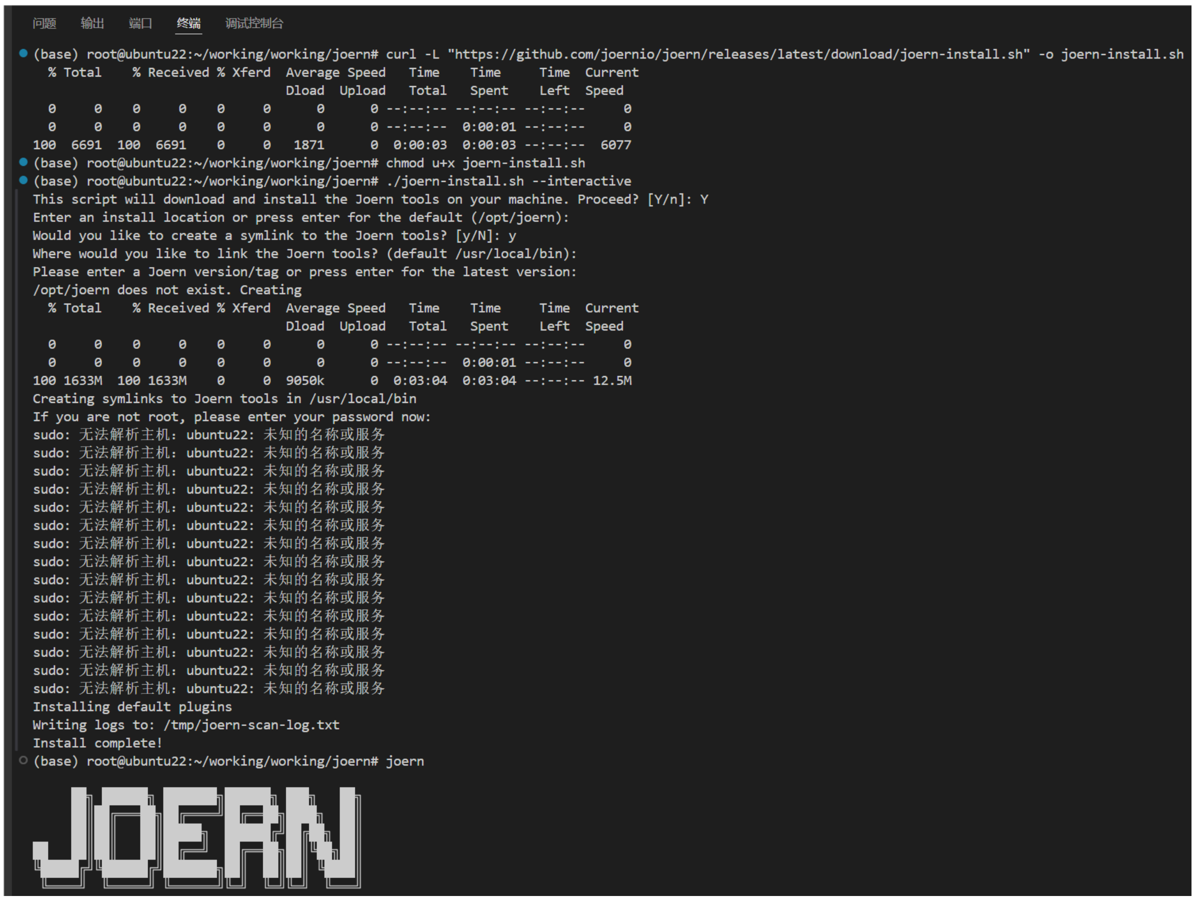
一、joern常用语句

1.Joern的安装

使用joern官网（**https://docs.joern.io/installation/**）提供的命令即可：

```
mkdir joern && cd joern # optional
curl -L "https://github.com/joernio/joern/releases/latest/download/joern-install.sh" -o joern-install.sh
chmod u+x joern-install.sh
./joern-install.sh --interactive
```

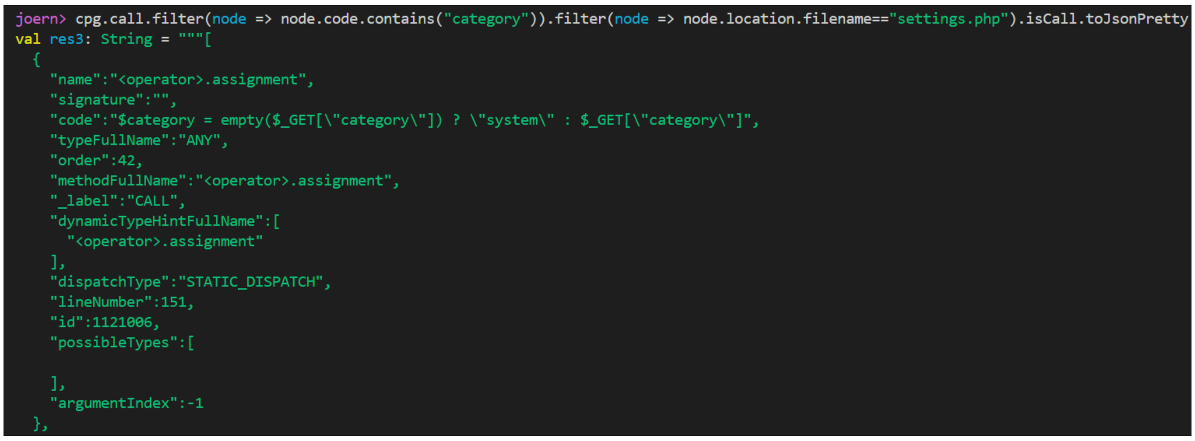


```
● (base) root@ubuntu22:~/working/working/joern# curl -L "https://github.com/joernio/joern/releases/latest/download/joern-install.sh" -o joern-install.sh
    % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                   Dload  Upload   Total   Spent    Left  Speed
    0     0    0     0    0     0      0      0 --:--:-- --:--:-- --:--:--     0
    0     0    0     0    0     0      0      0 --:--:--  0:00:01 --:--:--     0
  100  6691  100  6691    0     0   1871      0  0:00:03  0:00:03 --:--:--  6077
● (base) root@ubuntu22:~/working/working/joern# chmod u+x joern-install.sh
● (base) root@ubuntu22:~/working/working/joern# ./joern-install.sh --interactive
  This script will download and install the Joern tools on your machine. Proceed? [Y/n]: Y
  Enter an install location or press enter for the default (/opt/joern):
  Would you like to create a symlink to the Joern tools? [y/N]: y
  Where would you like to link the Joern tools? (default /usr/local/bin):
  Please enter a Joern version/tag or press enter for the latest version:
  /opt/joern does not exist. Creating
    % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                   Dload  Upload   Total   Spent    Left  Speed
    0     0    0     0    0     0      0      0 --:--:-- --:--:-- --:--:--     0
    0     0    0     0    0     0      0      0 --:--:--  0:00:01 --:--:--     0
  100 1633M  100 1633M    0     0  9050k      0  0:03:04  0:03:04 --:--:-- 12.5M
  Creating symlinks to Joern tools in /usr/local/bin
  If you are not root, please enter your password now:
  sudo: 无法解析主机: ubuntu22: 未知的名称或服务
  sudo: 无法解析主机: ubuntu22: 未知的名称或服务
  sudo: 无法解析主机: ubuntu22: 未知的名称或服务
  sudo: 无法解析主机: ubuntu22: 未知的名称或服务
  sudo: 无法解析主机: ubuntu22: 未知的名称或服务
  sudo: 无法解析主机: ubuntu22: 未知的名称或服务
  sudo: 无法解析主机: ubuntu22: 未知的名称或服务
  sudo: 无法解析主机: ubuntu22: 未知的名称或服务
  sudo: 无法解析主机: ubuntu22: 未知的名称或服务
  sudo: 无法解析主机: ubuntu22: 未知的名称或服务
  sudo: 无法解析主机: ubuntu22: 未知的名称或服务
  sudo: 无法解析主机: ubuntu22: 未知的名称或服务
  sudo: 无法解析主机: ubuntu22: 未知的名称或服务
  sudo: 无法解析主机: ubuntu22: 未知的名称或服务
  sudo: 无法解析主机: ubuntu22: 未知的名称或服务
  Installing default plugins
  Writing logs to: /tmp/joern-scan-log.txt
  Install complete!
○ (base) root@ubuntu22:~/working/working/joern# joern
```

2.污点分析过程所用的joern语句

（1）根据参数名称、文件名称过滤得到待分析的第一条语句

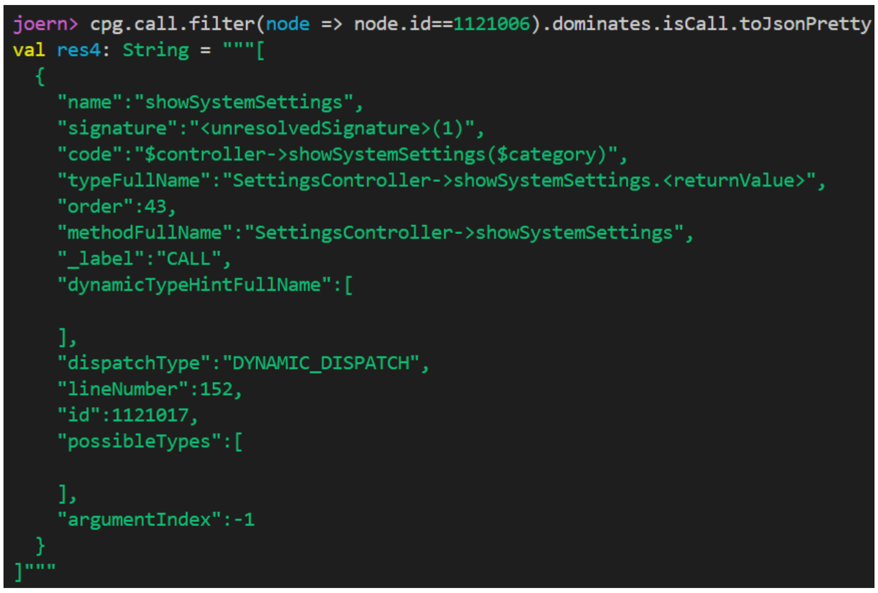
```
cpg.call.filter(node => node.code.contains("category")).filter(node =>
node.location.filename=="settings.php").toJsonPretty
```



```
joern> cpg.call.filter(node => node.code.contains("category")).filter(node => node.location.filename=="settings.php").isCall.toJsonPretty
val res3: String = """[
  {
    "name":"<operator>.assignment",
    "signature":"",
    "code":"$category = empty($_GET[\"category\"]) ? \"system\" : $_GET[\"category\"]",
    "typeFullName":"ANY",
    "order":42,
    "methodFullName":"<operator>.assignment",
    "_label":"CALL",
    "dynamicTypeHintFullName":[
      "<operator>.assignment"
    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":151,
    "id":1121006,
    "possibleTypes":[

    ],
    "argumentIndex":-1
  },
```

(2) 根据node id查询所有后继节点

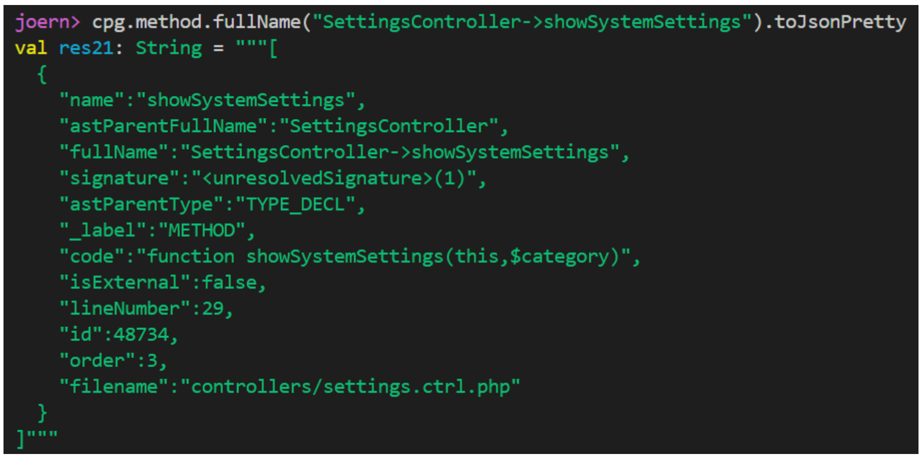
```
cpg.call.filter(node => node.id==1121006).dominates.isCall.toJsonPretty
```



```
joern> cpg.call.filter(node => node.id==1121006).dominates.isCall.toJsonPretty
val res4: String = """[
  {
    "name":"showSystemSettings",
    "signature":"<unresolvedSignature>(1)",
    "code":"$controller->showSystemSettings($category)",
    "typeFullName":"SettingsController->showSystemSettings.<returnValue>",
    "order":43,
    "methodFullName":"SettingsController->showSystemSettings",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"DYNAMIC_DISPATCH",
    "lineNumber":152,
    "id":1121017,
    "possibleTypes":[

    ],
    "argumentIndex":-1
  }
]"""
```

(3) 根据函数名称查找函数

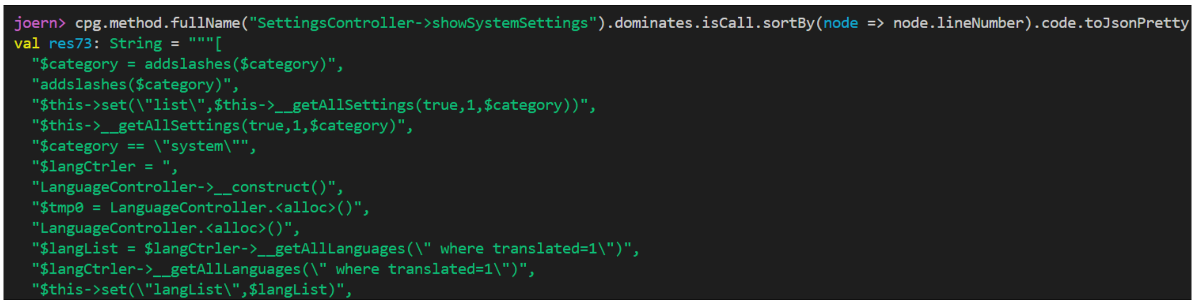
```
cpg.method.fullName("SettingsController->showSystemSettings").toJsonPretty
cpg.method.filter(node => node.fullName == "SettingsController->showSystemSettings").toJsonPretty
（这两语句居然有着一样的作用，推荐使用第2条语句）
```



```
joern> cpg.method.fullName("SettingsController->showSystemSettings").toJsonPretty
val res21: String = """[
  {
    "name":"showSystemSettings",
    "astParentFullName":"SettingsController",
    "fullName":"SettingsController->showSystemSettings",
    "signature":"<unresolvedSignature>(1)",
    "astParentType":"TYPE_DECL",
    "_label":"METHOD",
    "code":"function showSystemSettings(this,$category)",
    "isExternal":false,
    "lineNumber":29,
    "id":48734,
    "order":3,
    "filename":"controllers/settings.ctrl.php"
  }
]"""
```

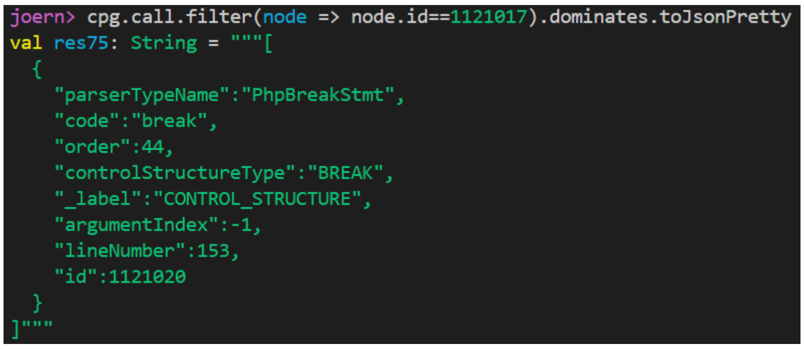
（4）查看一个函数的所有后继节点

```
cpg.method.fullName("SettingsController->showSystemSettings").dominates.isCall.sortBy(node =>
node.lineNumber).toJsonPretty
```



```
joern> cpg.method.fullName("SettingsController->showSystemSettings").dominates.isCall.sortBy(node => node.lineNumber).code.toJsonPretty
val res73: String = """[
  "$category = addslashes($category)",
  "addslashes($category)",
  "$this->set(\"list\",$this->__getAllSettings(true,1,$category))",
  "$this->__getAllSettings(true,1,$category)",
  "$category == \"system\"",
  "$langCtrler = ",
  "LanguageController->__construct()",
  "$tmp0 = LanguageController.<alloc>()",
  "LanguageController.<alloc>()",
  "$langList = $langCtrler->__getAllLanguages(\" where translated=1\")",
  "$langCtrler->__getAllLanguages(\" where translated=1\")",
  "$this->set(\"langList\",$langList)",
```

注意：为了进入函数内部查看函数内部的逻辑，这里不应该使用1121006节点的后继节点1121017来查找其后继节点，而是应该用这个函数来查其后继节点，如果查节点1121017的后继节点，结果并不会进入到该函数内部：



```
joern> cpg.call.filter(node => node.id==1121017).dominates.toJsonPretty
val res75: String = """[
  {
    "parserTypeName":"PhpBreakStmt",
    "code":"break",
    "order":44,
    "controlStructureType":"BREAK",
    "_label":"CONTROL_STRUCTURE",
    "argumentIndex":-1,
    "lineNumber":153,
    "id":1121020
  }
]"""
```

3.获取赋值语句左边的变量

属性：

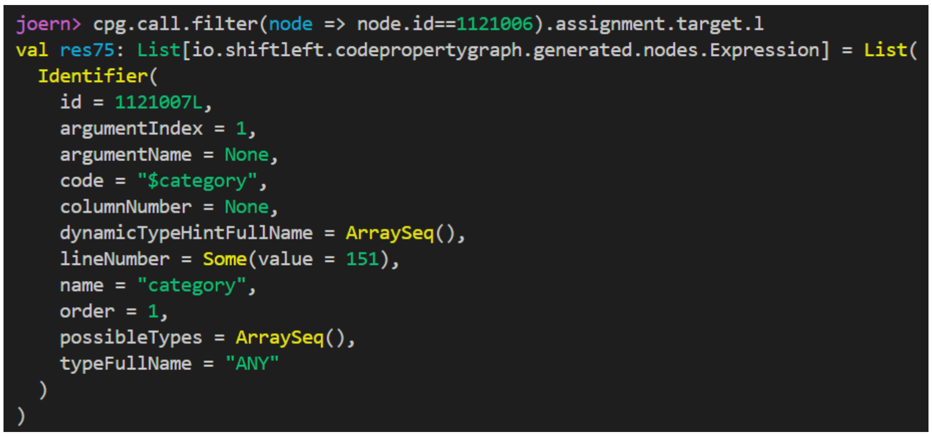
```
.target: Left-hand sides of assignments
```

源码：

```
$category = empty($_GET['category']) ? 'system' : $_GET['category'];
```

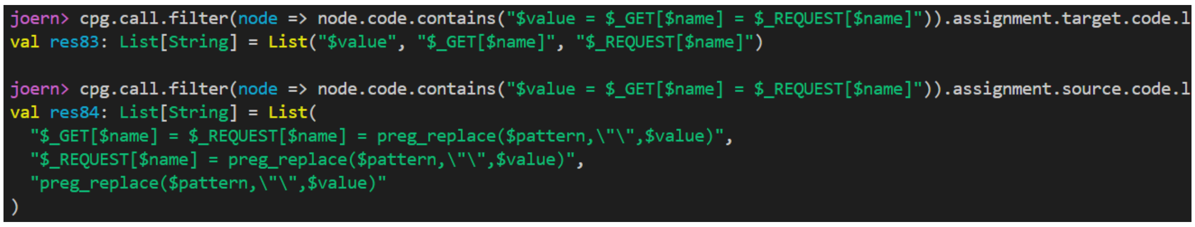
示例：

```
cpg.call.filter(node => node.id==1121006).assignment.target.toJsonPretty
```



```
joern> cpg.call.filter(node => node.id==1121006).assignment.target.l
val res75: List[io.shiftleft.codepropertygraph.generated.nodes.Expression] = List(
  Identifier(
    id = 1121007L,
    argumentIndex = 1,
    argumentName = None,
    code = "$category",
    columnNumber = None,
    dynamicTypeHintFullName = ArraySeq(),
    lineNumber = Some(value = 151),
    name = "category",
    order = 1,
    possibleTypes = ArraySeq(),
    typeFullName = "ANY"
  )
)
```

注意：左值、右值都可能有多个



```
joern> cpg.call.filter(node => node.code.contains("$value = $_GET[$name] = $_REQUEST[$name]")).assignment.target.code.l
val res83: List[String] = List("$value", "$_GET[$name]", "$_REQUEST[$name]")

joern> cpg.call.filter(node => node.code.contains("$value = $_GET[$name] = $_REQUEST[$name]")).assignment.source.code.l
val res84: List[String] = List(
  "$_GET[$name] = $_REQUEST[$name] = preg_replace($pattern,\"\",$value)",
  "$_REQUEST[$name] = preg_replace($pattern,\"\",$value)",
  "preg_replace($pattern,\"\",$value)"
)
```

4.获取赋值语句右边的变量

属性：

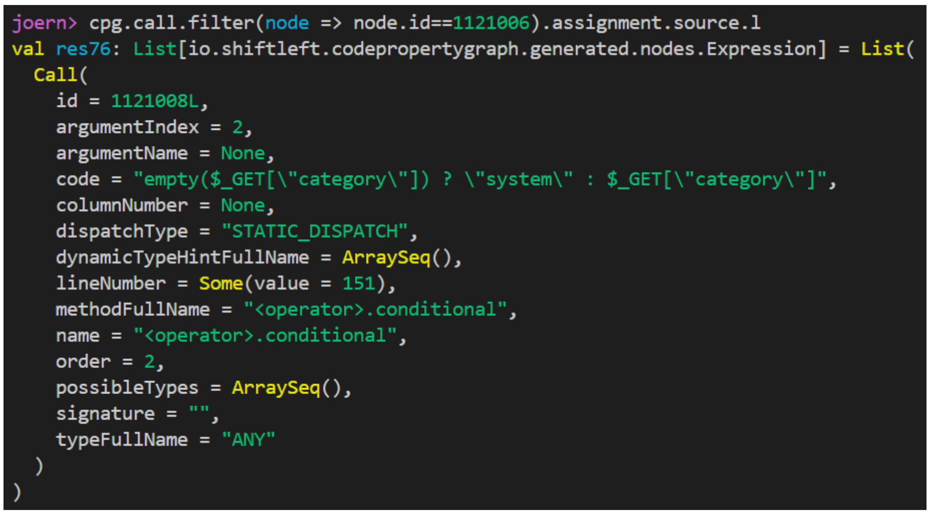
```
.source: Right-hand sides of assignments
```

源码：

```
$category = empty($_GET['category']) ? 'system' : $_GET['category'];
```

