Advanced Topics in Compilers

SCCManager

Simone Campanoni
simone.campanoni@northwestern.edu

Outline

- What is it and why NOELLE provides it

- SCC and its metadata

SCCManager

- It provides information/knowledge/semantics about a given SCC of a loop dependence graph
- Such semantics can be used to create degrees of freedom about satisfying the constraints dictated by the dependences included in an SCC

```
/*
 * Dependences.
 */
auto sccManager = loop->getSCCManager();
```

Instance of the class llvm::noelle::LoopDependenceInfo

Instance of the class llvm::noelle::SCCDAGAttrs

SCC and its metadata

For every SCC in an SCCDAG,
there is an instance of the class llvm::noelle::GenericSCC
that describes the semantics of such SCC

```
/*
 * Dependences.
 */
auto sccManager = loop->getSCCManager();
auto SCCDAG = sccManager->getSCCDAG();
```

```
/*
 * Check all SCCs.
 */
for (auto scc : SCCDAG->getSCCs()){

8 lines: Print the instructions that
}
```

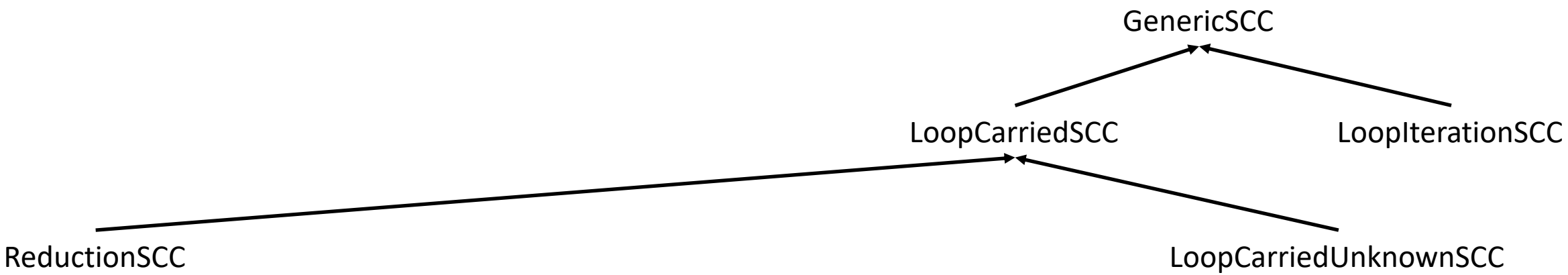
Instance of the class llvm::noelle::GenericSCC

```
/*
 * Fetch the SCC information.
 */
auto sccInfo = sccManager->getSCCAttrs(scc);
```

Outline

- What is it and why NOELLE provides it

- SCC and its metadata

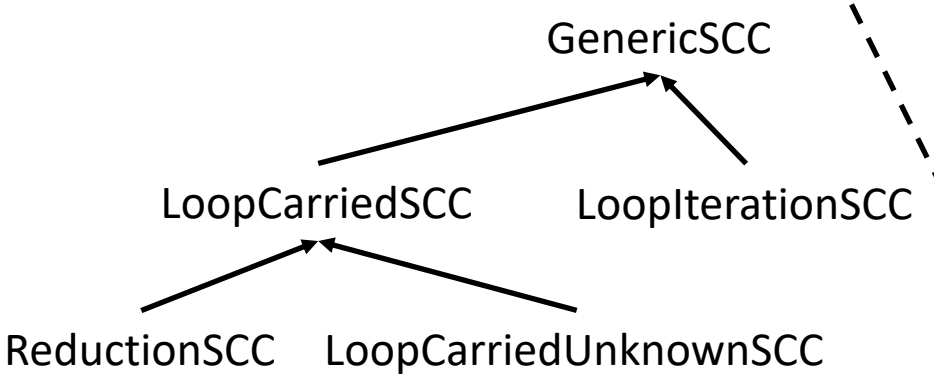

GenericSCC
LoopCarriedSCC
LoopIterationSCC
ReductionSCC
LoopCarriedUnknownSCC

Instance of the class llvm::noelle::GenericSCC

```
/*
 * Check all SCCs.
 */
for (auto scc : SCCDAG->getSCCs()){

8 lines: Print the instructions that
}
```

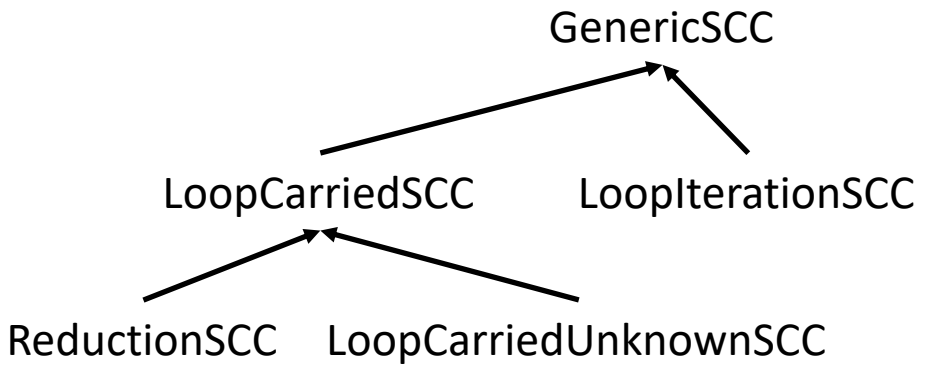
```
/*
 * Fetch the SCC information.
 */
auto sccInfo = sccManager->getSCCAttrs(scc);
```

```
/*
 * Check the SCC type
 */
if (isa<LoopCarriedSCC>(sccInfo)) {

  if (isa<ReductionSCC>(sccInfo)) {
    errs() << "     It can be reduced\n";

  } else if (isa<LoopCarriedUnknownSCC>(sccInfo)) {
    errs() << "     We don't know how to avoid executing this SCC sequentially\n";
  }

} else {
  auto liSCC = cast<LoopIterationSCC>(sccInfo);
  errs() << "     It doesn't have loop-carried dependences\n";
}
```



