Assignment 2

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Assignment 2: Quizzes + A Coding Task

- Two sets of quizzes (10 points)
  - LLVM compiler and its intermediate representation
  - Code graphs (including ICFG and PAG)
- One coding task (10 points)
  - **Goal**: implement a context-sensitive graph traversal on ICFG and print **feasible** paths from a source node to a sink node on the graph

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  - **Goal**: implement a context-sensitive graph traversal on ICFG and print **feasible** paths from a source node to a sink node on the graph
  - **Specification and code template**: `https://github.com/SVF-tools/Teaching-Software-Verification/wiki/Assignment-2`
  - **SVF CPP API** `https://github.com/SVF-tools/Teaching-Software-Verification/wiki/SVF-APIs`

You are encouraged to finish the quizzes before starting your coding task.

Context-Sensitive Control-Dependence (Algorithm)

Algorithm 1 Context sensitive control-flow reachability

Input : curNode : ICFGNode snk : ICFGNode path : vector⟨ICFGNode⟩
callstack : vector⟨SVFInstruction⟩ visited : set⟨ICFGNode, callstack⟩;

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1  dfs(curNode,dst)
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3    if pair ∈ visited then
4  |   return
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7    if src == snk then
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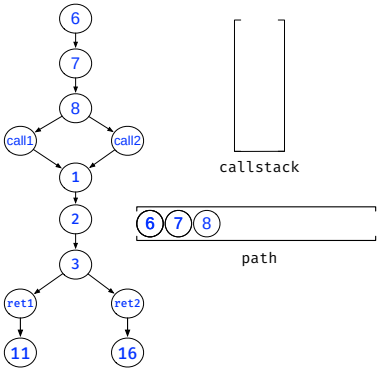
Context-Sensitive Control-Dependence

Obtaining a path from node 6 to node 11 on ICFG



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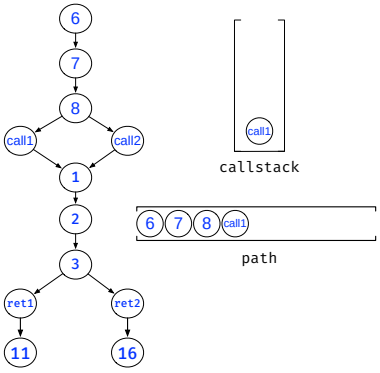

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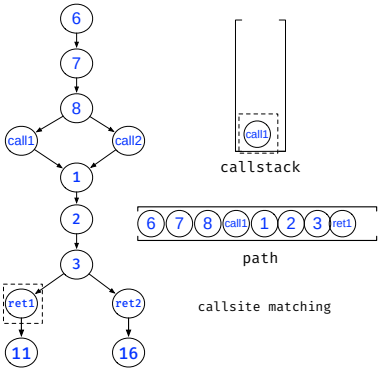

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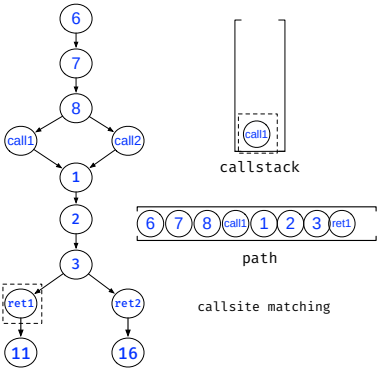

callstack

path

callsite matching

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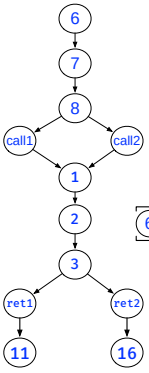

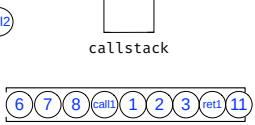

ICFG path:
6→7→8→call1→1→2→3→ret1→11

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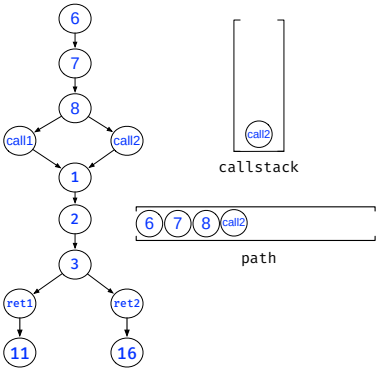