示例：

```
cpg.call.filter(node => node.id==1121006).assignment.source.toJsonPretty
```



```
joern> cpg.call.filter(node => node.id==1121006).assignment.source.l
val res76: List[io.shiftleft.codepropertygraph.generated.nodes.Expression] = List(
  Call(
    id = 1121008L,
    argumentIndex = 2,
    argumentName = None,
    code = "empty($_GET[\"category\"]) ? \"system\" : $_GET[\"category\"]",
    columnNumber = None,
    dispatchType = "STATIC_DISPATCH",
    dynamicTypeHintFullName = ArraySeq(),
    lineNumber = Some(value = 151),
    methodFullName = "<operator>.conditional",
    name = "<operator>.conditional",
    order = 2,
    possibleTypes = ArraySeq(),
    signature = "",
    typeFullName = "ANY"
  )
)
```

5.按照某一属性对结果进行排序

属性：

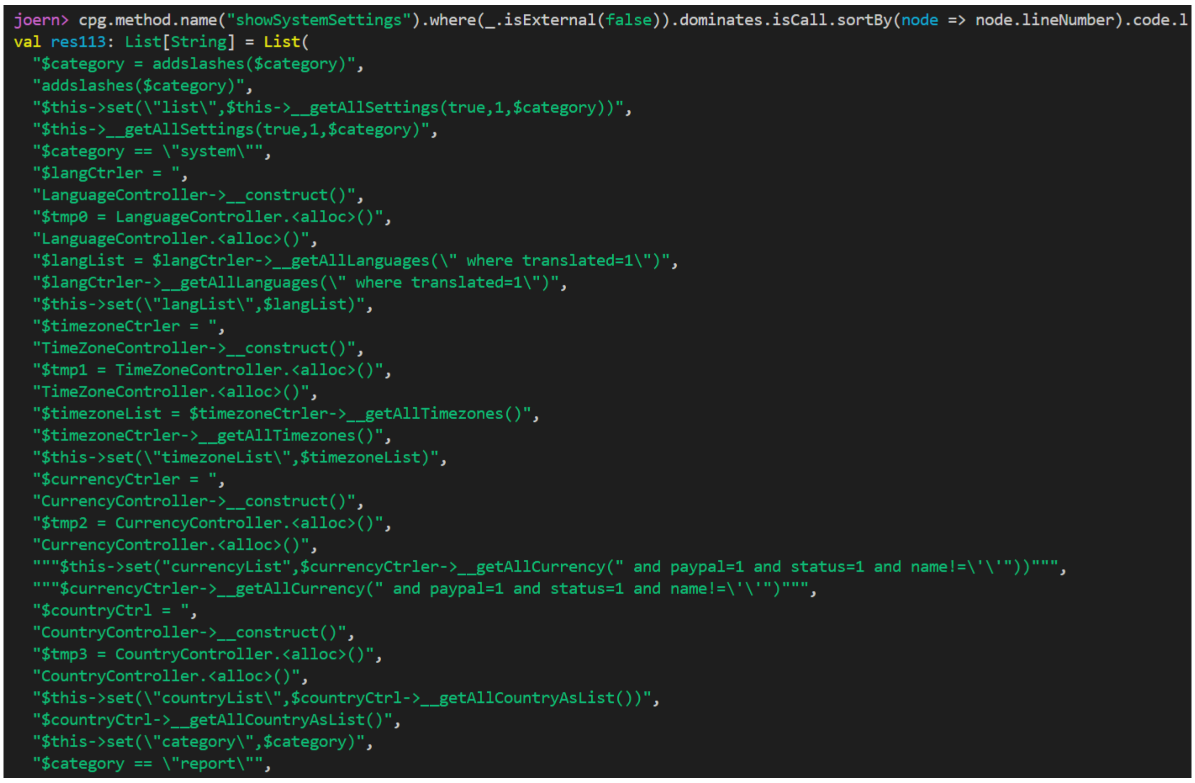
```
.sortBy: Sorts the query results by the specified fields
```

源码：

```
# function to show system settings
    function showSystemSettings($category='system') {
         $category = addslashes($category);
        $this->set('list', $this->__getAllSettings(true, 1, $category));
        if ($category == 'system') {
            $langCtrler = New LanguageController();
            $langList = $langCtrler->__getAllLanguages(" where translated=1");
            $this->set('langList', $langList);
            $timezoneCtrler = New TimeZoneController();
            $timezoneList = $timezoneCtrler->__getAllTimezones();
            $this->set('timezoneList', $timezoneList);
            $currencyCtrler = new CurrencyController();
            $this->set('currencyList', $currencyCtrler->__getAllCurrency(" and paypal=1 and status=1 and name!=''"));
            $countryCtrl = new CountryController();
            $this->set('countryList', $countryCtrl->__getAllCountryAsList());
        }
        $this->set('category', $category);
        // if report settings page
        if ($category == 'report') {
                $spTextReport = $this->getLanguageTexts('report', $_SESSION['lang_code']);
                $this->set('spTextReport', $spTextReport);
             $scheduleList = array(
                1 => $_SESSION['text']['label']['Daily'],
                2 => $spTextReport['2 Days'],
                7 => $_SESSION['text']['label']['Weekly'],
                30 => $_SESSION['text']['label']['Monthly'],
            );
             $this->set('scheduleList', $scheduleList);
               $this->render('settings/showreportsettings');
        } else if ($category == 'proxy') {
                $spTextProxy = $this->getLanguageTexts('proxy', $_SESSION['lang_code']);
                $this->set('spTextProxy', $spTextProxy);
               $this->render('settings/showproxysettings');
        } else {
            $spTextPanel = $this->getLanguageTexts('panel', $_SESSION['lang_code']);
            // switch through category
            switch ($category) {
                case "api":
                    $this->set('headLabel', $spTextPanel['API Settings']);
                    break;
                case "moz":
                    $this->set('headLabel', $spTextPanel['MOZ Settings']);
                    break;
                case "google":
                    $this->set('headLabel', $spTextPanel['Google Settings']);
                    break;
                case "dataforseo":
                      $this->set('headLabel', $spTextPanel['DataForSEO Settings']);
                      break;
                case "mail":
                      $this->set('headLabel', $spTextPanel['Mail Settings']);
                      break;
                default:
                    break;
            }
              $this->render('settings/showsettings');
        }
    }
```

示例:

```
cpg.method.name("showSystemSettings").where(_.isExternal(false)).dominates.isCall.sortBy(node => node.lineNumber).code.l
```



```
joern> cpg.method.name("showSystemSettings").where(_.isExternal(false)).dominates.isCall.sortBy(node => node.lineNumber).code.l
val res113: List[String] = List(
  "$category = addslashes($category)",
  "addslashes($category)",
  "$this->set(\"list\",$this->__getAllSettings(true,1,$category))",
  "$this->__getAllSettings(true,1,$category)",
  "$category == \"system\"",
  "$langCtrler = ",
  "LanguageController->__construct()",
  "$tmp0 = LanguageController.<alloc>()",
  "LanguageController.<alloc>()",
  "$langList = $langCtrler->__getAllLanguages(\" where translated=1\")",
  "$langCtrler->__getAllLanguages(\" where translated=1\")",
  "$this->set(\"langList\",$langList)",
  "$timezoneCtrler = ",
  "TimeZoneController->__construct()",
  "$tmp1 = TimeZoneController.<alloc>()",
  "TimeZoneController.<alloc>()",
  "$timezoneList = $timezoneCtrler->__getAllTimezones()",
  "$timezoneCtrler->__getAllTimezones()",
  "$this->set(\"timezoneList\",$timezoneList)",
  "$currencyCtrler = ",
  "CurrencyController->__construct()",
  "$tmp2 = CurrencyController.<alloc>()",
  "CurrencyController.<alloc>()",
  """$this->set("currencyList",$currencyCtrler->__getAllCurrency(" and paypal=1 and status=1 and name!=\'\'"))""",
  """$currencyCtrler->__getAllCurrency(" and paypal=1 and status=1 and name!=\'\'")""",
  "$countryCtrl = ",
  "CountryController->__construct()",
  "$tmp3 = CountryController.<alloc>()",
  "CountryController.<alloc>()",
  "$this->set(\"countryList\",$countryCtrl->__getAllCountryAsList())",
  "$countryCtrl->__getAllCountryAsList()",
  "$this->set(\"category\",$category)",
  "$category == \"report\"",
```

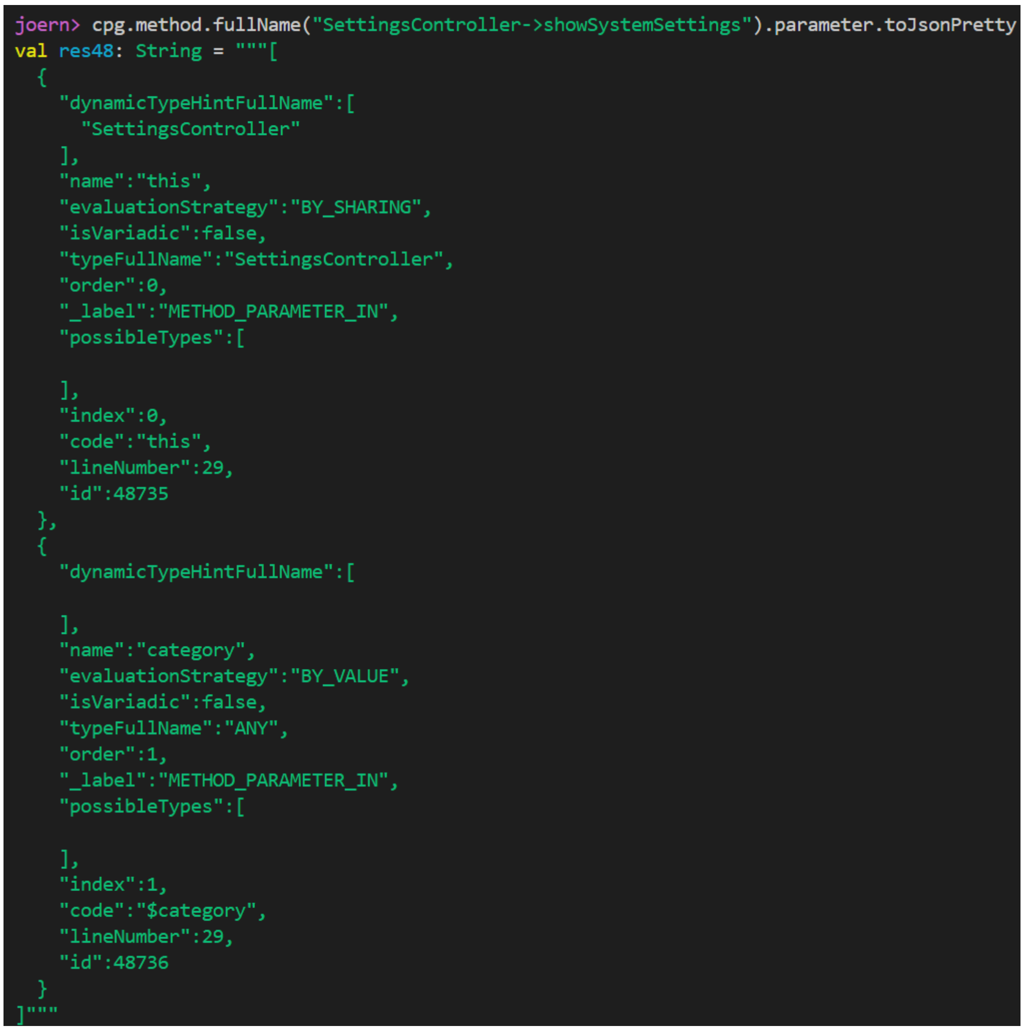
6.查询函数的参数

源码

```
function showSystemSettings($category='system') {
```

示例

```
cpg.method.fullName("SettingsController->showSystemSettings").parameter.toJsonPretty
```



```
joern> cpg.method.fullName("SettingsController->showSystemSettings").parameter.toJsonPretty
val res48: String = """[
  {
    "dynamicTypeHintFullName":[
      "SettingsController"
    ],
    "name":"this",
    "evaluationStrategy":"BY_SHARING",
    "isVariadic":false,
    "typeFullName":"SettingsController",
    "order":0,
    "_label":"METHOD_PARAMETER_IN",
    "possibleTypes":[

    ],
    "index":0,
    "code":"this",
    "lineNumber":29,
    "id":48735
  },
  {
    "dynamicTypeHintFullName":[

    ],
    "name":"category",
    "evaluationStrategy":"BY_VALUE",
    "isVariadic":false,
    "typeFullName":"ANY",
    "order":1,
    "_label":"METHOD_PARAMETER_IN",
    "possibleTypes":[

    ],
    "index":1,
    "code":"$category",
    "lineNumber":29,
    "id":48736
  }
]"""
```

7.查询函数被调用时传入的实参

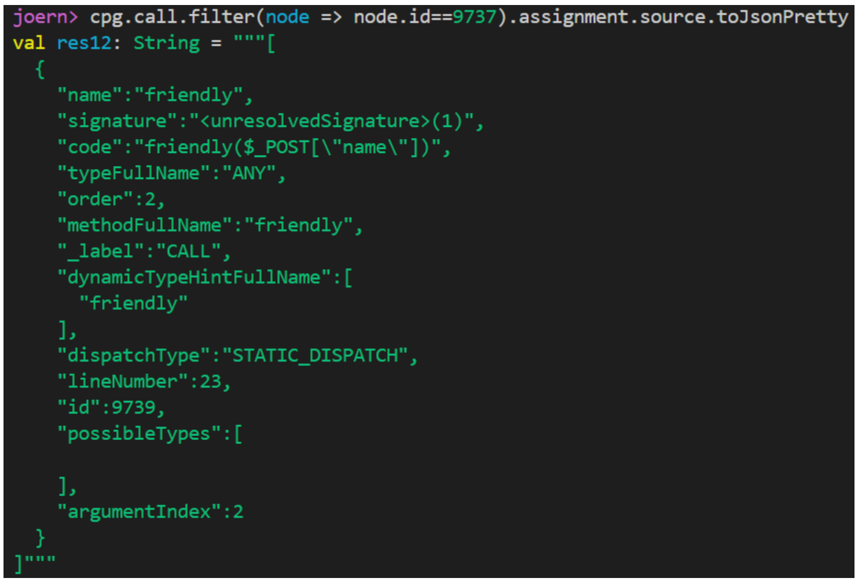
源码:

```
$name=friendly($_POST['name']);
```

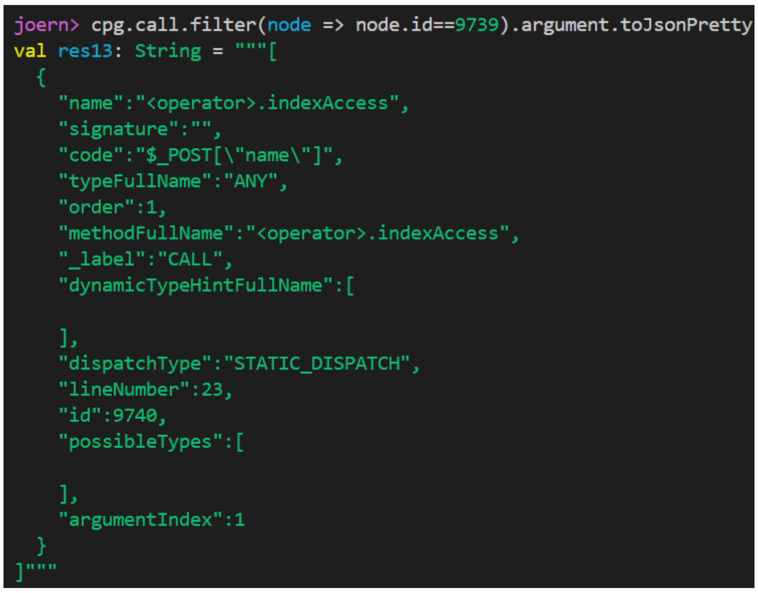
示例:

```
cpg.call.filter(node => node.id==9737).assignment.source.toJsonPretty
cpg.call.filter(node => node.id==9739).argument.toJsonPretty
```

9737对应的是"`$name=friendly($_POST['name']);`",9739对应的是"`friendly($_POST['name'])`"。



```
joern> cpg.call.filter(node => node.id==9737).assignment.source.toJsonPretty
val res12: String = """[
  {
    "name":"friendly",
    "signature":"<unresolvedSignature>(1)",
    "code":"friendly($_POST[\"name\"])",
    "typeFullName":"ANY",
    "order":2,
    "methodFullName":"friendly",
    "_label":"CALL",
    "dynamicTypeHintFullName":[
      "friendly"
    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":23,
    "id":9739,
    "possibleTypes":[

    ],
    "argumentIndex":2
  }
]"""
```

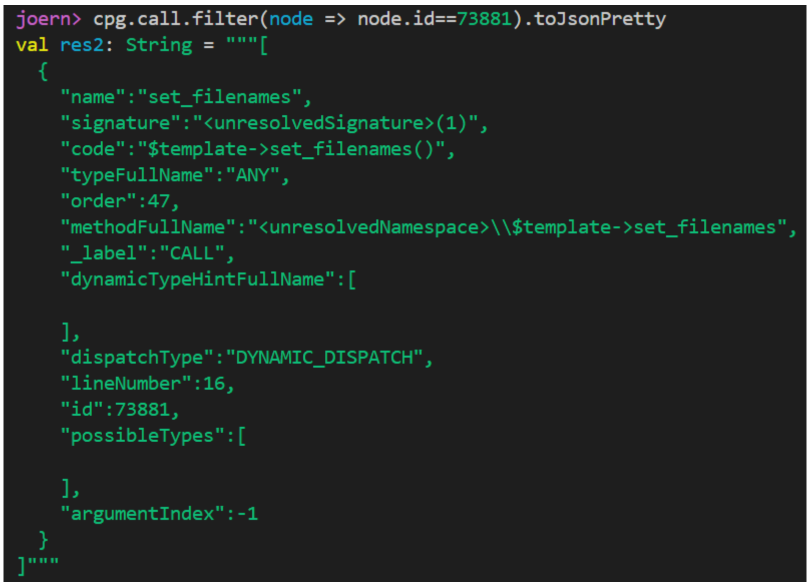


```
joern> cpg.call.filter(node => node.id==9739).argument.toJsonPretty
val res13: String = """[
  {
    "name":"<operator>.indexAccess",
    "signature":"",
    "code":"$_POST[\"name\"]",
    "typeFullName":"ANY",
    "order":1,
    "methodFullName":"<operator>.indexAccess",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":23,
    "id":9740,
    "possibleTypes":[

    ],
    "argumentIndex":1
  }
]"""
```

注意：有些时候查出来的参数可能是一个**BLOCK**！

源码

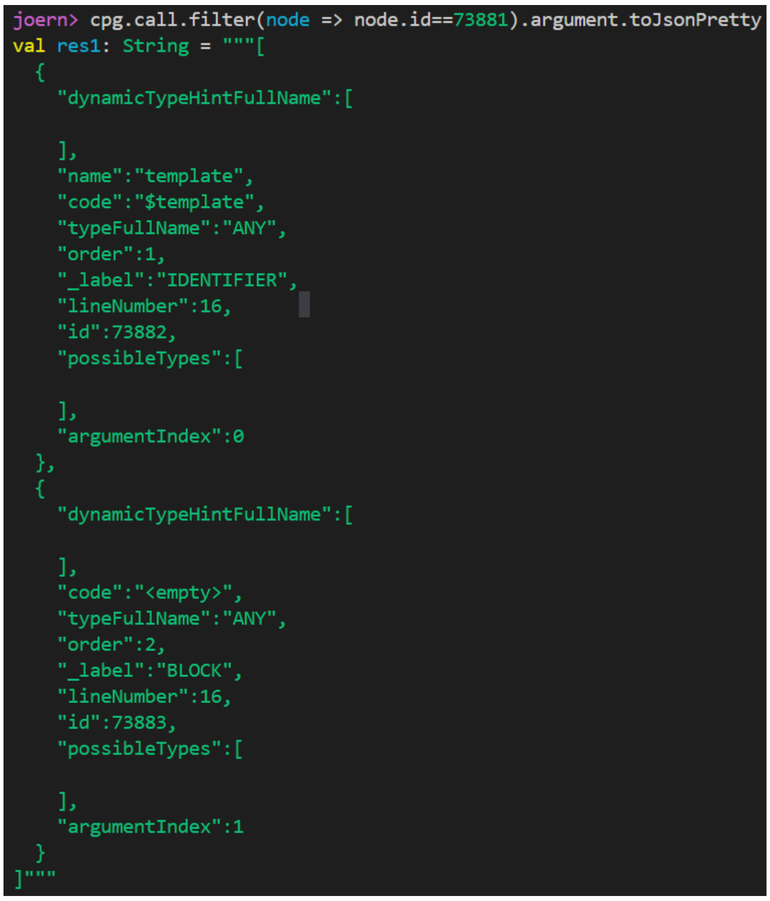
```
$template->set_filenames(array('plugins' => 'plugins_installed.tpl'));
```



```
joern> cpg.call.filter(node => node.id==73881).toJsonPretty
val res2: String = """[
  {
    "name":"set_filenames",
    "signature":"<unresolvedSignature>(1)",
    "code":"$template->set_filenames()",
    "typeFullName":"ANY",
    "order":47,
    "methodFullName":"<unresolvedNamespace>\\$template->set_filenames",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"DYNAMIC_DISPATCH",
    "lineNumber":16,
    "id":73881,
    "possibleTypes":[

    ],
    "argumentIndex":-1
  }
]"""
```

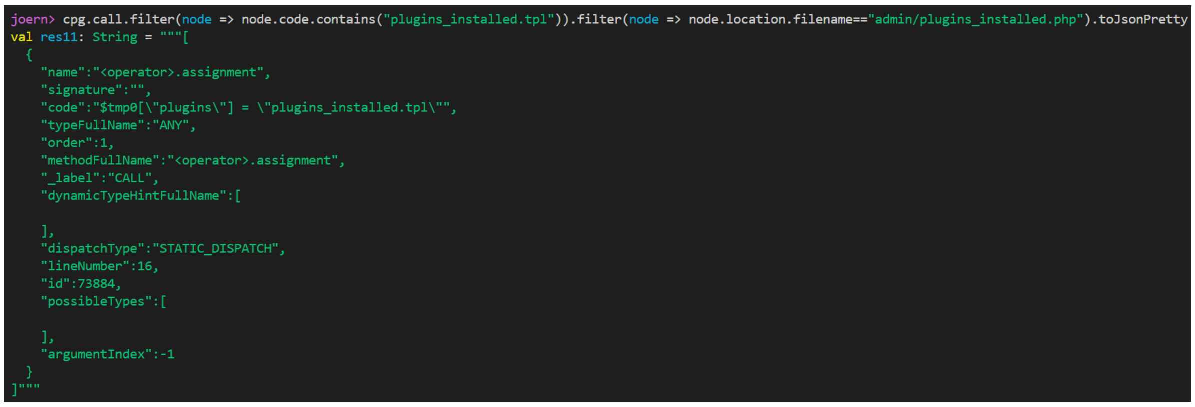
此时可以看到，在Joern解析得到的代码中，这一行的函数调用参数少了参数：`array('plugins' => 'plugins_installed.tpl')`，我们尝试查询这里传入的参数，结果发现第一个参数变为了BLOCK：

```
cpg.call.filter(node => node.id==73881).argument.toJsonPretty
```