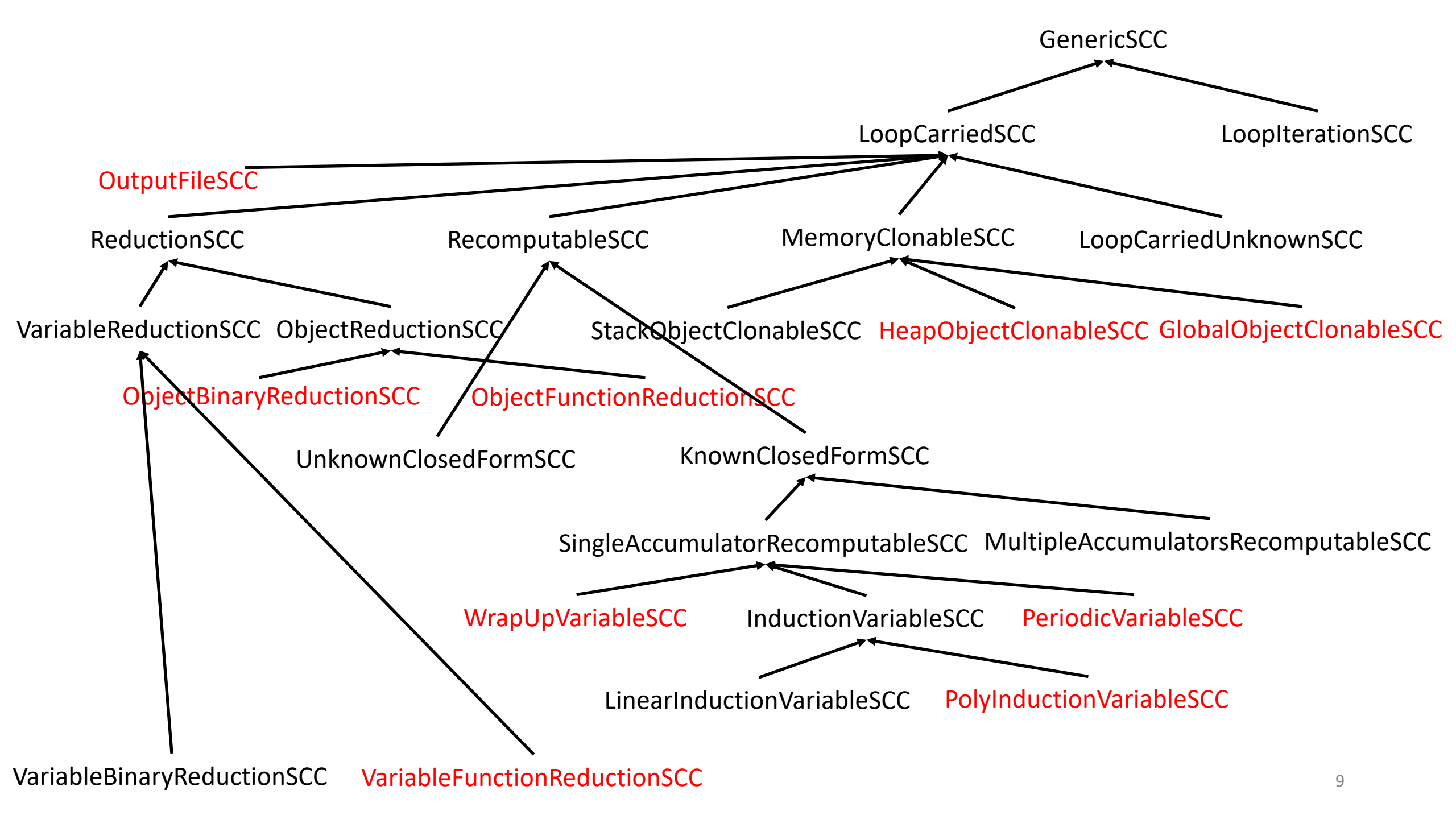
Instance of the class llvm::noelle::GenericSCC

```
/*
 * Fetch the SCC information.
 */
auto sccInfo = sccManager->getSCCAttrs(scc);
```



Instance of the class llvm::noelle::ReductionSCC

```
if (auto redSCC = dyn_cast<ReductionSCC>(sccInfo)){

  /*
   * Use the APIs of this specific SCC.
   */
  errs() << "   Identity value = " << redSCC->getIdentityValue() << "\n";
  errs() << "   PHI accumulator = " << redSCC->getPhiThatAccumulatesValuesBetweenLoopIterations() << "\n";
}
```


GenericSCC
LoopCarriedSCC
LoopIterationSCC
OutputFileSCC
ReductionSCC
RecomputableSCC
MemoryClonableSCC
LoopCarriedUnknownSCC
VariableReductionSCC
ObjectReductionSCC
StackObjectClonableSCC
HeapObjectClonableSCC
GlobalObjectClonableSCC
ObjectBinaryReductionSCC
ObjectFunctionReductionSCC
UnknownClosedFormSCC
KnownClosedFormSCC
SingleAccumulatorRecomputableSCC
MultipleAccumulatorsRecomputableSCC
WrapUpVariableSCC
InductionVariableSCC
PeriodicVariableSCC
LinearInductionVariableSCC
PolyInductionVariableSCC
VariableBinaryReductionSCC
VariableFunctionReductionSCC

Always have faith in your ability

Success will come your way eventually

Best of luck!