
>gcc -E b_mc.c > b_mc.mc
```
3. Perform ACC compilation (i.e., weaving)


```
>acc a_acc.acc b_mc.mc
```

4. Perform compilation

```
>gcc a_acc.c b_mc.c
```

command line options

1. -a , -aspectmatch

The advices will also match the join points inside aspect files.

2. -af=<suffix> , -aspect-suffix=<suffix>

Specifies the file suffix for the aspect file.

3. -h , -help

Display help information.

4. -m[=<file name>], -matchinfo[=<file name>]

The join point-advice matching information is output.

5. -mf=<suffix> , -mainfile-suffix=<suffix>

Specifies the file suffix for the non-aspect file.

6. -n, -no-line

No #line directives are generated in output.

7. -t , -thread-safe

The code generated to support the cflow() pointcut is thread-safe (based on specific gcc functionality).

8. -v , -version

The compiler’s version number is printed.

For up to date information, please refer to <http://www.AspectC.net>.

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