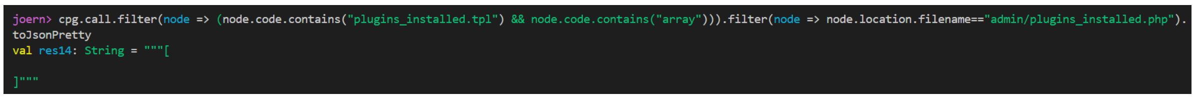


```
joern> cpg.call.filter(node => node.id==73881).argument.toJsonPretty
val res1: String = """[
  {
    "dynamicTypeHintFullName":[

    ],
    "name":"template",
    "code":"$template",
    "typeFullName":"ANY",
    "order":1,
    "_label":"IDENTIFIER",
    "lineNumber":16,
    "id":73882,
    "possibleTypes":[

    ],
    "argumentIndex":0
  },
  {
    "dynamicTypeHintFullName":[

    ],
    "code":"<empty>",
    "typeFullName":"ANY",
    "order":2,
    "_label":"BLOCK",
    "lineNumber":16,
    "id":73883,
    "possibleTypes":[

    ],
    "argumentIndex":1
  }
]"""
```

我们找一下这个参数具体的位置：



```
joern> cpg.call.filter(node => node.code.contains("plugins_installed.tpl")).filter(node => node.location.filename=="admin/plugins_installed.php").toJsonPretty
val res11: String = """[
  {
    "name":"<operator>.assignment",
    "signature":"",
    "code":"$tmp0[\"plugins\"] = \"plugins_installed.tpl\"",
    "typeFullName":"ANY",
    "order":1,
    "methodFullName":"<operator>.assignment",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":16,
    "id":73884,
    "possibleTypes":[

    ],
    "argumentIndex":-1
  }
]"""
```



```
joern> cpg.call.filter(node => (node.code.contains("plugins_installed.tpl") && node.code.contains("array"))).filter(node => node.location.filename=="admin/plugins_installed.php").
toJsonPretty
val res14: String = """[

]"""
```

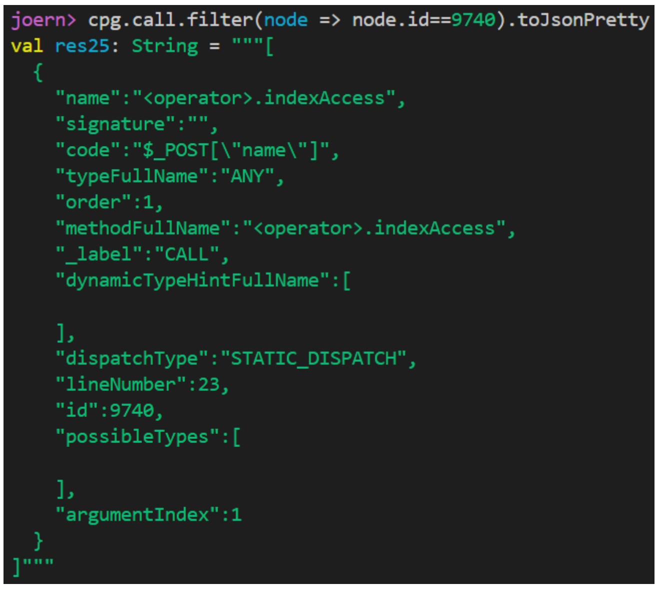
可以看到，包含了array的参数已经不在了，猜测这里出现错误的原因在于Joern将**array变量**建模为了BLOCK。

8.查询实参被哪些call site调用（部分到整体）

源码：

```
$name=friendly($_POST['name']);
```

现在想要看 `$_POST['name']` 被哪些call site调用过， `$_POST['name']` 对应的node id为9740：

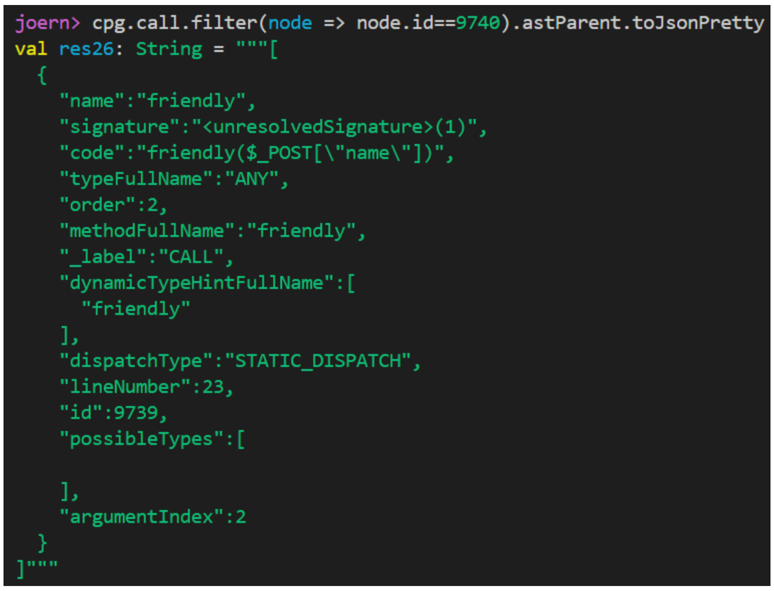


```
joern> cpg.call.filter(node => node.id==9740).toJsonPretty
val res25: String = """[
  {
    "name":"<operator>.indexAccess",
    "signature":"",
    "code":"$_POST[\"name\"]",
    "typeFullName":"ANY",
    "order":1,
    "methodFullName":"<operator>.indexAccess",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":23,
    "id":9740,
    "possibleTypes":[

    ],
    "argumentIndex":1
  }
]"""
```

逐次往上分析：

（1）找到 `friendly($_POST['name'])`

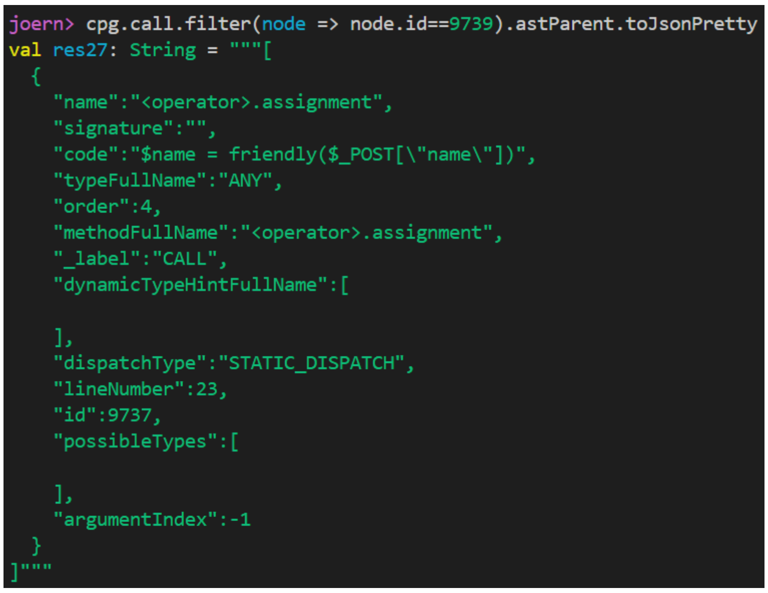
```
cpg.call.filter(node => node.id==9740).astParent.toJsonPretty
```



```
joern> cpg.call.filter(node => node.id==9740).astParent.toJsonPretty
val res26: String = """[
  {
    "name":"friendly",
    "signature":"<unresolvedSignature>(1)",
    "code":"friendly($_POST[\"name\"])",
    "typeFullName":"ANY",
    "order":2,
    "methodFullName":"friendly",
    "_label":"CALL",
    "dynamicTypeHintFullName":[
      "friendly"
    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":23,
    "id":9739,
    "possibleTypes":[

    ],
    "argumentIndex":2
  }
]"""
```

（2）找到 `$name=friendly($_POST['name'])`

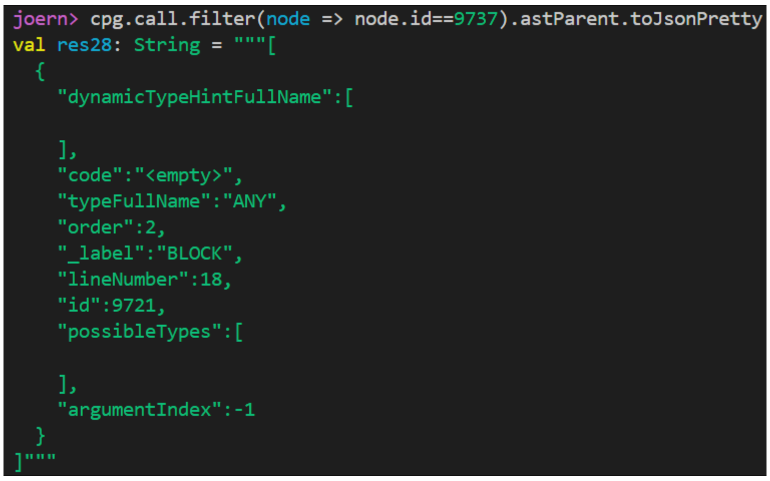
```
cpg.call.filter(node => node.id==9739).astParent.toJsonPretty
```



```
joern> cpg.call.filter(node => node.id==9739).astParent.toJsonPretty
val res27: String = """[
  {
    "name":"<operator>.assignment",
    "signature":"",
    "code":"$name = friendly($_POST[\"name\"])",
    "typeFullName":"ANY",
    "order":4,
    "methodFullName":"<operator>.assignment",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":23,
    "id":9737,
    "possibleTypes":[

    ],
    "argumentIndex":-1
  }
]"""
```

（3）找到 `<empty>`，此时认为已经不能找到更上一级的调用点了。

```
cpg.call.filter(node => node.id==9737).astParent.toJsonPretty
```



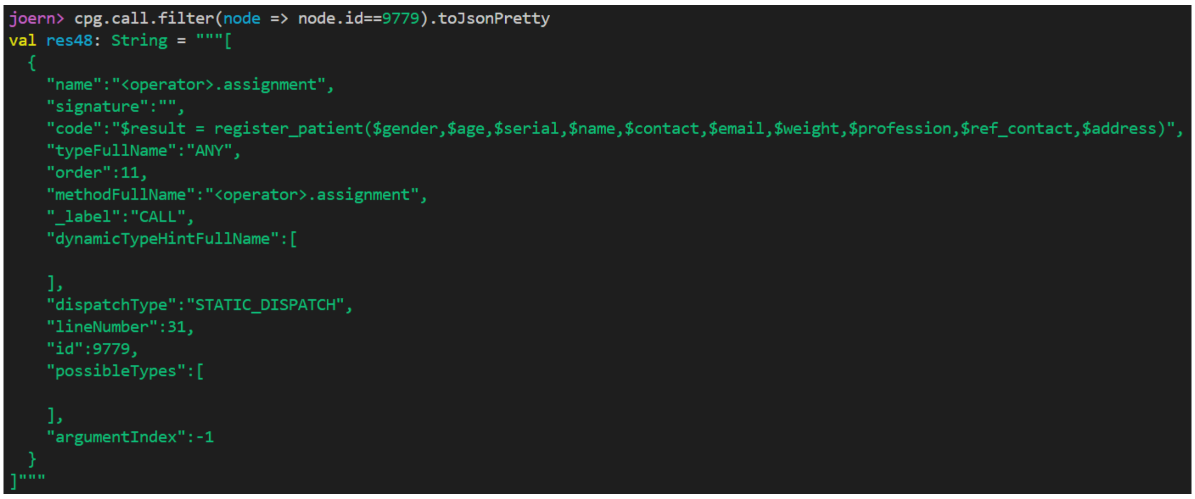
```
joern> cpg.call.filter(node => node.id==9737).astParent.toJsonPretty
val res28: String = """[
  {
    "dynamicTypeHintFullName":[

    ],
    "code":"<empty>",
    "typeFullName":"ANY",
    "order":2,
    "_label":"BLOCK",
    "lineNumber":18,
    "id":9721,
    "possibleTypes":[

    ],
    "argumentIndex":-1
  }
]"""
```

9.查询一条语句的子语句（整体到部分）

源码：

```
$result=register_patient($gender,$age,$serial,$name,$contact,$email,$weight,$profession,$ref_contact,$address);
```

现在想要看这一行代码可以被拆分为哪些子语句：

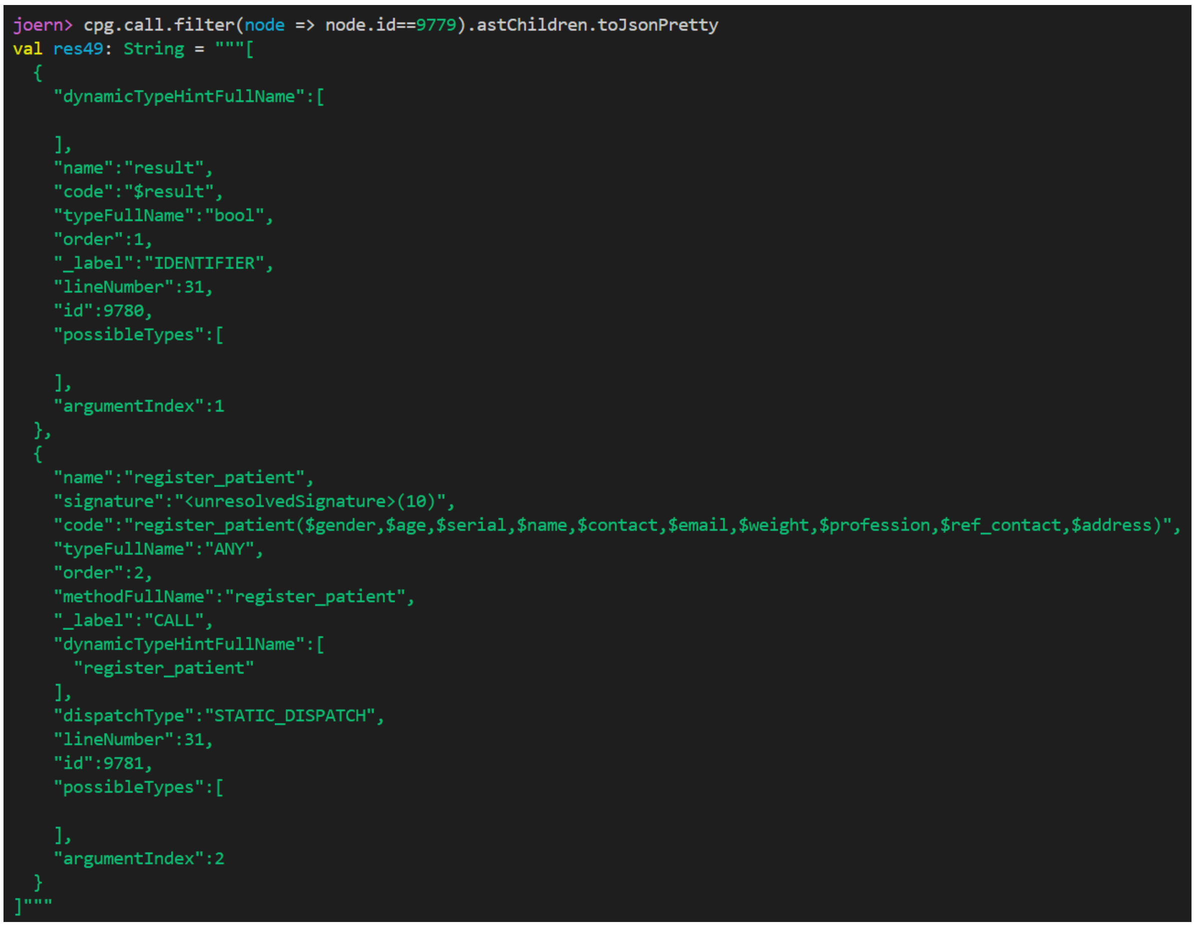


```
joern> cpg.call.filter(node => node.id==9779).toJsonPretty
val res48: String = """[
  {
    "name":"<operator>.assignment",
    "signature":"",
    "code":"$result = register_patient($gender,$age,$serial,$name,$contact,$email,$weight,$profession,$ref_contact,$address)",
    "typeFullName":"ANY",
    "order":11,
    "methodFullName":"<operator>.assignment",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":31,
    "id":9779,
    "possibleTypes":[

    ],
    "argumentIndex":-1
  }
]"""
```

逐次往下分析：

（1）找到 `$result` 和 `register_patient($gender,$age,$serial,$name,$contact,$email,$weight,$profession,$ref_contact,$address)`

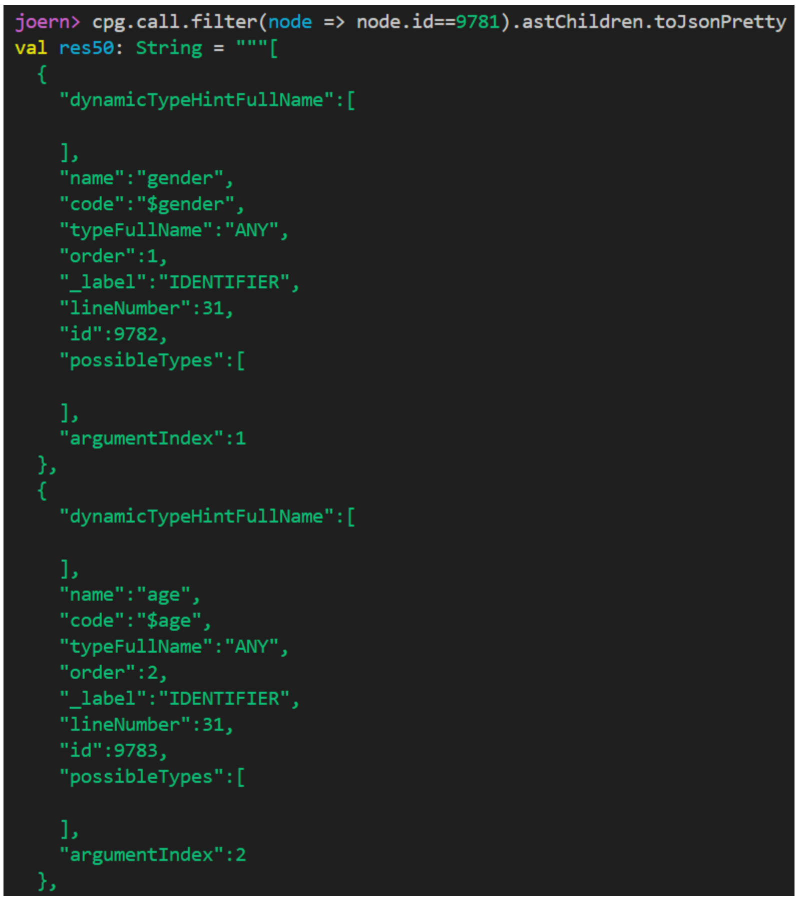
```
cpg.call.filter(node => node.id==9779).astChildren.toJsonPretty
```



```
joern> cpg.call.filter(node => node.id==9779).astChildren.toJsonPretty
val res49: String = """[
  {
    "dynamicTypeHintFullName":[

    ],
    "name":"result",
    "code":"$result",
    "typeFullName":"bool",
    "order":1,
    "_label":"IDENTIFIER",
    "lineNumber":31,
    "id":9780,
    "possibleTypes":[

    ],
    "argumentIndex":1
  },
  {
    "name":"register_patient",
    "signature":"<unresolvedSignature>(10)",
    "code":"register_patient($gender,$age,$serial,$name,$contact,$email,$weight,$profession,$ref_contact,$address)",
    "typeFullName":"ANY",
    "order":2,
    "methodFullName":"register_patient",
    "_label":"CALL",
    "dynamicTypeHintFullName":[
      "register_patient"
    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":31,
    "id":9781,
    "possibleTypes":[

    ],
    "argumentIndex":2
  }
]"""
```

（2）找到 `register_patient` 函数的实参

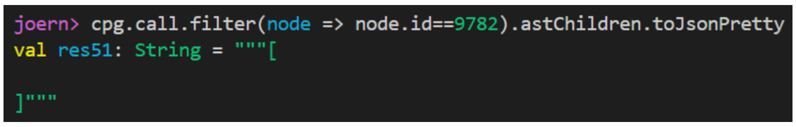
```
cpg.call.filter(node => node.id==9781).astChildren.toJsonPretty
```



```
joern> cpg.call.filter(node => node.id==9781).astChildren.toJsonPretty
val res50: String = """[
  {
    "dynamicTypeHintFullName":[

    ],
    "name":"gender",
    "code":"$gender",
    "typeFullName":"ANY",
    "order":1,
    "_label":"IDENTIFIER",
    "lineNumber":31,
    "id":9782,
    "possibleTypes":[

    ],
    "argumentIndex":1
  },
  {
    "dynamicTypeHintFullName":[

    ],
    "name":"age",
    "code":"$age",
    "typeFullName":"ANY",
    "order":2,
    "_label":"IDENTIFIER",
    "lineNumber":31,
    "id":9783,
    "possibleTypes":[

    ],
    "argumentIndex":2
  },
```

（3）找到 `<empty>`，此时认为已经不能找到更上一级的调用点了。

```
cpg.call.filter(node => node.id==9782).astChildren.toJsonPretty
```



```
joern> cpg.call.filter(node => node.id==9782).astChildren.toJsonPretty
val res51: String = """[

]"""
```