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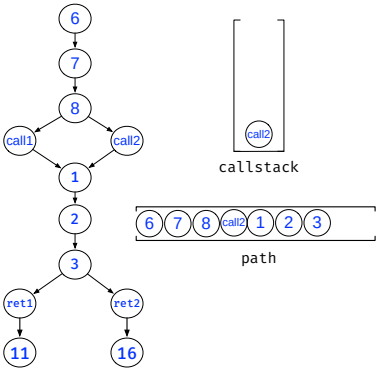

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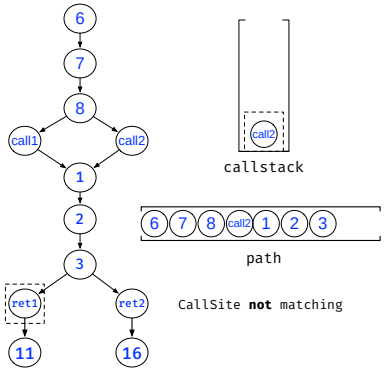

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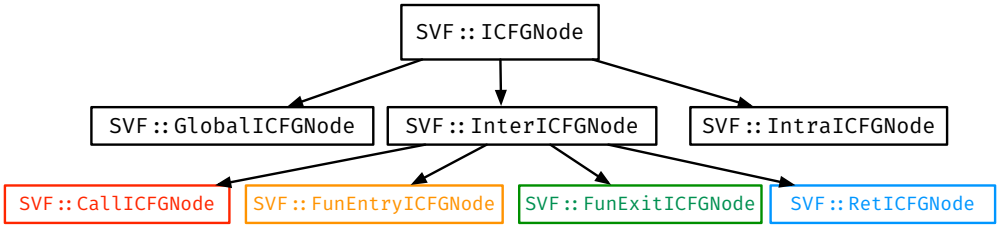
ICFG Node and Edge Classes



https://github.com/SVF-tools/SVF/blob/master/include/Graphs/ICFGNode.h

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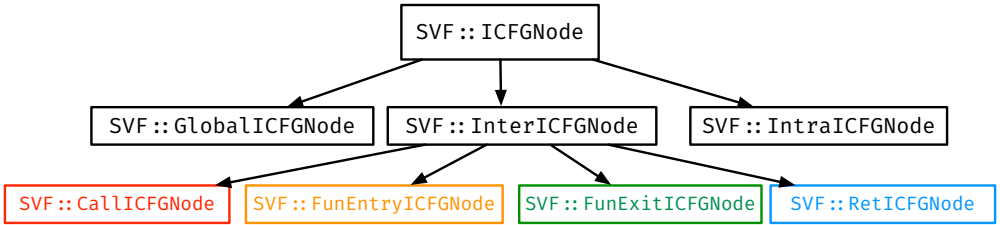

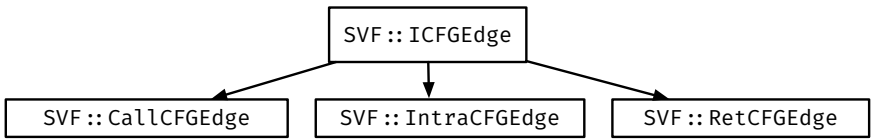

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`cast` and `dyn_cast`

- C++ Inheritance: see slides in Week 2.
- Casting a **parent** class pointer to pointer of a **Child** type:
  - `SVFUtil::cast`
    - Casts a pointer or reference to an instance of a specified class. This cast fails and aborts the program if the object or reference is not the specified class at runtime.
  - `SVFUtil::dyn_cast`
    - "Checked cast" operation. Checks to see if the operand is of the specified type, and if so, returns a pointer to it (this operator does not work with references). If the operand is not of the correct type, a null pointer is returned.
    - Works very much like the dynamic_cast<> operator in C++, and should be used in the same circumstances.
- Example: accessing the attributes of the child class via casting.
  - `RetBlockNode* retNode = SVFUtil::cast<RetBlockNode>(ICFGNode);`
  - `CallCFGEdge* callEdge = SVFUtil::dyn_cast<CallCFGEdge>(ICFGEdge);`