New LLVM Switch-per-Function Feature

May 2023

Function Attributes

- Attributes allow users to control the functionally, optimizations, code generations, and compiler decisions of the function
- For example, the "minsize" attribute keeps the function code size as small as possible:

```
void __attribute__((minsize)) foo0(int *p, int *q) {...}
```

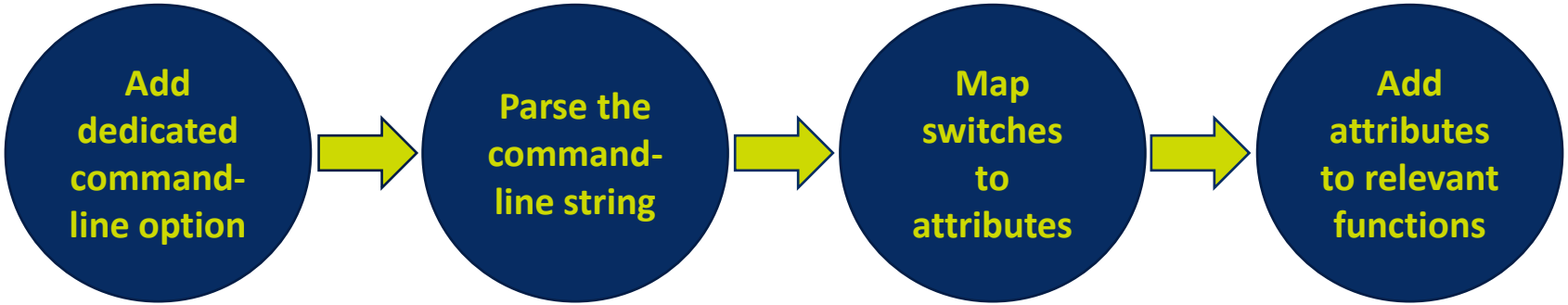
- **Disadvantage**:
  - Forces the user to modify the source code

Switch-per-Function

- Control optimizations at the function level from the command-line:
  - No source code modify required
  - Easy to configure
  - Usage example:

```
-mllvm -cxd-switch-per-function="foo0=-fmin-size”
```

CEVA Implementation Steps



CEVA Implementation Steps

1. Add a dedicated command-line option in **clang\lib\CodeGen\ TargetInfo.cpp**:

```
static llvm::cl::opt<AttrsPerFunction> SetFuncsAttrsTable("cxd-switch-per-function", llvm::cl::Hidden,
            llvm::cl::desc("Set attrs per function"));
```

2. Override the **setTargetAttributes** function from the **TargetCodeGenInfo** class to parse the string following the `-cxd-switch-per-function="…"` options.

CEVA Implementation Steps

3. Map each option from the parsed string to the matching function and the relevant attribute.
   - The main data structure is a map from **switch syntax** to **attribute syntax** and **bool value**, representing whether the switch should have a value.

```
SwitchToAttrMap = {
    {
        {"-fmin-size", std::make_pair("minsize", false)},
```

CEVA Implementation Steps

4. Add each attribute to its relevant function:

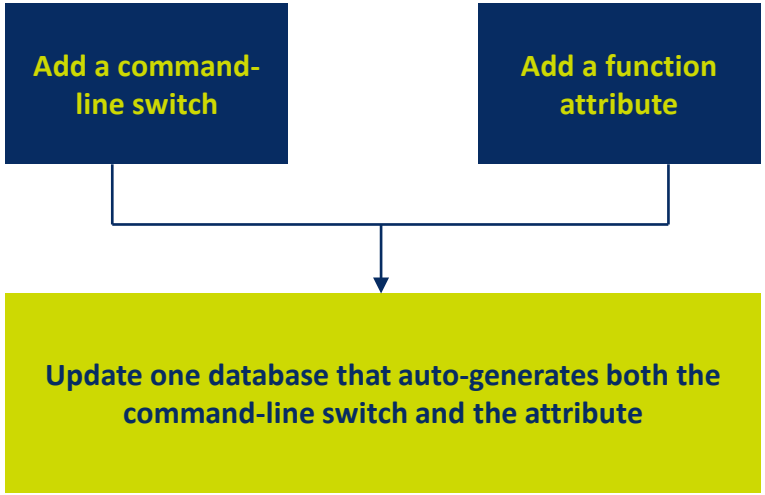
```
auto It = SwitchToAttrMap.find(SwitchName);
std::string AttrName = It->second.first;
if (It->second.second) {
  Fn->addFnAttr(AttrName, SwitchValue);
} else {
  Fn->addFnAttr(AttrName);
}
```

Adding New Attributes

- Some switches do not have corresponding attributes.
- We added corresponding attributes to these selected switches.
- The Switch-per-Function feature is now also available for these switches.
- We have found this extremely essential for optimizing customer code.

Suggestion for Future Support

- Add a mechanism to define, in one place, an option that will become both a global command-line option as well as a function attribute that will apply this option to a specific function:
  - Auto-generate the mapping between a switch and an attribute
  - Easier to maintain



Summary

1. Disadvantages of function attributes

2. Solution: Switch-per-Function feature

3. Switch-per-Function feature implementation

4. Expand range of switches per function

5. Suggestion for future support