10.argument 和 parameter 的区别

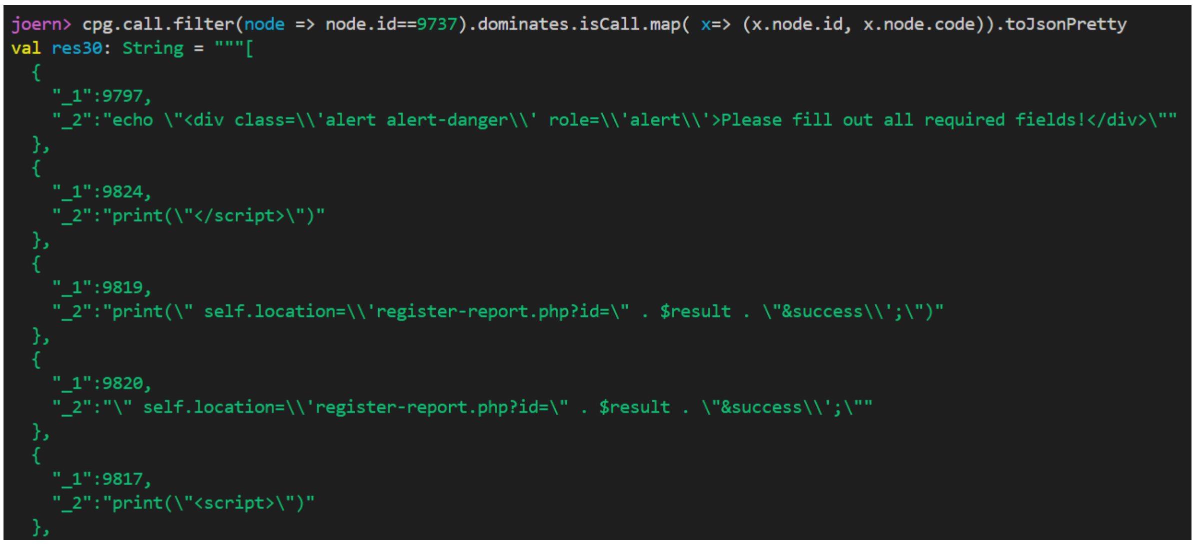
argument表示实际传给某一个函数的实参；而parameter表示定义函数时的形参。

argument一般在cpg.call.语句中使用；而parameter一般在cpg.method.语句中使用。

11.查询指定字段

注意：指定字段前，要确保你查出来的这些字段含有这些字段，否则会报错。

```
cpg.call.filter(node => node.id==9737).dominates.isCall.map( x=> (x.node.id, x.node.code)).toJsonPretty
```



```
joern> cpg.call.filter(node => node.id==9737).dominates.isCall.map( x=> (x.node.id, x.node.code)).toJsonPretty
val res30: String = """[
  {
    "_1":9797,
    "_2":"echo \"<div class=\\'alert alert-danger\\' role=\\'alert\\'>Please fill out all required fields!</div>\""
  },
  {
    "_1":9824,
    "_2":"print(\"</script>\")"
  },
  {
    "_1":9819,
    "_2":"print(\" self.location=\\'register-report.php?id=\" . $result . \"&success\\';\")"
  },
  {
    "_1":9820,
    "_2":"\" self.location=\\'register-report.php?id=\" . $result . \"&success\\';\""
  },
  {
    "_1":9817,
    "_2":"print(\"<script>\")"
  },
```

12.joern污点分析的使用

（1）案例一

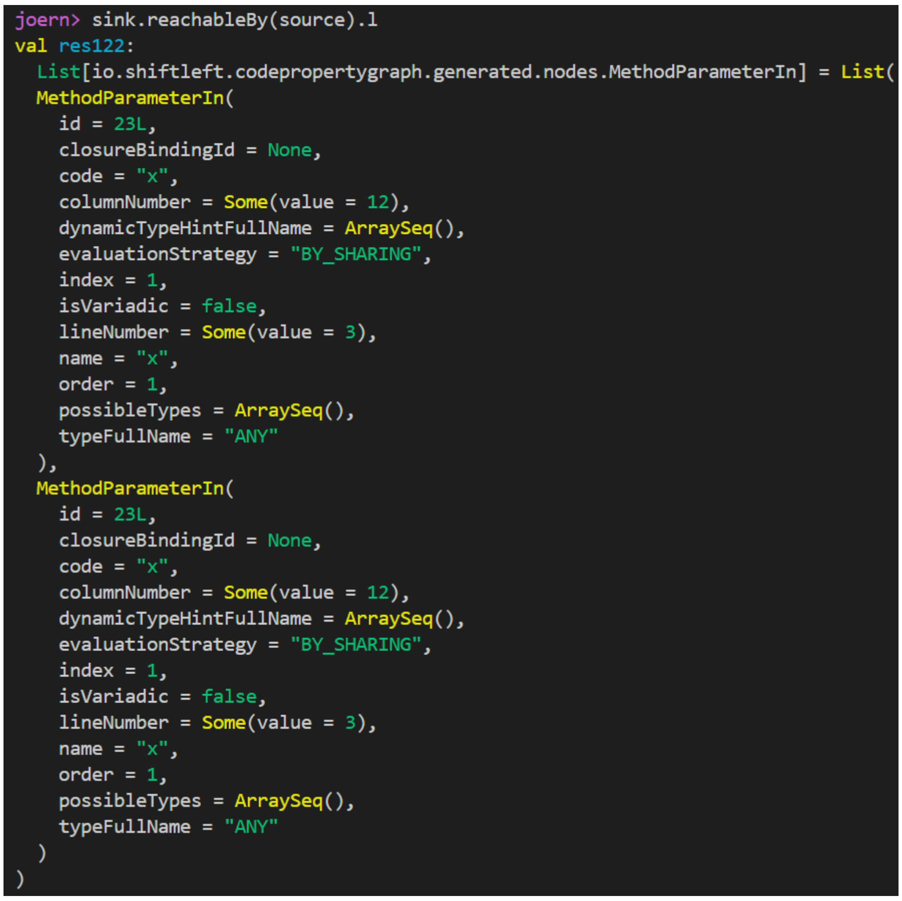
源码

```
import os

def source(x):
      temp_x = x
      temp_y = temp_x
      temp_z = temp_y
      os.system(temp_z)
```

定义source、sink

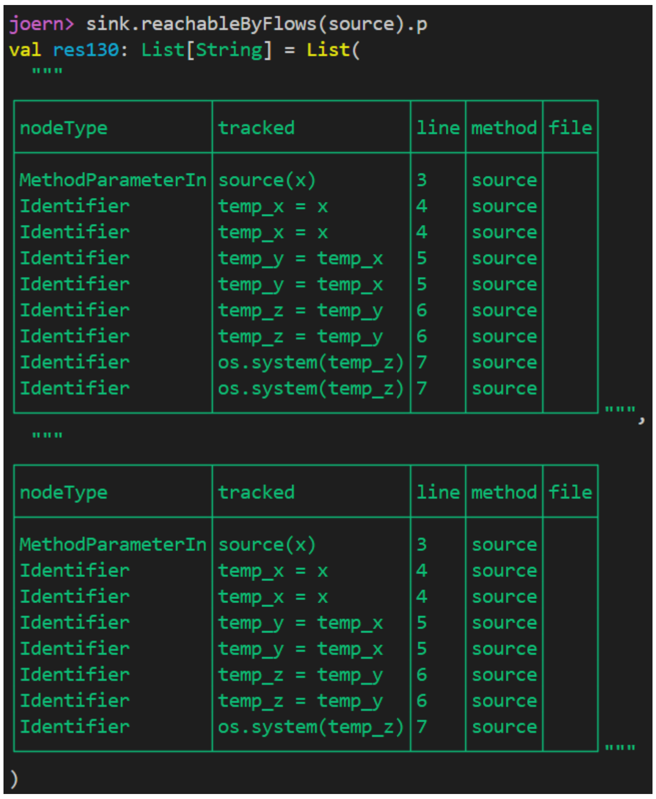
```
def source = cpg.method.name("source").parameter
def sink = cpg.call.name("system").argument
```

```
sink.reachableBy(source).l
```



```
joern> sink.reachableBy(source).l
val res122:
  List[io.shiftleft.codepropertygraph.generated.nodes.MethodParameterIn] = List(
  MethodParameterIn(
    id = 23L,
    closureBindingId = None,
    code = "x",
    columnNumber = Some(value = 12),
    dynamicTypeHintFullName = ArraySeq(),
    evaluationStrategy = "BY_SHARING",
    index = 1,
    isVariadic = false,
    lineNumber = Some(value = 3),
    name = "x",
    order = 1,
    possibleTypes = ArraySeq(),
    typeFullName = "ANY"
  ),
  MethodParameterIn(
    id = 23L,
    closureBindingId = None,
    code = "x",
    columnNumber = Some(value = 12),
    dynamicTypeHintFullName = ArraySeq(),
    evaluationStrategy = "BY_SHARING",
    index = 1,
    isVariadic = false,
    lineNumber = Some(value = 3),
    name = "x",
    order = 1,
    possibleTypes = ArraySeq(),
    typeFullName = "ANY"
  )
)
```

```
sink.reachableByFlows(source).p
```



```
joern> sink.reachableByFlows(source).p
val res130: List[String] = List(
  """
┌─────────────────┬───────────────────┬────┬──────┬────┐
│nodeType         │tracked            │line│method│file│
├─────────────────┼───────────────────┼────┼──────┼────┤
│MethodParameterIn│source(x)          │3   │source│    │
│Identifier       │temp_x = x         │4   │source│    │
│Identifier       │temp_x = x         │4   │source│    │
│Identifier       │temp_y = temp_x    │5   │source│    │
│Identifier       │temp_y = temp_x    │5   │source│    │
│Identifier       │temp_z = temp_y    │6   │source│    │
│Identifier       │temp_z = temp_y    │6   │source│    │
│Identifier       │os.system(temp_z)  │7   │source│    │
│Identifier       │os.system(temp_z)  │7   │source│    │
└─────────────────┴───────────────────┴────┴──────┴────┘""",
  """
┌─────────────────┬───────────────────┬────┬──────┬────┐
│nodeType         │tracked            │line│method│file│
├─────────────────┼───────────────────┼────┼──────┼────┤
│MethodParameterIn│source(x)          │3   │source│    │
│Identifier       │temp_x = x         │4   │source│    │
│Identifier       │temp_x = x         │4   │source│    │
│Identifier       │temp_y = temp_x    │5   │source│    │
│Identifier       │temp_y = temp_x    │5   │source│    │
│Identifier       │temp_z = temp_y    │6   │source│    │
│Identifier       │temp_z = temp_y    │6   │source│    │
│Identifier       │os.system(temp_z)  │7   │source│    │
└─────────────────┴───────────────────┴────┴──────┴────┘"""
)
```

（2）案例二

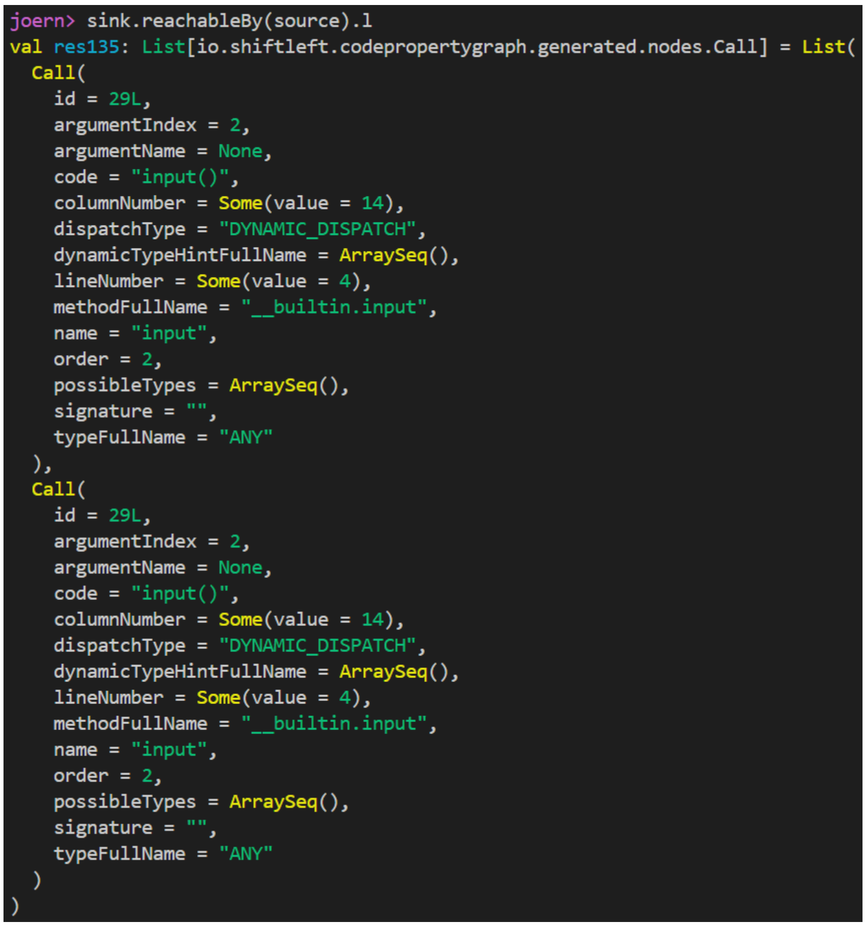
源码

```
import os

def source(x):
        temp_x = input()
        temp_y = temp_x
        temp_z = temp_y
        os.system(temp_z)
```

定义source、sink

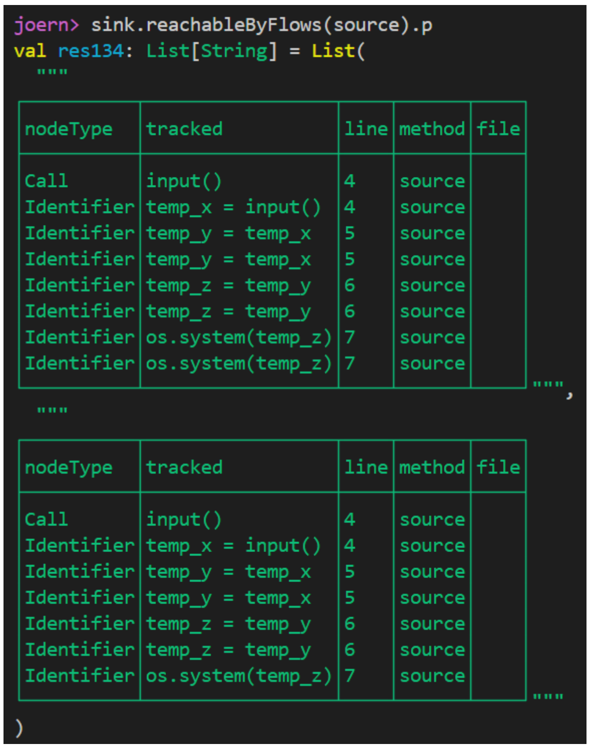
```
def source = cpg.call.name("input")
def sink = cpg.call.name("system").argument
```

```
sink.reachableBy(source).l
```



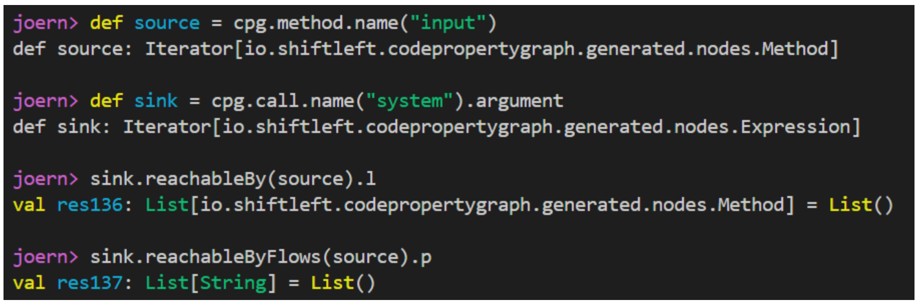
```
joern> sink.reachableBy(source).l
val res135: List[io.shiftleft.codepropertygraph.generated.nodes.Call] = List(
  Call(
    id = 29L,
    argumentIndex = 2,
    argumentName = None,
    code = "input()",
    columnNumber = Some(value = 14),
    dispatchType = "DYNAMIC_DISPATCH",
    dynamicTypeHintFullName = ArraySeq(),
    lineNumber = Some(value = 4),
    methodFullName = "__builtin.input",
    name = "input",
    order = 2,
    possibleTypes = ArraySeq(),
    signature = "",
    typeFullName = "ANY"
  ),
  Call(
    id = 29L,
    argumentIndex = 2,
    argumentName = None,
    code = "input()",
    columnNumber = Some(value = 14),
    dispatchType = "DYNAMIC_DISPATCH",
    dynamicTypeHintFullName = ArraySeq(),
    lineNumber = Some(value = 4),
    methodFullName = "__builtin.input",
    name = "input",
    order = 2,
    possibleTypes = ArraySeq(),
    signature = "",
    typeFullName = "ANY"
  )
)
```

```
sink.reachableByFlows(source).p
```



```
joern> sink.reachableByFlows(source).p
val res134: List[String] = List(
  """
┌──────────┬──────────────────┬────┬──────┬────┐
│nodeType  │tracked           │line│method│file│
├──────────┼──────────────────┼────┼──────┼────┤
│Call      │input()           │4   │source│    │
│Identifier│temp_x = input()  │4   │source│    │
│Identifier│temp_y = temp_x   │5   │source│    │
│Identifier│temp_y = temp_x   │5   │source│    │
│Identifier│temp_z = temp_y   │6   │source│    │
│Identifier│temp_z = temp_y   │6   │source│    │
│Identifier│os.system(temp_z) │7   │source│    │
│Identifier│os.system(temp_z) │7   │source│    │
└──────────┴──────────────────┴────┴──────┴────┘""",
  """
┌──────────┬──────────────────┬────┬──────┬────┐
│nodeType  │tracked           │line│method│file│
├──────────┼──────────────────┼────┼──────┼────┤
│Call      │input()           │4   │source│    │
│Identifier│temp_x = input()  │4   │source│    │
│Identifier│temp_y = temp_x   │5   │source│    │
│Identifier│temp_y = temp_x   │5   │source│    │
│Identifier│temp_z = temp_y   │6   │source│    │
│Identifier│temp_z = temp_y   │6   │source│    │
│Identifier│os.system(temp_z) │7   │source│    │
└──────────┴──────────────────┴────┴──────┴────┘"""
)
```

注意：这里两处都是call，如果定义source时使用了method，结果如下：



```
joern> def source = cpg.method.name("input")
def source: Iterator[io.shiftleft.codepropertygraph.generated.nodes.Method]

joern> def sink = cpg.call.name("system").argument
def sink: Iterator[io.shiftleft.codepropertygraph.generated.nodes.Expression]

joern> sink.reachableBy(source).l
val res136: List[io.shiftleft.codepropertygraph.generated.nodes.Method] = List()

joern> sink.reachableByFlows(source).p
val res137: List[String] = List()
```

（3）案例三

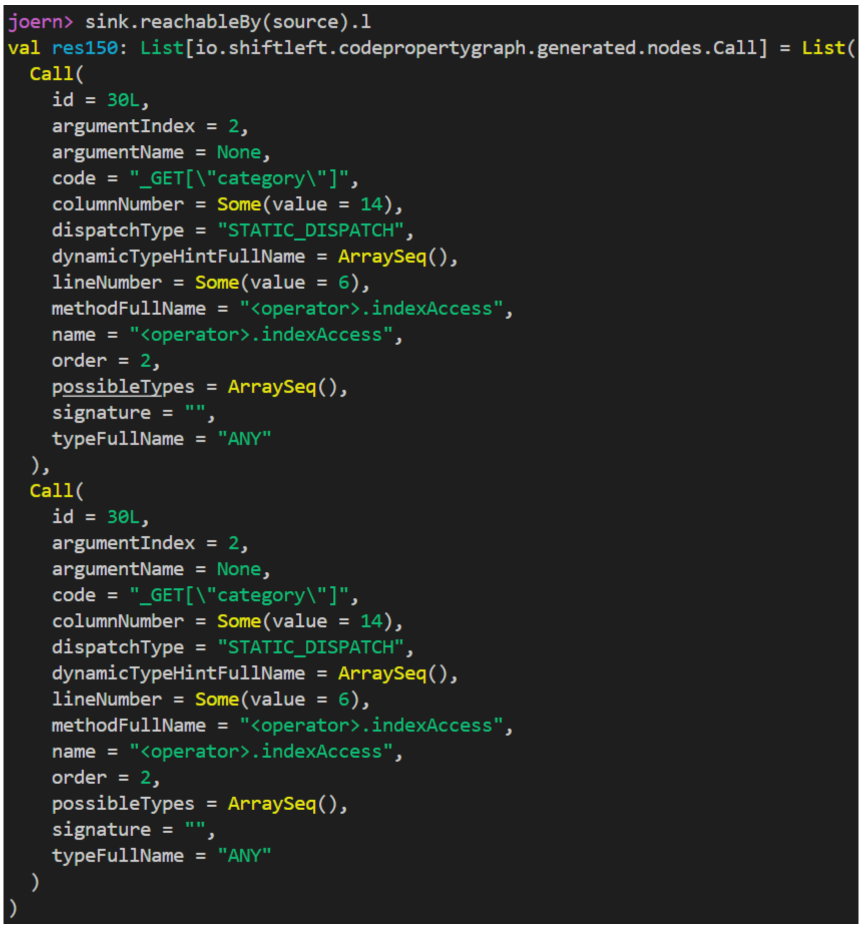
源码

```
import os

_GET = []

def source(x):
    temp_x = _GET["category"]
    temp_y = temp_x
    temp_z = temp_y
    os.system(temp_z)
```

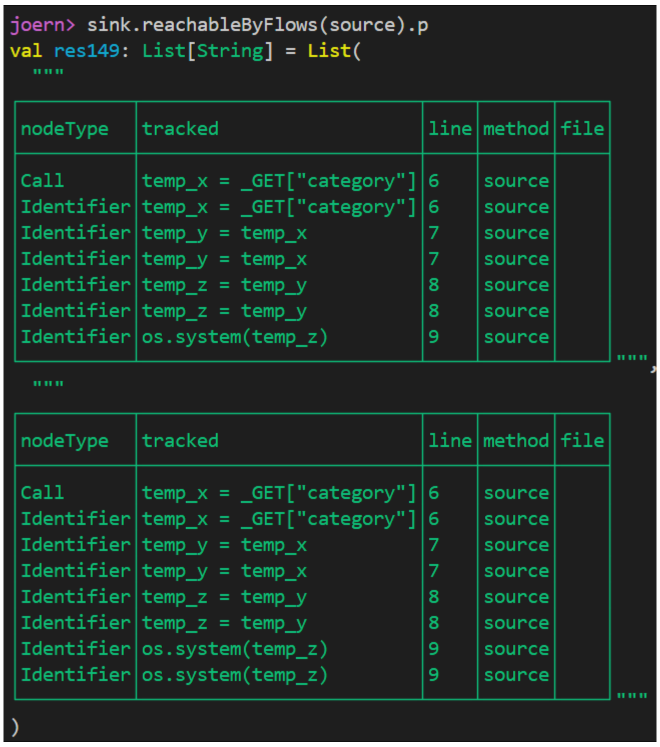
定义source、sink

```
def source = cpg.call.name("<operator>.indexAccess").filter(node => node.code.contains("_GET"))
def sink = cpg.call.name("system").argument
```

```
sink.reachableBy(source).l
```


```
joern> sink.reachableBy(source).l
val res150: List[io.shiftleft.codepropertygraph.generated.nodes.Call] = List(
  Call(
    id = 30L,
    argumentIndex = 2,
    argumentName = None,
    code = "_GET[\"category\"]",
    columnNumber = Some(value = 14),
    dispatchType = "STATIC_DISPATCH",
    dynamicTypeHintFullName = ArraySeq(),
    lineNumber = Some(value = 6),
    methodFullName = "<operator>.indexAccess",
    name = "<operator>.indexAccess",
    order = 2,
    possibleTypes = ArraySeq(),
    signature = "",
    typeFullName = "ANY"
  ),
  Call(
    id = 30L,
    argumentIndex = 2,
    argumentName = None,
    code = "_GET[\"category\"]",
    columnNumber = Some(value = 14),
    dispatchType = "STATIC_DISPATCH",
    dynamicTypeHintFullName = ArraySeq(),
    lineNumber = Some(value = 6),
    methodFullName = "<operator>.indexAccess",
    name = "<operator>.indexAccess",
    order = 2,
    possibleTypes = ArraySeq(),
    signature = "",
    typeFullName = "ANY"
  )
)
```

```
sink.reachableByFlows(source).p
```


```
joern> sink.reachableByFlows(source).p
val res149: List[String] = List(
  """
┌──────────┬─────────────────────────┬────┬──────┬────┐
│nodeType  │tracked                  │line│method│file│
├──────────┼─────────────────────────┼────┼──────┼────┤
│Call      │temp_x = _GET["category"]│6   │source│    │
│Identifier│temp_x = _GET["category"]│6   │source│    │
│Identifier│temp_y = temp_x          │7   │source│    │
│Identifier│temp_y = temp_x          │7   │source│    │
│Identifier│temp_z = temp_y          │8   │source│    │
│Identifier│temp_z = temp_y          │8   │source│    │
│Identifier│os.system(temp_z)        │9   │source│    │
└──────────┴─────────────────────────┴────┴──────┴────┘""",
  """
┌──────────┬─────────────────────────┬────┬──────┬────┐
│nodeType  │tracked                  │line│method│file│
├──────────┼─────────────────────────┼────┼──────┼────┤
│Call      │temp_x = _GET["category"]│6   │source│    │
│Identifier│temp_x = _GET["category"]│6   │source│    │
│Identifier│temp_y = temp_x          │7   │source│    │
│Identifier│temp_y = temp_x          │7   │source│    │
│Identifier│temp_z = temp_y          │8   │source│    │
│Identifier│temp_z = temp_y          │8   │source│    │
│Identifier│os.system(temp_z)        │9   │source│    │
│Identifier│os.system(temp_z)        │9   │source│    │
└──────────┴─────────────────────────┴────┴──────┴────┘"""
)
```

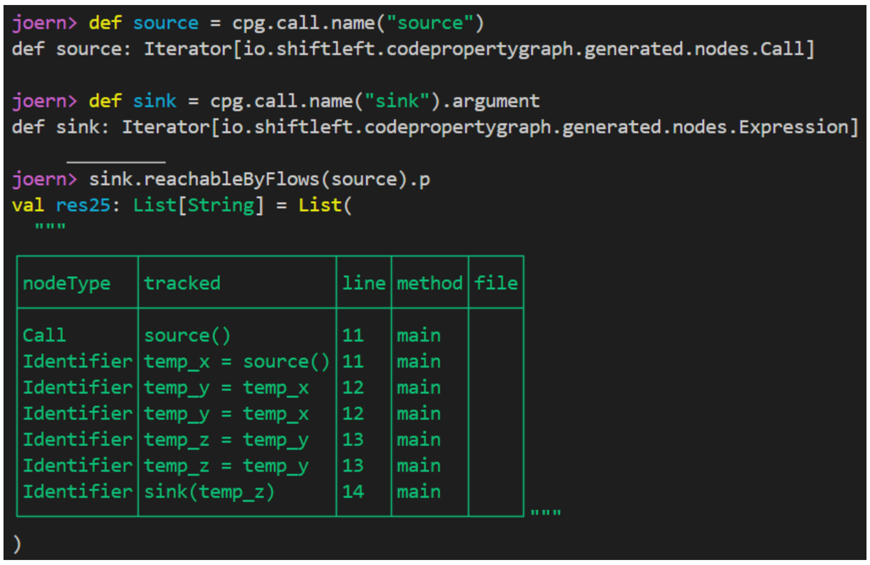
(4）案例四

源码

```
import os

def source():
    x = input()
```

```
	return x

def sink(text):
	os.system(text)

def main(x):
	temp_x = source()
	temp_y = temp_x
	temp_z = temp_y
	sink(temp_z)
```

示例：

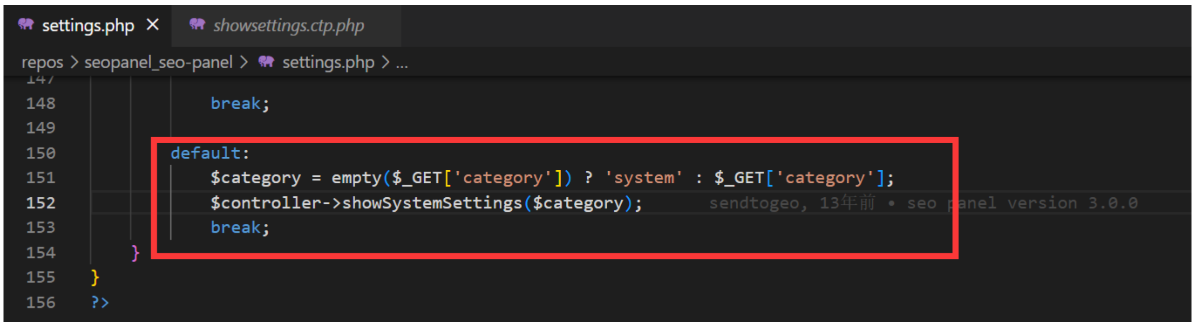


```
joern> def source = cpg.call.name("source")
def source: Iterator[io.shiftleft.codepropertygraph.generated.nodes.Call]

joern> def sink = cpg.call.name("sink").argument
def sink: Iterator[io.shiftleft.codepropertygraph.generated.nodes.Expression]

joern> sink.reachableByFlows(source).p
val res25: List[String] = List(
  """
┌──────────┬────────────────────┬────┬──────┬────┐
│nodeType  │tracked             │line│method│file│
├──────────┼────────────────────┼────┼──────┼────┤
│Call      │source()            │11  │main  │    │
│Identifier│temp_x = source()   │11  │main  │    │
│Identifier│temp_y = temp_x     │12  │main  │    │
│Identifier│temp_y = temp_x     │12  │main  │    │
│Identifier│temp_z = temp_y     │13  │main  │    │
│Identifier│temp_z = temp_y     │13  │main  │    │
│Identifier│sink(temp_z)        │14  │main  │    │
└──────────┴────────────────────┴────┴──────┴────┘"""
)
```

（5）案例五

源码：

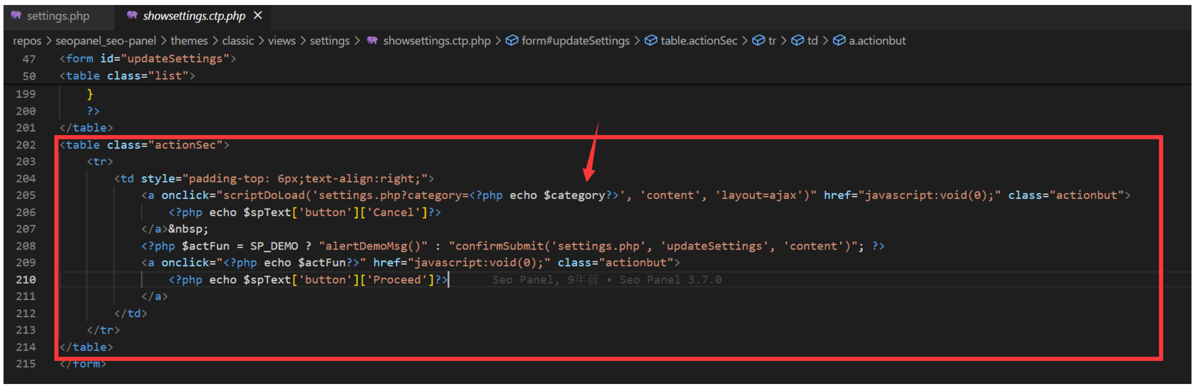
/home/devdata/repos/seopanel_seo-panel/settings.php



settings.php × | showsettings.ctp.php
repos > seopanel_seo-panel > settings.php > ...

```
				break;

			default:
				$category = empty($_GET['category']) ? 'system' : $_GET['category'];
				$controller->showSystemSettings($category);		sendtogeo, 13年前 • seo panel version 3.0.0
				break;
		}
	}
	?>
```

/home/devdata/repos/seopanel_seo-panel/themes/classic/views/settings/showsettings.ctp.php

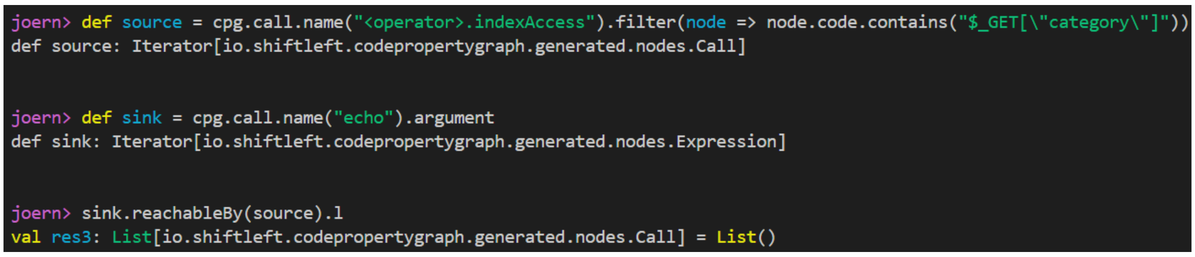


settings.php | showsettings.ctp.php ×
repos > seopanel_seo-panel > themes > classic > views > settings > showsettings.ctp.php > form#updateSettings > table.actionSec > tr > td > a.actionbut

```
<form id="updateSettings">
<table class="list">
	}
	?>
</table>
<table class="actionSec">
	<tr>
		<td style="padding-top: 6px;text-align:right;">
			<a onclick="scriptDoLoad('settings.php?category=<?php echo $category?>', 'content', 'layout=ajax')" href="javascript:void(0);" class="actionbut">
				<?php echo $spText['button']['Cancel']?>
			</a>&nbsp;
			<?php $actFun = SP_DEMO ? "alertDemoMsg()" : "confirmSubmit('settings.php', 'updateSettings', 'content')"; ?>
			<a onclick="<?php echo $actFun?>" href="javascript:void(0);" class="actionbut">
				<?php echo $spText['button']['Proceed']?>		Seo Panel, 9年前 • Seo Panel 3.7.0
			</a>
		</td>
	</tr>
</table>
</form>
```

```
def source = cpg.call.name("<operator>.indexAccess").filter(node =>
node.code.contains("$_GET[\"category\"]"))
def sink = cpg.call.name("echo").argument
sink.reachableBy(source).l
```

在这个案例中没有结果：



```
joern> def source = cpg.call.name("<operator>.indexAccess").filter(node => node.code.contains("$_GET[\"category\"]"))
def source: Iterator[io.shiftleft.codepropertygraph.generated.nodes.Call]


joern> def sink = cpg.call.name("echo").argument
def sink: Iterator[io.shiftleft.codepropertygraph.generated.nodes.Expression]


joern> sink.reachableBy(source).l
val res3: List[io.shiftleft.codepropertygraph.generated.nodes.Call] = List()
```

13.查询一个类的父类

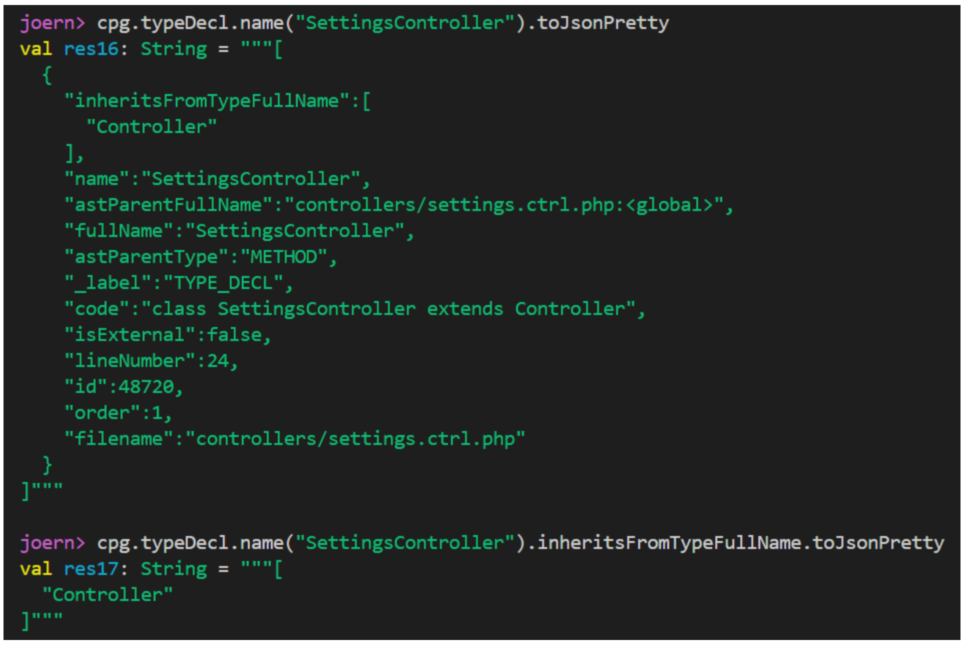
源码：

```
<?php
class SettingsController extends Controller{
    var $layout = 'ajax';
    # function to show system settings
    function showSystemSettings($category='system') {
          $category = addslashes($category);
         $this->set('list', $this->__getAllSettings(true, 1, $category));
        if ($category == 'system') {
             $langCtrler = New LanguageController();
             $langList = $langCtrler->__getAllLanguages(" where translated=1");
             $this->set('langList', $langList);
             $timezoneCtrler = New TimeZoneController();
             $timezoneList = $timezoneCtrler->__getAllTimezones();
             $this->set('timezoneList', $timezoneList);
             $currencyCtrler = new CurrencyController();
             $this->set('currencyList', $currencyCtrler->__getAllCurrency(" and paypal=1 and status=1
and name!=''"));
             $countryCtrl = new CountryController();
             $this->set('countryList', $countryCtrl->__getAllCountryAsList());
        }
        $this->set('category', $category);

        // if report settings page
        if ($category == 'report') {
                  $spTextReport = $this->getLanguageTexts('report', $_SESSION['lang_code']);
                  $this->set('spTextReport', $spTextReport);
              $scheduleList = array(
                 1 => $_SESSION['text']['label']['Daily'],
                 2 => $spTextReport['2 Days'],
                 7 => $_SESSION['text']['label']['Weekly'],
                 30 => $_SESSION['text']['label']['Monthly'],
             );
              $this->set('scheduleList', $scheduleList);
                $this->render('settings/showreportsettings');
        } else if ($category == 'proxy') {
                  $spTextProxy = $this->getLanguageTexts('proxy', $_SESSION['lang_code']);
```

```
                    $this->set('spTextProxy', $spTextProxy);
                  $this->render('settings/showproxysettings');
          } else {
              $spTextPanel = $this->getLanguageTexts('panel', $_SESSION['lang_code']);

              // switch through category
              switch ($category) {
                  case "api":
                      $this->set('headLabel', $spTextPanel['API Settings']);
                      break;
                  case "moz":
                      $this->set('headLabel', $spTextPanel['MOZ Settings']);
                      break;
                  case "google":
                      $this->set('headLabel', $spTextPanel['Google Settings']);
                      break;
                  case "dataforseo":
                        $this->set('headLabel', $spTextPanel['DataForSEO Settings']);
                        break;
                  case "mail":
                        $this->set('headLabel', $spTextPanel['Mail Settings']);
                        break;
                  default:
                      break;

              }
                $this->render('settings/showsettings');
          }
      }
  }
?>
```

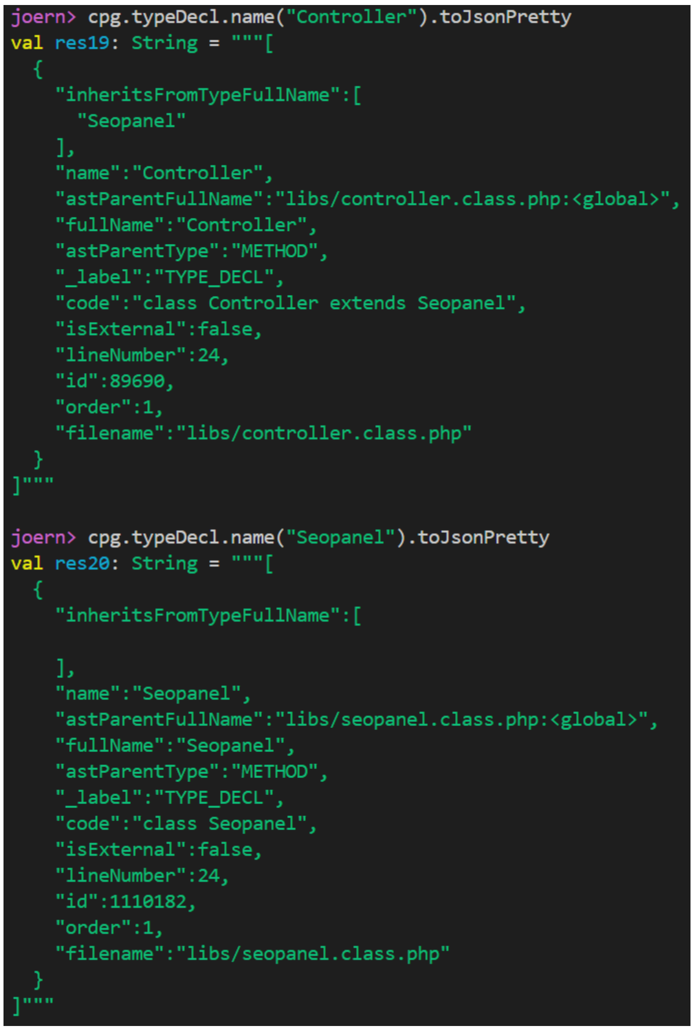
示例

```
cpg.typeDecl.name("SettingsController").inheritsFromTypeFullName.toJsonPretty
cpg.typeDecl.filter(node => node.name=="SettingsController").inheritsFromTypeFullName.toJsonPretty
```



```
joern> cpg.typeDecl.name("SettingsController").toJsonPretty
val res16: String = """[
  {
    "inheritsFromTypeFullName":[
      "Controller"
    ],
    "name":"SettingsController",
    "astParentFullName":"controllers/settings.ctrl.php:<global>",
    "fullName":"SettingsController",
    "astParentType":"METHOD",
    "_label":"TYPE_DECL",
    "code":"class SettingsController extends Controller",
    "isExternal":false,
    "lineNumber":24,
    "id":48720,
    "order":1,
    "filename":"controllers/settings.ctrl.php"
  }
]"""

joern> cpg.typeDecl.name("SettingsController").inheritsFromTypeFullName.toJsonPretty
val res17: String = """[
  "Controller"
]"""
```

还可以接着查父类的父类：



```
joern> cpg.typeDecl.name("Controller").toJsonPretty
val res19: String = """[
  {
    "inheritsFromTypeFullName":[
      "Seopanel"
    ],
    "name":"Controller",
    "astParentFullName":"libs/controller.class.php:<global>",
    "fullName":"Controller",
    "astParentType":"METHOD",
    "_label":"TYPE_DECL",
    "code":"class Controller extends Seopanel",
    "isExternal":false,
    "lineNumber":24,
    "id":89690,
    "order":1,
    "filename":"libs/controller.class.php"
  }
]"""

joern> cpg.typeDecl.name("Seopanel").toJsonPretty
val res20: String = """[
  {
    "inheritsFromTypeFullName":[

    ],
    "name":"Seopanel",
    "astParentFullName":"libs/seopanel.class.php:<global>",
    "fullName":"Seopanel",
    "astParentType":"METHOD",
    "_label":"TYPE_DECL",
    "code":"class Seopanel",
    "isExternal":false,
    "lineNumber":24,
    "id":1110182,
    "order":1,
    "filename":"libs/seopanel.class.php"
  }
]"""
```

14.查找CFG子节点

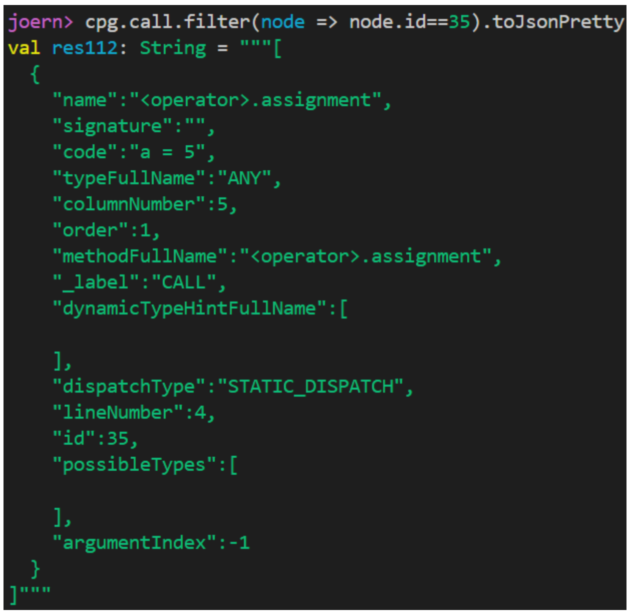
查找CFG子节点的函数不是cfgNext，而是_cfgOut函数。

源码：

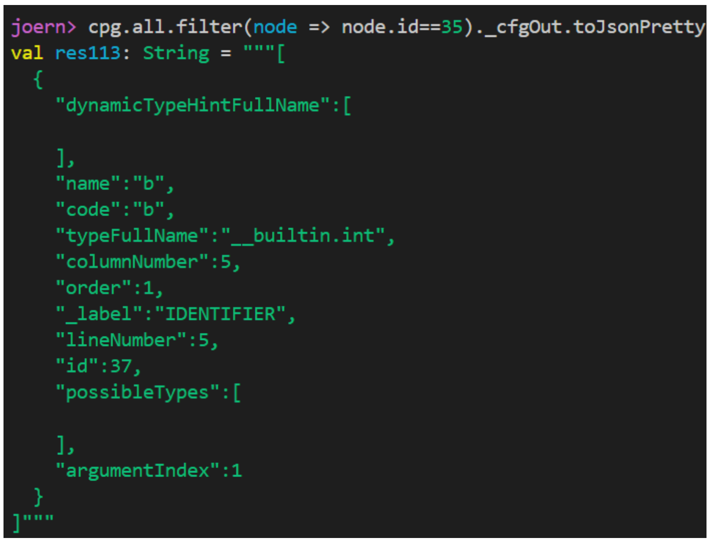
```
def main():
      a = 5
      b = 20
      x = 10
      if x < 10:
            print("x < 10")
      else:
            print("x >= 10")
      c = 30
      d = a + b + c
```

示例：

查找 `a = 5` 的CFG子节点


```
joern> cpg.call.filter(node => node.id==35).toJsonPretty
val res112: String = """[
  {
    "name":"<operator>.assignment",
    "signature":"",
    "code":"a = 5",
    "typeFullName":"ANY",
    "columnNumber":5,
    "order":1,
    "methodFullName":"<operator>.assignment",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":4,
    "id":35,
    "possibleTypes":[

    ],
    "argumentIndex":-1
  }
]"""
```

```
cpg.all.filter(node => node.id==35)._cfgOut.toJsonPretty
```


```
joern> cpg.all.filter(node => node.id==35)._cfgOut.toJsonPretty
val res113: String = """[
  {
    "dynamicTypeHintFullName":[

    ],
    "name":"b",
    "code":"b",
    "typeFullName":"__builtin.int",
    "columnNumber":5,
    "order":1,
    "_label":"IDENTIFIER",
    "lineNumber":5,
    "id":37,
    "possibleTypes":[

    ],
    "argumentIndex":1
  }
]"""
```

注意：这里cpg节点类型要使用 **all** 类型，这样做是为了找节点子节点过程中，不会受到节点本身类型的影响。

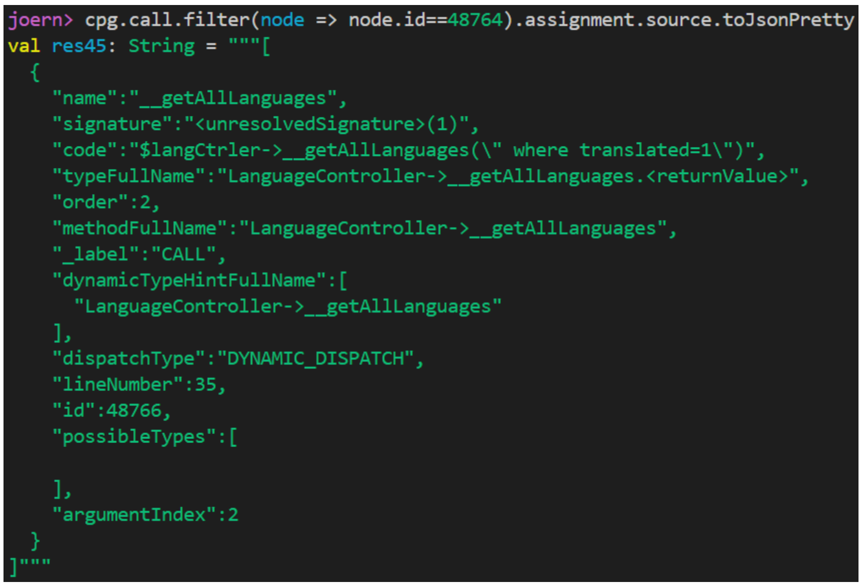
15.查找创建对象语句

源码：

```
$langCtrler = New LanguageController();
$langList = $langCtrler->__getAllLanguages(" where translated=1");
```

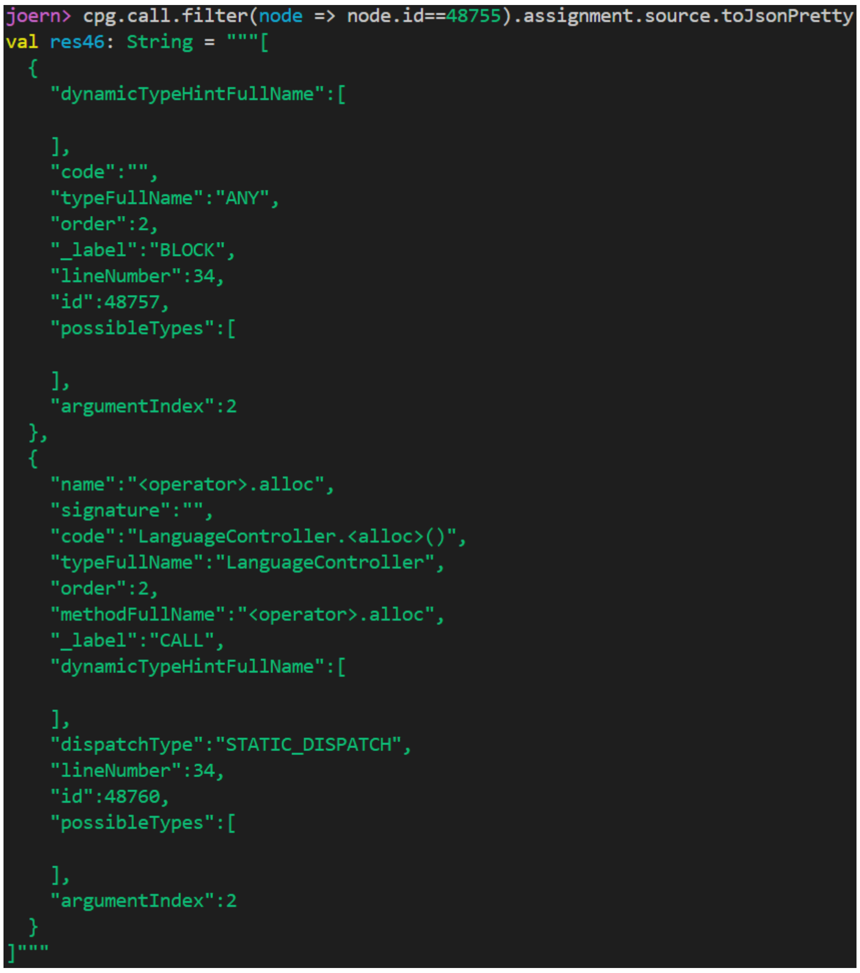
示例：

```
cpg.call.filter(node => node.id==48764).assignment.source.toJsonPretty
```



```
joern> cpg.call.filter(node => node.id==48764).assignment.source.toJsonPretty
val res45: String = """[
  {
    "name":"__getAllLanguages",
    "signature":"<unresolvedSignature>(1)",
    "code":"$langCtrler->__getAllLanguages(\" where translated=1\")",
    "typeFullName":"LanguageController->__getAllLanguages.<returnValue>",
    "order":2,
    "methodFullName":"LanguageController->__getAllLanguages",
    "_label":"CALL",
    "dynamicTypeHintFullName":[
      "LanguageController->__getAllLanguages"
    ],
    "dispatchType":"DYNAMIC_DISPATCH",
    "lineNumber":35,
    "id":48766,
    "possibleTypes":[

    ],
    "argumentIndex":2
  }
]"""
```

```
cpg.call.filter(node => node.id==48755).assignment.source.toJsonPretty
```



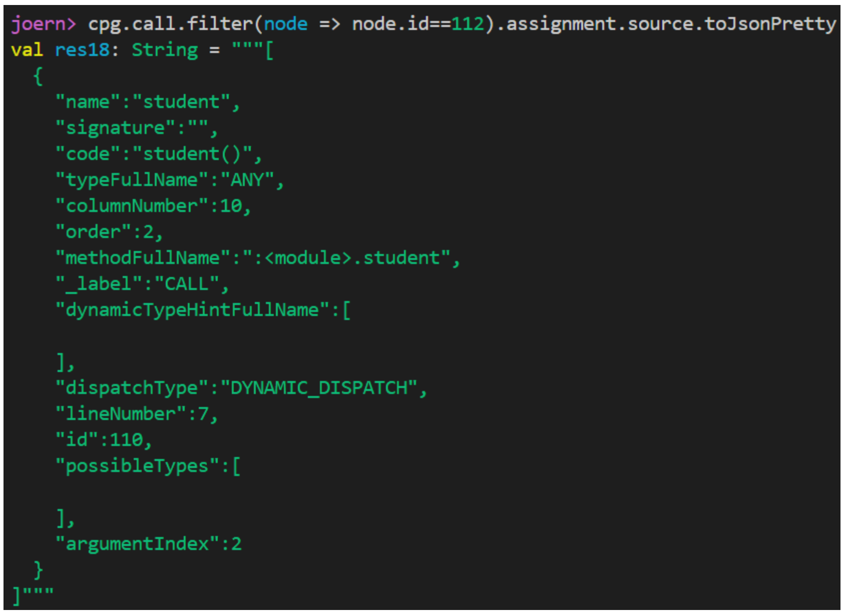
```
joern> cpg.call.filter(node => node.id==48755).assignment.source.toJsonPretty
val res46: String = """[
  {
    "dynamicTypeHintFullName":[

    ],
    "code":"",
    "typeFullName":"ANY",
    "order":2,
    "_label":"BLOCK",
    "lineNumber":34,
    "id":48757,
    "possibleTypes":[

    ],
    "argumentIndex":2
  },
  {
    "name":"<operator>.alloc",
    "signature":"",
    "code":"LanguageController.<alloc>()",
    "typeFullName":"LanguageController",
    "order":2,
    "methodFullName":"<operator>.alloc",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":34,
    "id":48760,
    "possibleTypes":[

    ],
    "argumentIndex":2
  }
]"""
```

源码:

```
class student():
      def __init__(self):
            self.name = None
            self.age = None

def main():
      s1 = student() # 112
      s2 = s1 # 115
```

示例：

```
cpg.call.filter(node => node.id==112).assignment.source.toJsonPretty
```



```
joern> cpg.call.filter(node => node.id==112).assignment.source.toJsonPretty
val res18: String = """[
  {
    "name":"student",
    "signature":"",
    "code":"student()",
    "typeFullName":"ANY",
    "columnNumber":10,
    "order":2,
    "methodFullName":":<module>.student",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"DYNAMIC_DISPATCH",
    "lineNumber":7,
    "id":110,
    "possibleTypes":[

    ],
    "argumentIndex":2
  }
]"""
```

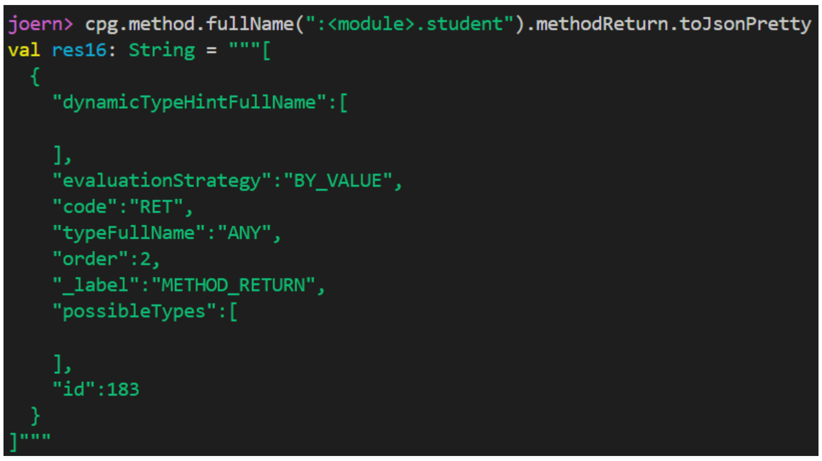
总结：

创建对象语句是赋值语句，但其source与普通的赋值语句具有一定的区别。

TODO：还需要观察，看看这个BLOCK node是不是必然出现。

16.查看函数返回值

```
cpg.method.fullName(":<module>.student").methodReturn.toJsonPretty
```



```
joern> cpg.method.fullName(":<module>.student").methodReturn.toJsonPretty
val res16: String = """[
  {
    "dynamicTypeHintFullName":[

    ],
    "evaluationStrategy":"BY_VALUE",
    "code":"RET",
    "typeFullName":"ANY",
    "order":2,
    "_label":"METHOD_RETURN",
    "possibleTypes":[

    ],
    "id":183
  }
]"""
```

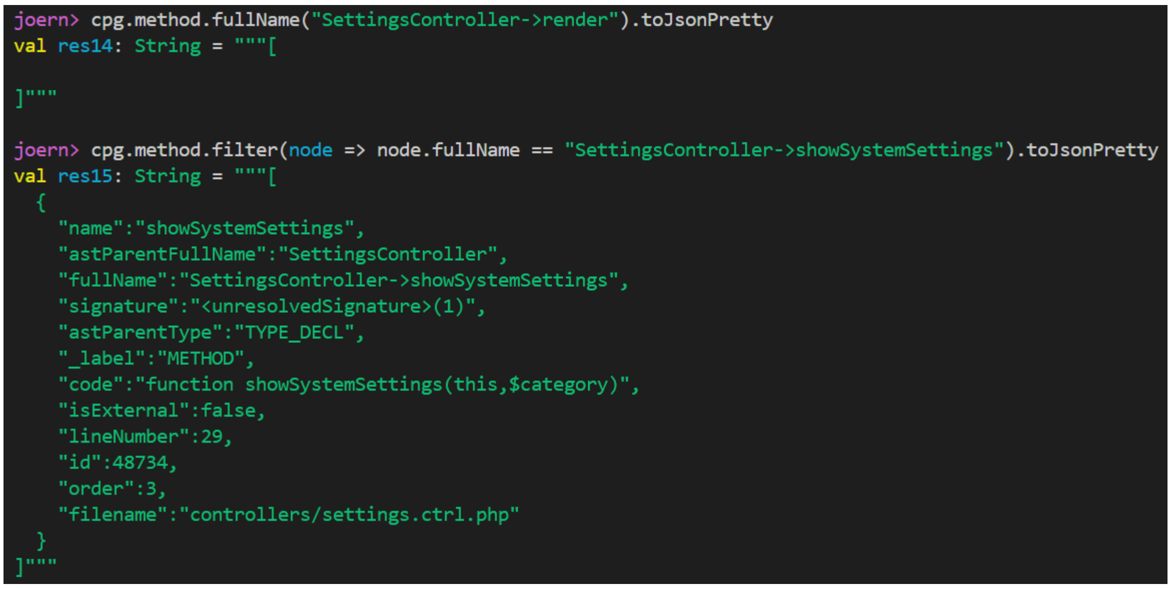
17.查看函数紧接着的CFG Node

源码：

```
    # function to show system settings
    function showSystemSettings($category='system') {
          $category = addslashes($category);
         $this->set('list', $this->__getAllSettings(true, 1, $category));
```

示例：

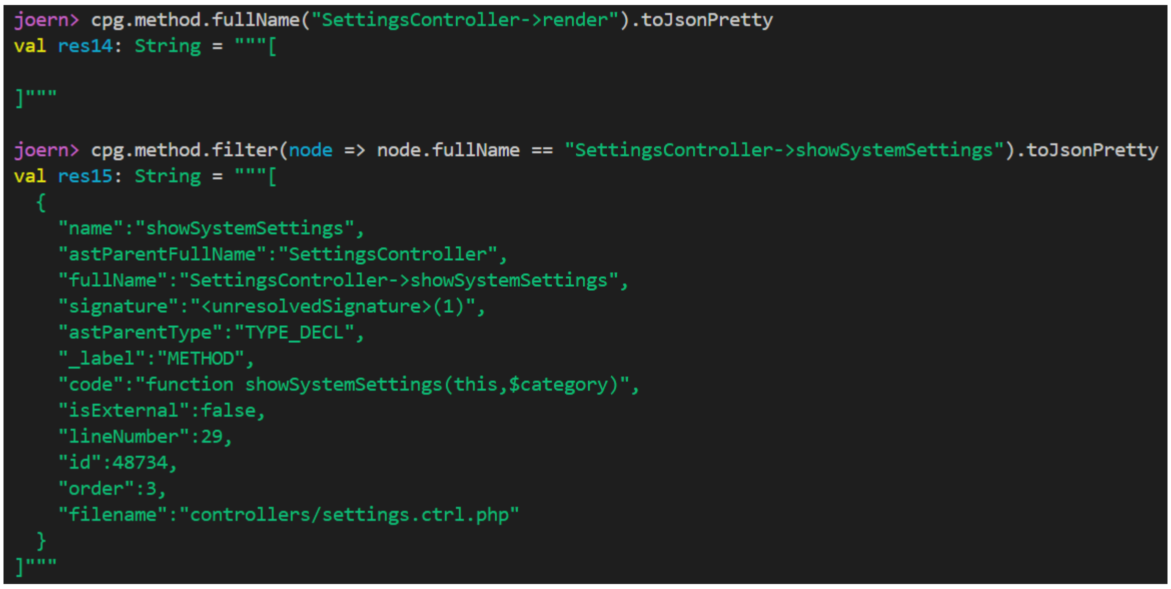
```
cpg.method.filter(node => node.fullName == "SettingsController->showSystemSettings").toJsonPretty
cpg.method.filter(node => node.fullName == "SettingsController->render").toJsonPretty
```



```
joern> cpg.method.fullName("SettingsController->render").toJsonPretty
val res14: String = """[

]"""

joern> cpg.method.filter(node => node.fullName == "SettingsController->showSystemSettings").toJsonPretty
val res15: String = """[
  {
    "name":"showSystemSettings",
    "astParentFullName":"SettingsController",
    "fullName":"SettingsController->showSystemSettings",
    "signature":"<unresolvedSignature>(1)",
    "astParentType":"TYPE_DECL",
    "_label":"METHOD",
    "code":"function showSystemSettings(this,$category)",
    "isExternal":false,
    "lineNumber":29,
    "id":48734,
    "order":3,
    "filename":"controllers/settings.ctrl.php"
  }
]"""
```

现在要查找SettingsController->showSystemSettings紧接着的CFG Node：

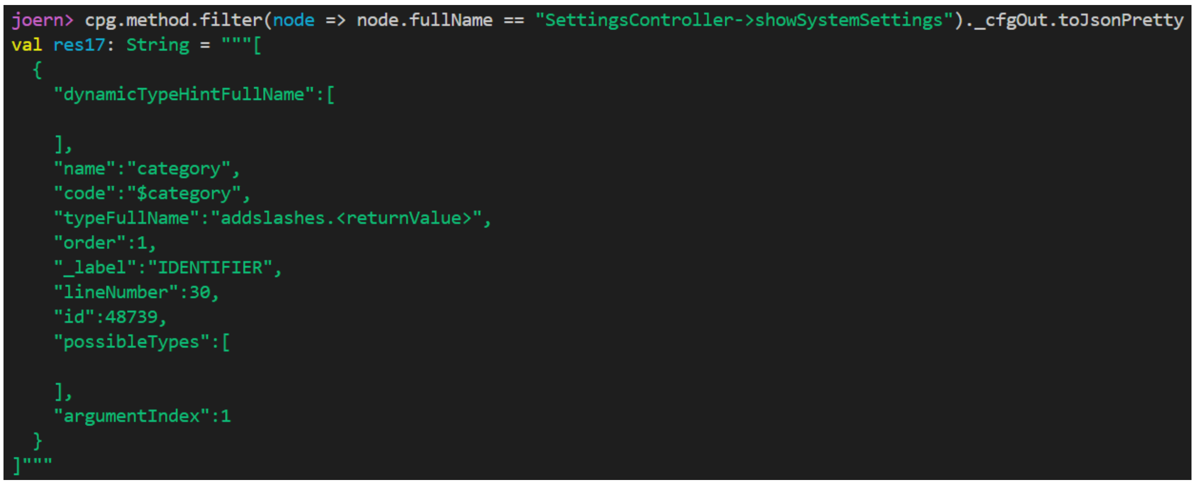
```
cpg.method.filter(node => node.fullName == "SettingsController-
>showSystemSettings").cfgNext.toJsonPretty
cpg.method.filter(node => node.fullName == ":<module>.student.
<returnValue>.find_min").cfgNext.toJsonPretty
```



```
joern> cpg.method.fullName("SettingsController->render").toJsonPretty
val res14: String = """[

]"""

joern> cpg.method.filter(node => node.fullName == "SettingsController->showSystemSettings").toJsonPretty
val res15: String = """[
  {
    "name":"showSystemSettings",
    "astParentFullName":"SettingsController",
    "fullName":"SettingsController->showSystemSettings",
    "signature":"<unresolvedSignature>(1)",
    "astParentType":"TYPE_DECL",
    "_label":"METHOD",
    "code":"function showSystemSettings(this,$category)",
    "isExternal":false,
    "lineNumber":29,
    "id":48734,
    "order":3,
    "filename":"controllers/settings.ctrl.php"
  }
]"""
```

似乎也可以使用：

```
cpg.method.filter(node => node.fullName == "SettingsController-
>showSystemSettings")._cfgOut.toJsonPretty
cpg.method.filter(node => node.fullName == "Student.hello:void(Student)")._cfgOut.toJsonPretty
```



```
joern> cpg.method.filter(node => node.fullName == "SettingsController->showSystemSettings")._cfgOut.toJsonPretty
val res17: String = """[
  {
    "dynamicTypeHintFullName":[

    ],
    "name":"category",
    "code":"$category",
    "typeFullName":"addslashes.<returnValue>",
    "order":1,
    "_label":"IDENTIFIER",
    "lineNumber":30,
    "id":48739,
    "possibleTypes":[

    ],
    "argumentIndex":1
  }
]"""
```

特殊情况:

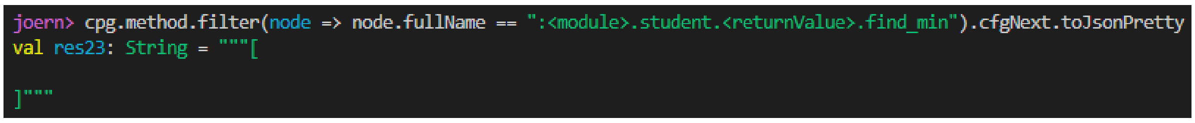
当这个函数有返回值时，用原本的fullname找不到后继节点，这时候应该去除fullname中的`<returnValue>`，例如:

源码:

```
class student():
      def __init__(self):
            self.name = None
            self.age = None

      def find_min(self, a: int, b: int, c: int, d: int):
            min1 = min(a, b)
            min2 = min(min1, c)
            min3 = min(min2, d)
            return min3

def find_max(a: int, b: int, c: int, d: int):
      max1 = max(a, b)
      max2 = max(max1, c)
      max3 = max(max2, d)
      return max3

def main():
      s1 = student() # 212
      x = s1.find_min(a=10, b=20, c=30, d=40) # 223
      y = find_max(a=10, b=20, c=30, d=40) # 231
      print(f"x={x}") # 237
      print(f"y={y}") # 243

main()
```

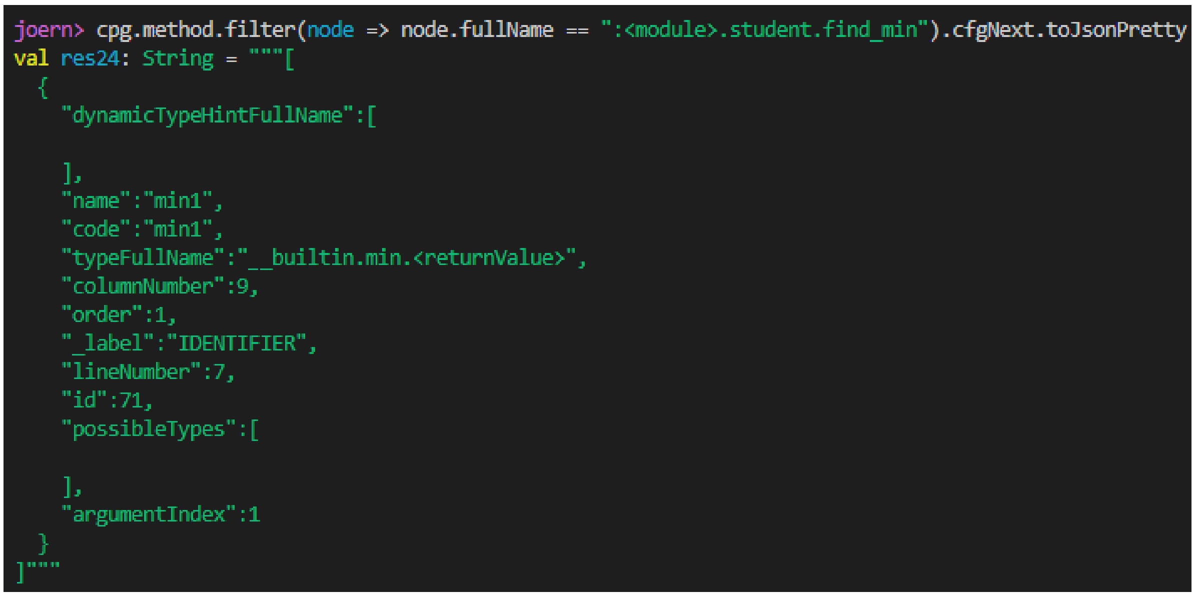
示例:

```
cpg.method.filter(node => node.fullName == ":<module>.student.
<returnValue>.find_min").cfgNext.toJsonPretty
```



```
joern> cpg.method.filter(node => node.fullName == ":<module>.student.<returnValue>.find_min").cfgNext.toJsonPretty
val res23: String = """[

]"""
```

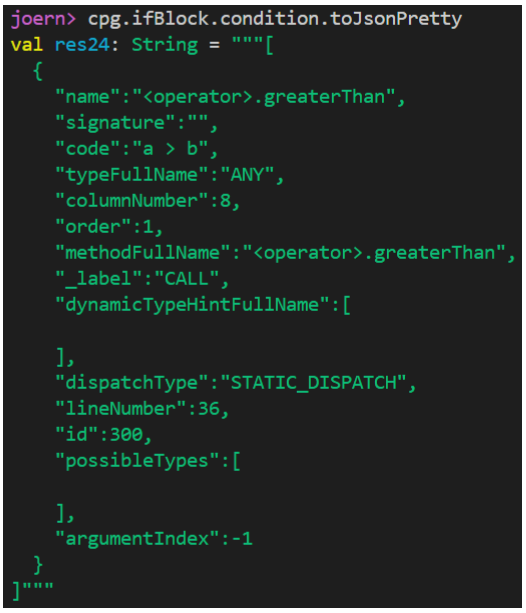
```
cpg.method.filter(node => node.fullName == ":<module>.student.find_min").cfgNext.toJsonPretty
```



```
joern> cpg.method.filter(node => node.fullName == ":<module>.student.find_min").cfgNext.toJsonPretty
val res24: String = """[
  {
    "dynamicTypeHintFullName":[

    ],
    "name":"min1",
    "code":"min1",
    "typeFullName":"__builtin.min.<returnValue>",
    "columnNumber":9,
    "order":1,
    "_label":"IDENTIFIER",
    "lineNumber":7,
    "id":71,
    "possibleTypes":[

    ],
    "argumentIndex":1
  }
]"""
```

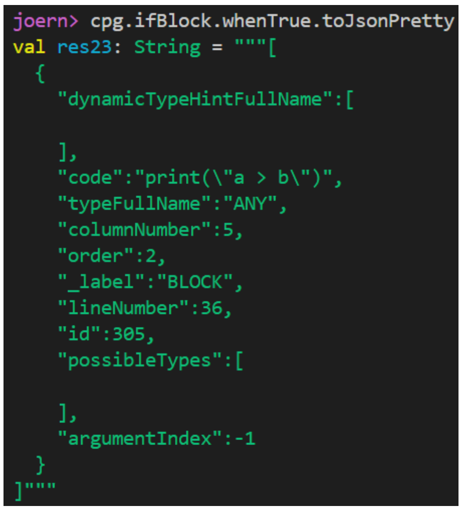
18.查看IF语句的条件与分支

```
cpg.ifBlock.condition.toJsonPretty
```



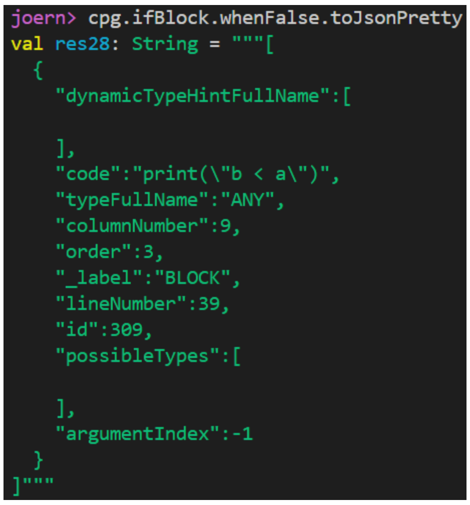
```
joern> cpg.ifBlock.condition.toJsonPretty
val res24: String = """[
  {
    "name":"<operator>.greaterThan",
    "signature":"",
    "code":"a > b",
    "typeFullName":"ANY",
    "columnNumber":8,
    "order":1,
    "methodFullName":"<operator>.greaterThan",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":36,
    "id":300,
    "possibleTypes":[

    ],
    "argumentIndex":-1
  }
]"""
```

```
cpg.ifBlock.whenTrue.toJsonPretty
```



```
joern> cpg.ifBlock.whenTrue.toJsonPretty
val res23: String = """[
  {
    "dynamicTypeHintFullName":[

    ],
    "code":"print(\"a > b\")",
    "typeFullName":"ANY",
    "columnNumber":5,
    "order":2,
    "_label":"BLOCK",
    "lineNumber":36,
    "id":305,
    "possibleTypes":[

    ],
    "argumentIndex":-1
  }
]"""
```

```
cpg.ifBlock.whenFalse.toJsonPretty
```



```
joern> cpg.ifBlock.whenFalse.toJsonPretty
val res28: String = """[
  {
    "dynamicTypeHintFullName":[

    ],
    "code":"print(\"b < a\")",
    "typeFullName":"ANY",
    "columnNumber":9,
    "order":3,
    "_label":"BLOCK",
    "lineNumber":39,
    "id":309,
    "possibleTypes":[

    ],
    "argumentIndex":-1
  }
]"""
```

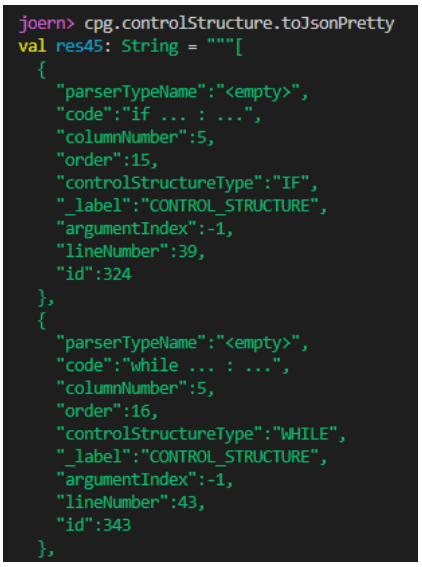
19.查看控制语句的条件

源码：

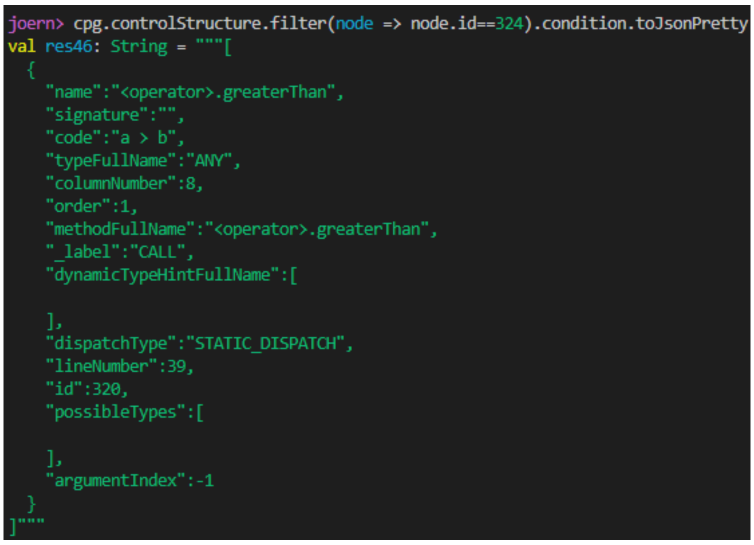
```
if a > b: # 314
        print("a > b") # 317
    else:
        print("b < a") # 322
    while b > 0: # 326
        b = b - 1
        a = a + 1
```

示例：

```
cpg.controlStructure.toJsonPretty
cpg.controlStructure.filter(node => node.id==24).astChildren.toJsonPretty
# 查看for循环的初始化、条件和更新3个部分对应的CPG Nodes
cpg.controlStructure.filter(node => node.id==24).astChildren.isCall.toJsonPretty
```

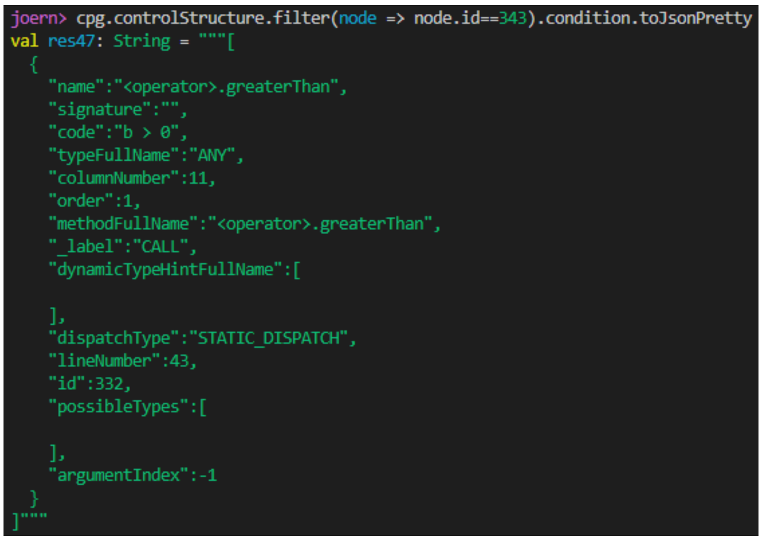


```
joern> cpg.controlStructure.toJsonPretty
val res45: String = """[
  {
    "parserTypeName":"<empty>",
    "code":"if ... : ...",
    "columnNumber":5,
    "order":15,
    "controlStructureType":"IF",
    "_label":"CONTROL_STRUCTURE",
    "argumentIndex":-1,
    "lineNumber":39,
    "id":324
  },
  {
    "parserTypeName":"<empty>",
    "code":"while ... : ...",
    "columnNumber":5,
    "order":16,
    "controlStructureType":"WHILE",
    "_label":"CONTROL_STRUCTURE",
    "argumentIndex":-1,
    "lineNumber":43,
    "id":343
  },
cpg.controlStructure.filter(node => node.id==324).condition.toJsonPretty
cpg.controlStructure.filter(_.lineNumber==Some(value = 39)).toJsonPretty
```



```
joern> cpg.controlStructure.filter(node => node.id==324).condition.toJsonPretty
val res46: String = """[
  {
    "name":"<operator>.greaterThan",
    "signature":"",
    "code":"a > b",
    "typeFullName":"ANY",
    "columnNumber":8,
    "order":1,
    "methodFullName":"<operator>.greaterThan",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":39,
    "id":320,
    "possibleTypes":[

    ],
    "argumentIndex":-1
  }
]"""
```

```
cpg.controlStructure.filter(node => node.id==343).condition.toJsonPretty
```



```
joern> cpg.controlStructure.filter(node => node.id==343).condition.toJsonPretty
val res47: String = """[
  {
    "name":"<operator>.greaterThan",
    "signature":"",
    "code":"b > 0",
    "typeFullName":"ANY",
    "columnNumber":11,
    "order":1,
    "methodFullName":"<operator>.greaterThan",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":43,
    "id":332,
    "possibleTypes":[

    ],
    "argumentIndex":-1
  }
]"""
```

20.判断一条语句是否是控制流

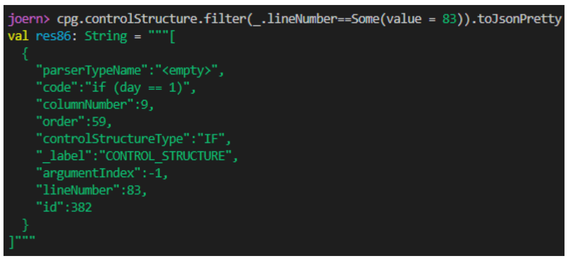
查询该语句后面的一个call语句，看它是否被该语句所控制，用到的命令主要有:

```
cpg.all.filter(node => node.id==35)._cfgOut.toJsonPretty
cpg.call.filter(node => node.id==182).controlledBy.toJsonPretty
```

21.寻找一条语句对应的控制语句

方法一：根据行号

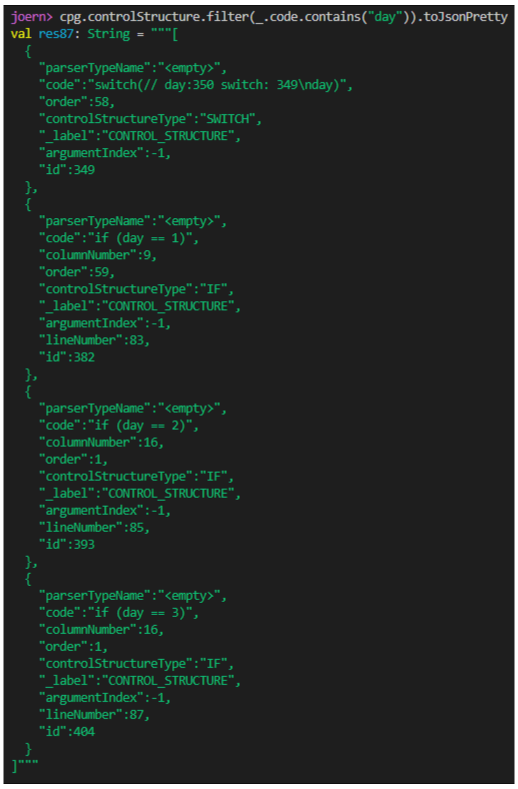
```
cpg.controlStructure.filter(_.lineNumber==Some(value = 83)).toJsonPretty
```



```
joern> cpg.controlStructure.filter(_.lineNumber==Some(value = 83)).toJsonPretty
val res86: String = """[
  {
    "parserTypeName":"<empty>",
    "code":"if (day == 1)",
    "columnNumber":9,
    "order":59,
    "controlStructureType":"IF",
    "_label":"CONTROL_STRUCTURE",
    "argumentIndex":-1,
    "lineNumber":83,
    "id":382
  }
]"""
```

方法二：根据是否含有相应的代码

```
cpg.controlStructure.filter(_.code.contains("day")).toJsonPretty
```



```
joern> cpg.controlStructure.filter(_.code.contains("day")).toJsonPretty
val res87: String = """[
  {
    "parserTypeName":"<empty>",
    "code":"switch(// day:350 switch: 349\nday)",
    "order":58,
    "controlStructureType":"SWITCH",
    "_label":"CONTROL_STRUCTURE",
    "argumentIndex":-1,
    "id":349
  },
  {
    "parserTypeName":"<empty>",
    "code":"if (day == 1)",
    "columnNumber":9,
    "order":59,
    "controlStructureType":"IF",
    "_label":"CONTROL_STRUCTURE",
    "argumentIndex":-1,
    "lineNumber":83,
    "id":382
  },
  {
    "parserTypeName":"<empty>",
    "code":"if (day == 2)",
    "columnNumber":16,
    "order":1,
    "controlStructureType":"IF",
    "_label":"CONTROL_STRUCTURE",
    "argumentIndex":-1,
    "lineNumber":85,
    "id":393
  },
  {
    "parserTypeName":"<empty>",
    "code":"if (day == 3)",
    "columnNumber":16,
    "order":1,
    "controlStructureType":"IF",
    "_label":"CONTROL_STRUCTURE",
    "argumentIndex":-1,
    "lineNumber":87,
    "id":404
  }
]"""
```

方法二会检索到许多节点，还需要根据node id进行判断才行。

22.判断函数是否是类的函数?

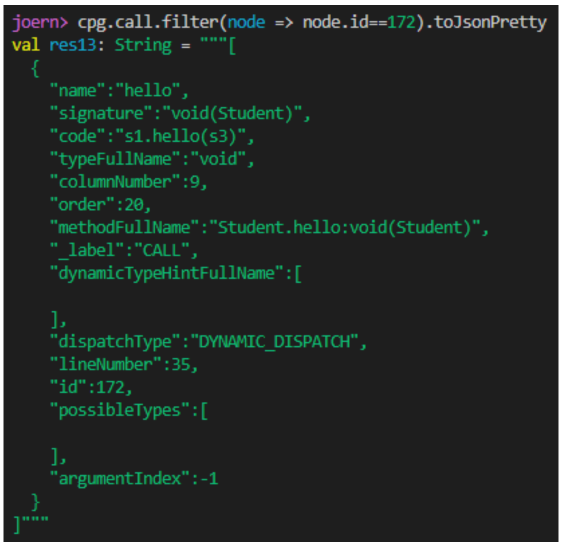
源码:

```
class Student {
      String name;
      int age;
      double[] scores = new double[3];
      HashMap<String, String> myMap = new HashMap<String, String>();

      public void hello(Teacher teacher) {
            System.out.println("Hello! teacher " + teacher.name);
     }

      public void hello(Student student) {
            System.out.println("Hello! student " + student.name);
     }
}
```

```
s1.hello(s3); // 172
```

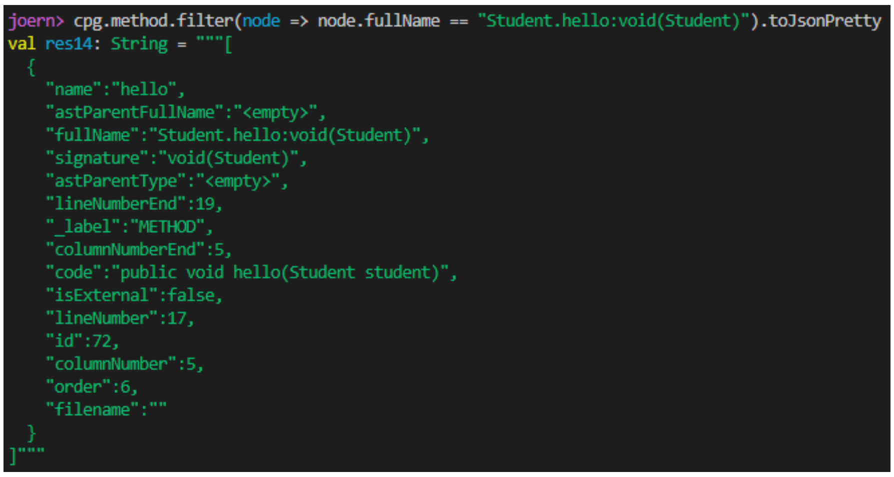
示例：

```
cpg.call.filter(node => node.id==172).toJsonPretty
```



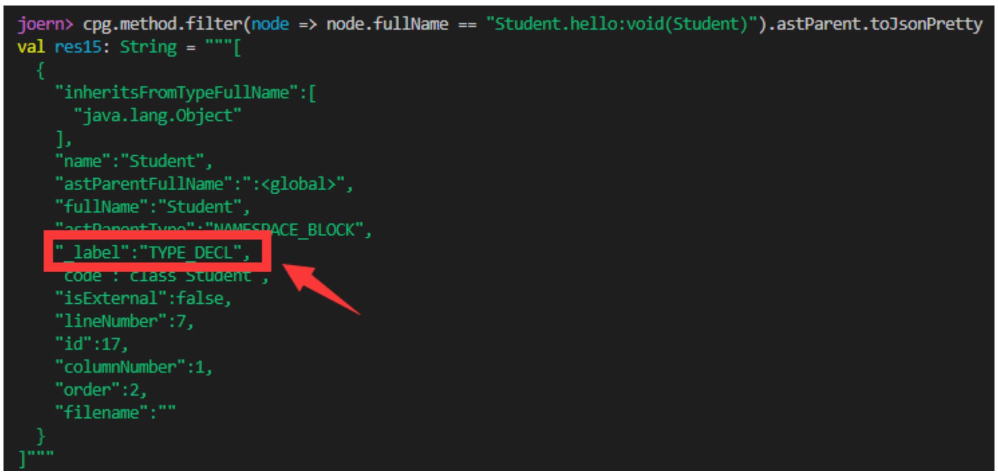
```
joern> cpg.call.filter(node => node.id==172).toJsonPretty
val res13: String = """[
  {
    "name":"hello",
    "signature":"void(Student)",
    "code":"s1.hello(s3)",
    "typeFullName":"void",
    "columnNumber":9,
    "order":20,
    "methodFullName":"Student.hello:void(Student)",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"DYNAMIC_DISPATCH",
    "lineNumber":35,
    "id":172,
    "possibleTypes":[

    ],
    "argumentIndex":-1
  }
]"""
```

```
cpg.method.filter(node => node.fullName == "Student.hello:void(Student)").toJsonPretty
```



```
joern> cpg.method.filter(node => node.fullName == "Student.hello:void(Student)").toJsonPretty
val res14: String = """[
  {
    "name":"hello",
    "astParentFullName":"<empty>",
    "fullName":"Student.hello:void(Student)",
    "signature":"void(Student)",
    "astParentType":"<empty>",
    "lineNumberEnd":19,
    "_label":"METHOD",
    "columnNumberEnd":5,
    "code":"public void hello(Student student)",
    "isExternal":false,
    "lineNumber":17,
    "id":72,
    "columnNumber":5,
    "order":6,
    "filename":""
  }
]"""
```

```
cpg.method.filter(node => node.fullName == "Student.hello:void(Student)").astParent.toJsonPretty
```



```
joern> cpg.method.filter(node => node.fullName == "Student.hello:void(Student)").astParent.toJsonPretty
val res15: String = """[
  {
    "inheritsFromTypeFullName":[
      "java.lang.Object"
    ],
    "name":"Student",
    "astParentFullName":":<global>",
    "fullName":"Student",
    "astParentType":"NAMESPACE_BLOCK",
    "_label":"TYPE_DECL",
    "code":"class Student",
    "isExternal":false,
    "lineNumber":7,
    "id":17,
    "columnNumber":1,
    "order":2,
    "filename":""
  }
]"""
```

根据函数定义的父节点的 `_label` 属性是否为 `"TYPE_DECL"` 即可判断该函数是否是类的函数。

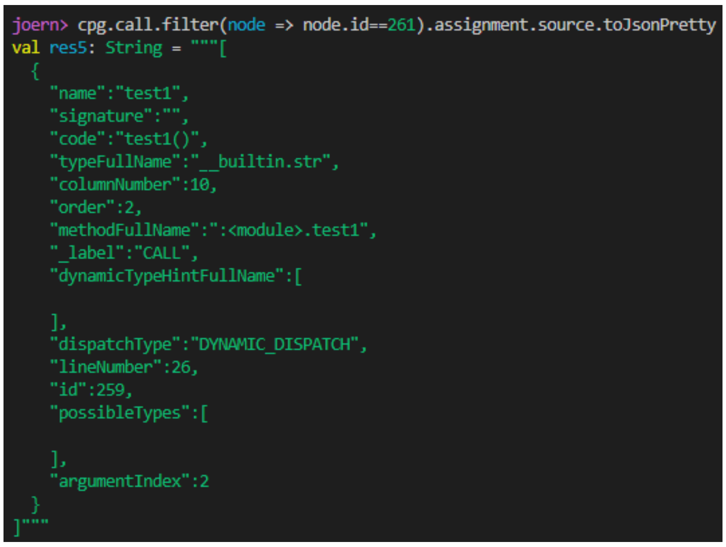
23.判断函数是否是普通函数?

源码:

```
def test1():
      return "None"
s2 = test1() # 261
```

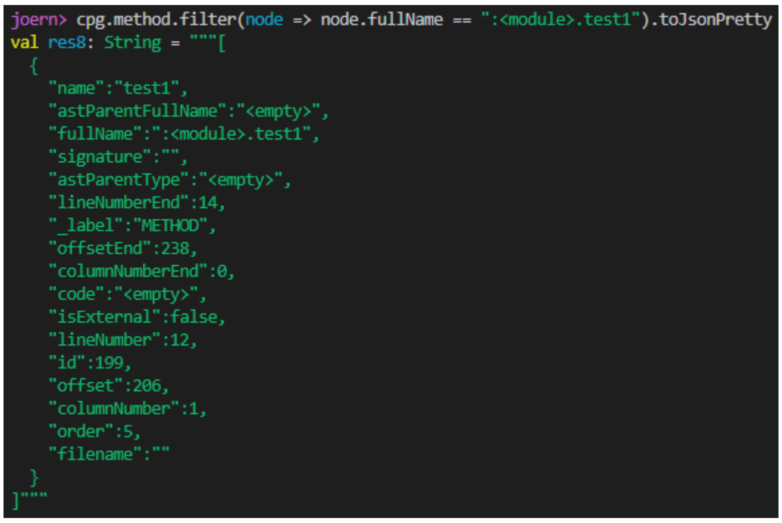
示例:

```
cpg.call.filter(node => node.id==261).assignment.source.toJsonPretty
```



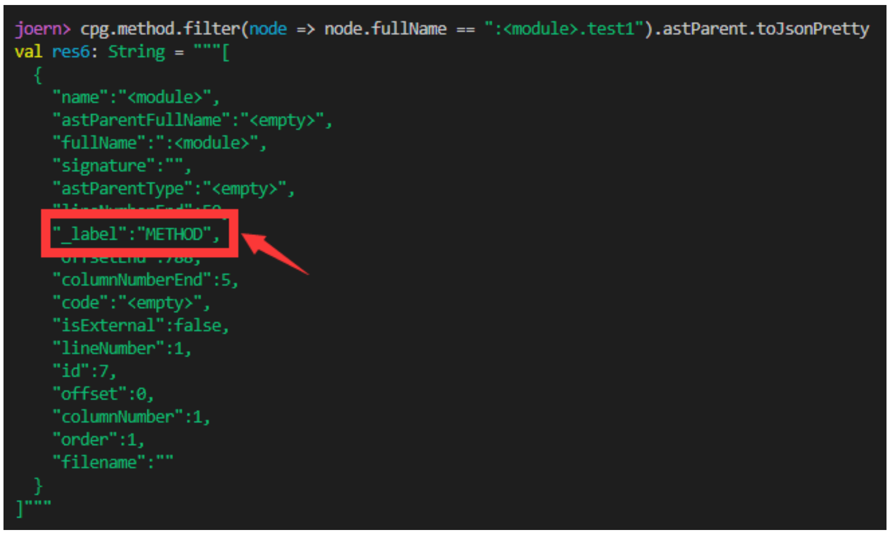
```
joern> cpg.call.filter(node => node.id==261).assignment.source.toJsonPretty
val res5: String = """[
  {
    "name":"test1",
    "signature":"",
    "code":"test1()",
    "typeFullName":"__builtin.str",
    "columnNumber":10,
    "order":2,
    "methodFullName":":<module>.test1",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"DYNAMIC_DISPATCH",
    "lineNumber":26,
    "id":259,
    "possibleTypes":[

    ],
    "argumentIndex":2
  }
]"""
```

```
cpg.method.filter(node => node.fullName == ":<module>.test1").toJsonPretty
```



```
joern> cpg.method.filter(node => node.fullName == ":<module>.test1").toJsonPretty
val res8: String = """[
  {
    "name":"test1",
    "astParentFullName":"<empty>",
    "fullName":":<module>.test1",
    "signature":"",
    "astParentType":"<empty>",
    "lineNumberEnd":14,
    "_label":"METHOD",
    "offsetEnd":238,
    "columnNumberEnd":0,
    "code":"<empty>",
    "isExternal":false,
    "lineNumber":12,
    "id":199,
    "offset":206,
    "columnNumber":1,
    "order":5,
    "filename":""
  }
]"""
```

```
cpg.method.filter(node => node.fullName == ":<module>.test1").astParent.toJsonPretty
```



```
joern> cpg.method.filter(node => node.fullName == ":<module>.test1").astParent.toJsonPretty
val res6: String = """[
  {
    "name":"<module>",
    "astParentFullName":"<empty>",
    "fullName":":<module>",
    "signature":"",
    "astParentType":"<empty>",
    "lineNumberEnd":50,
    "_label":"METHOD",
    "offsetEnd":788,
    "columnNumberEnd":5,
    "code":"<empty>",
    "isExternal":false,
    "lineNumber":1,
    "id":7,
    "offset":0,
    "columnNumber":1,
    "order":1,
    "filename":""
  }
]"""
```

根据函数定义的父节点的 `_label` 属性是否为 `"METHOD"` 即可判断该函数是否是普通函数。

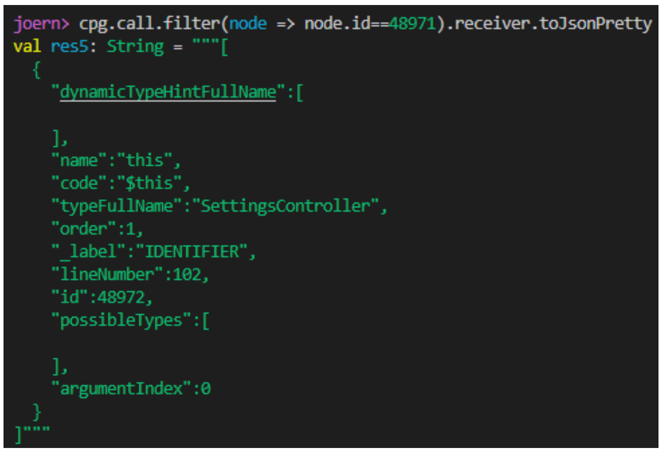
24.查找函数的接收者

源码:

```
$this->render('settings/showsettings'); // "id":48971
$blogContent = getCustomizerPage('aboutus'); // "id":49194
```

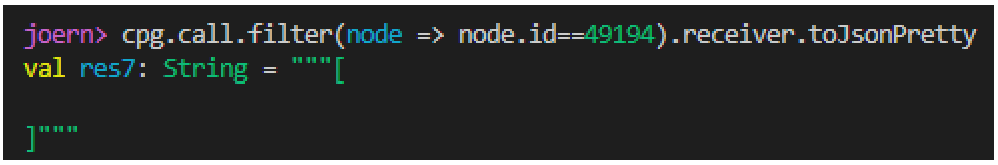
示例:

```
cpg.call.filter(node => node.id==48971).receiver.toJsonPretty
```



```
joern> cpg.call.filter(node => node.id==48971).receiver.toJsonPretty
val res5: String = """[
  {
    "dynamicTypeHintFullName":[

    ],
    "name":"this",
    "code":"$this",
    "typeFullName":"SettingsController",
    "order":1,
    "_label":"IDENTIFIER",
    "lineNumber":102,
    "id":48972,
    "possibleTypes":[

    ],
    "argumentIndex":0
  }
]"""
```

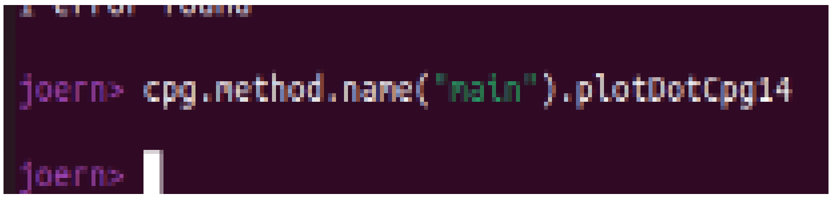
```
cpg.call.filter(node => node.id==49194).receiver.toJsonPretty
```



```
joern> cpg.call.filter(node => node.id==49194).receiver.toJsonPretty
val res7: String = """[

]"""
```

25.绘制CPG

```
cpg.method.name("main").plotDotCpg14
```



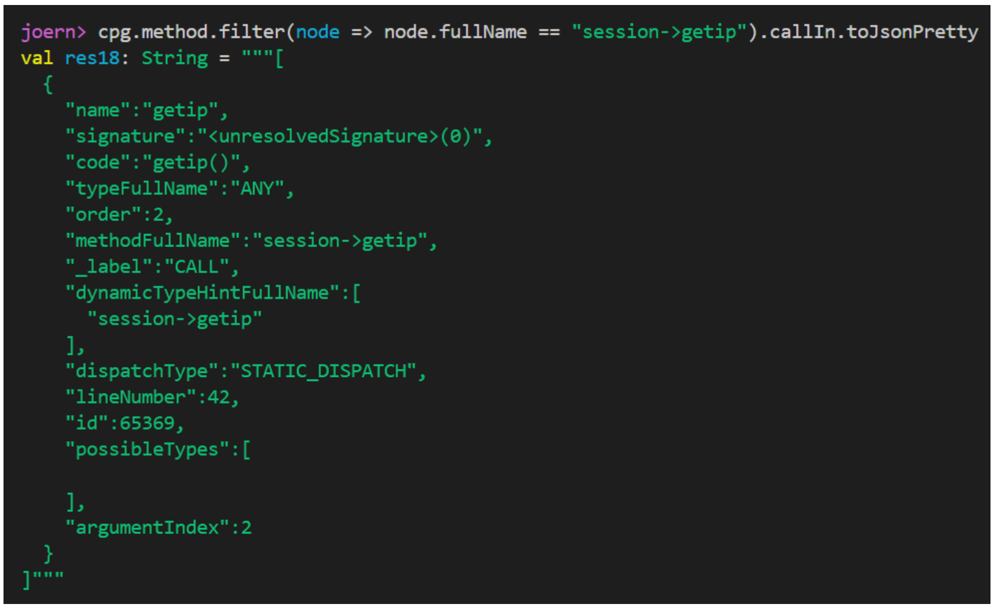
```
joern> cpg.method.name("main").plotDotCpg14

joern>
```

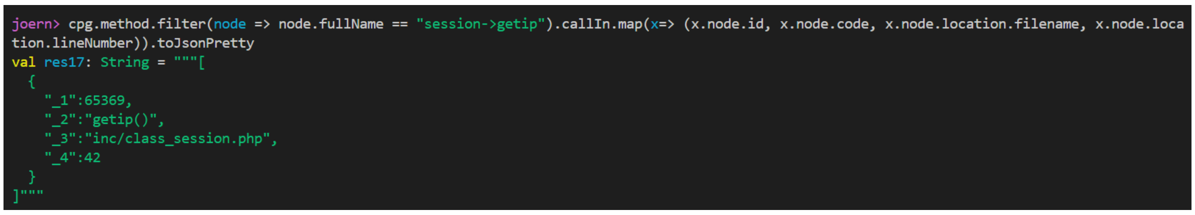
26.scala语言中的与或非

```
# scala中的逻辑或
cpg.call.filter(node => (node.methodFullName == "<operator>.assignmentConcat" || node.methodFullName == 
"<operator>.concat")).toJsonPretty

# 也可以使用一个数组来判断
cpg.call.filter(node => Array("<operator>.assignmentConcat","
<operator>.concat").contains(node.methodFullName)).toJsonPretty

# scala中的逻辑与
cpg.call.filter(node => Array("<operator>.assignmentConcat","
<operator>.concat").contains(node.methodFullName)).filter(node => (node.code.contains("SELECT") && 
node.code.contains("_GET"))).toJsonPretty

# scala中的逻辑非
cpg.call.filter(node => Array("<operator>.assignmentConcat").contains(node.methodFullName)).filter(node 
=> (node.code.contains("<a") && node.code.contains("$") && (!
node.code.contains("$_SESSION")))).toJsonPretty

cpg.call.filter(node => (node.code.contains("$_GET[\"HTTP_CLIENT_IP\"]") ||
node.code.contains("$_POST[\"HTTP_CLIENT_IP\"]") || node.code.contains("$_COOKIE[\"HTTP_CLIENT_IP\"]")
|| node.code.contains("$_SERVER[\"HTTP_CLIENT_IP\"]") ||
node.code.contains("$_REQUEST[\"HTTP_CLIENT_IP\"]") ||
node.code.contains("$_SESSION[\"HTTP_CLIENT_IP\"]") || node.code.contains("$_FILES[\"HTTP_CLIENT_IP\"]")
|| node.code.contains("$_ENV[\"HTTP_CLIENT_IP\"]"))).map(x=> (x.node.id, x.node.code,
x.node.location.filename, x.node.location.lineNumber, x.node.methodFullName)).toJsonPretty

cpg.call.filter(node => ((node.code.contains("echo") || node.code.contains("print")) &&
node.code.contains("$category") && node.location.filename.contains("settings/showsettings"))).map(x=>
(x.node.id, x.node.code, x.node.location.filename, x.node.location.lineNumber,
x.node.methodFullName)).toJsonPretty
```

27.获取函数调用点

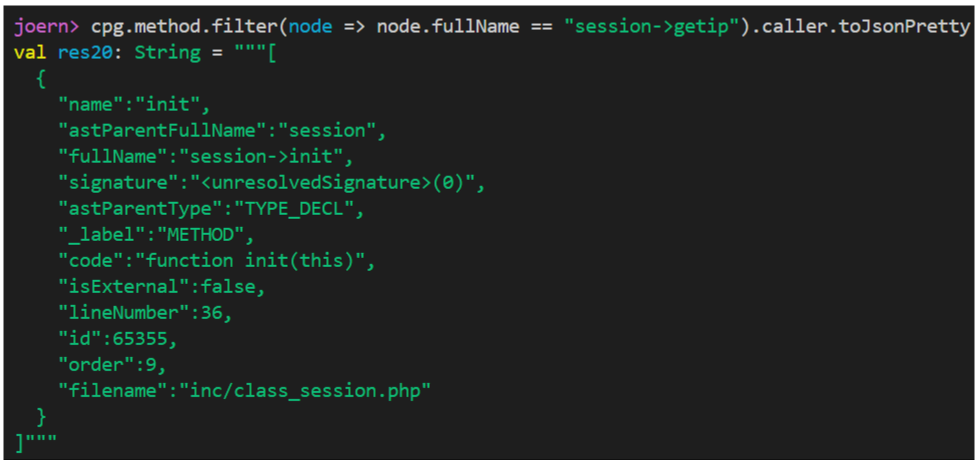
```
cpg.method.filter(node => node.fullName == "session->getip").callIn.toJsonPretty
```


```
joern> cpg.method.filter(node => node.fullName == "session->getip").callIn.toJsonPretty
val res18: String = """[
  {
    "name":"getip",
    "signature":"<unresolvedSignature>(0)",
    "code":"getip()",
    "typeFullName":"ANY",
    "order":2,
    "methodFullName":"session->getip",
    "_label":"CALL",
    "dynamicTypeHintFullName":[
      "session->getip"
    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":42,
    "id":65369,
    "possibleTypes":[

    ],
    "argumentIndex":2
  }
]"""
```


```
joern> cpg.method.filter(node => node.fullName == "session->getip").callIn.map(x=> (x.node.id, x.node.code, x.node.location.filename, x.node.loca
tion.lineNumber)).toJsonPretty
val res17: String = """[
  {
    "_1":65369,
    "_2":"getip()",
    "_3":"inc/class_session.php",
    "_4":42
  }
]"""
```

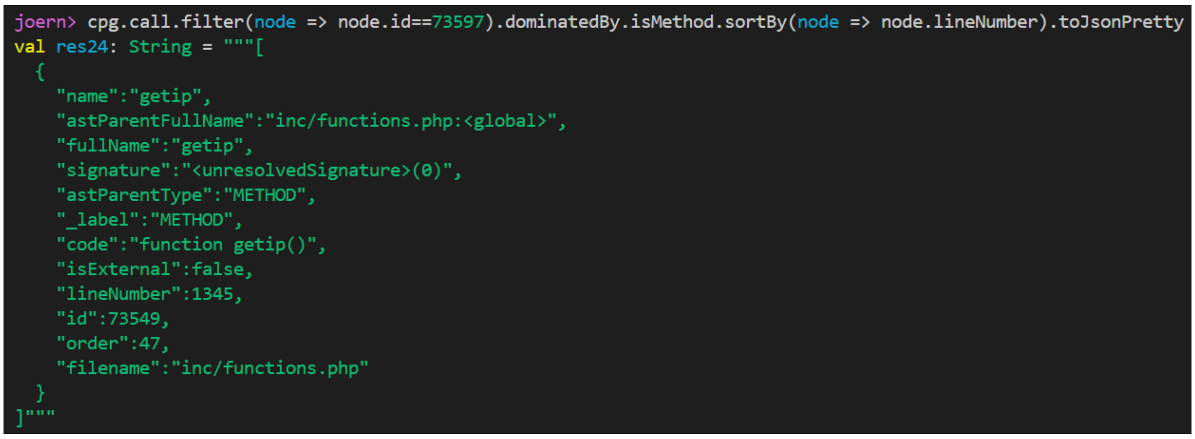
28.获取函数被哪些函数调用

```
cpg.method.filter(node => node.fullName == "session->getip").caller.toJsonPretty
cpg.method.filter(node => node.fullName == "session->init").caller.toJsonPretty
```

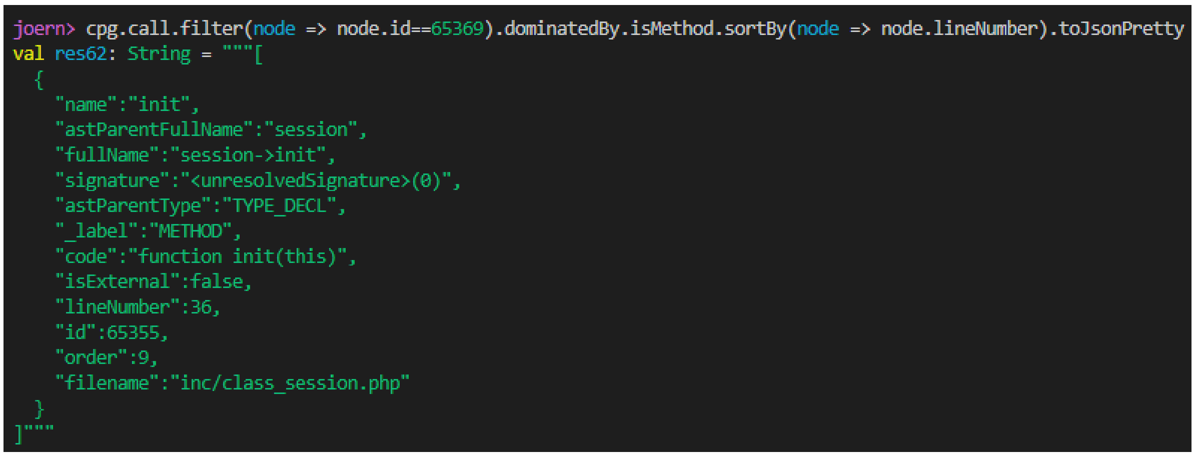

```
joern> cpg.method.filter(node => node.fullName == "session->getip").caller.toJsonPretty
val res20: String = """[
  {
    "name":"init",
    "astParentFullName":"session",
    "fullName":"session->init",
    "signature":"<unresolvedSignature>(0)",
    "astParentType":"TYPE_DECL",
    "_label":"METHOD",
    "code":"function init(this)",
    "isExternal":false,
    "lineNumber":36,
    "id":65355,
    "order":9,
    "filename":"inc/class_session.php"
  }
]"""
```

29.查看一条语句所属的函数定义节点

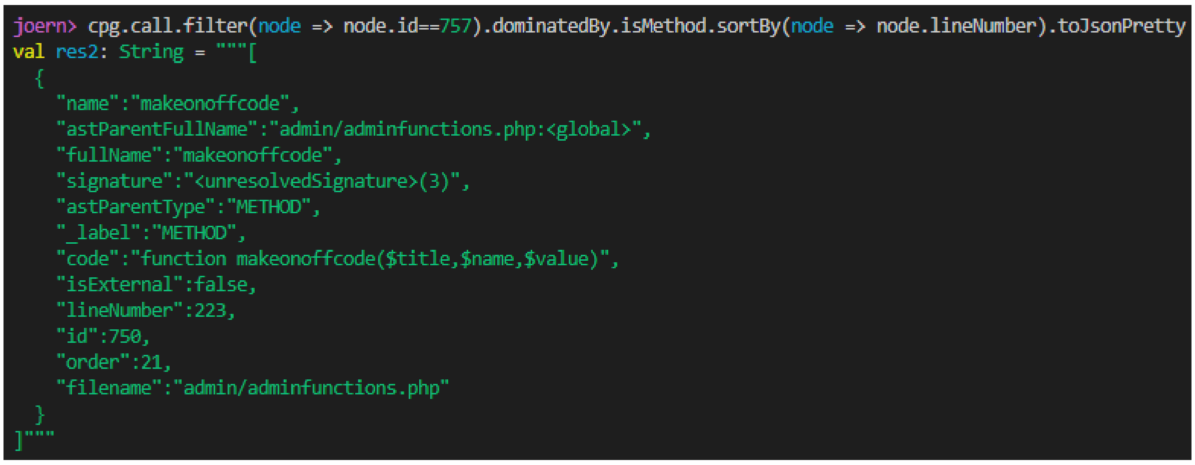
```
cpg.call.filter(node => node.id==73597).dominatedBy.isMethod.sortBy(node =>
node.lineNumber).toJsonPretty
cpg.call.filter(node => node.id==65369).dominatedBy.isMethod.sortBy(node =>
node.lineNumber).toJsonPretty
cpg.call.filter(node => node.id==757).dominatedBy.isMethod.sortBy(node => node.lineNumber).toJsonPretty
cpg.call.filter(node => node.id==263).dominatedBy.isMethod.sortBy(node => node.lineNumber).toJsonPretty
cpg.call.filter(node => node.id==127).dominatedBy.isMethod.sortBy(node => node.lineNumber).toJsonPretty
cpg.call.filter(node => node.id==1121006).dominatedBy.isMethod.sortBy(node =>
node.lineNumber).toJsonPretty
```



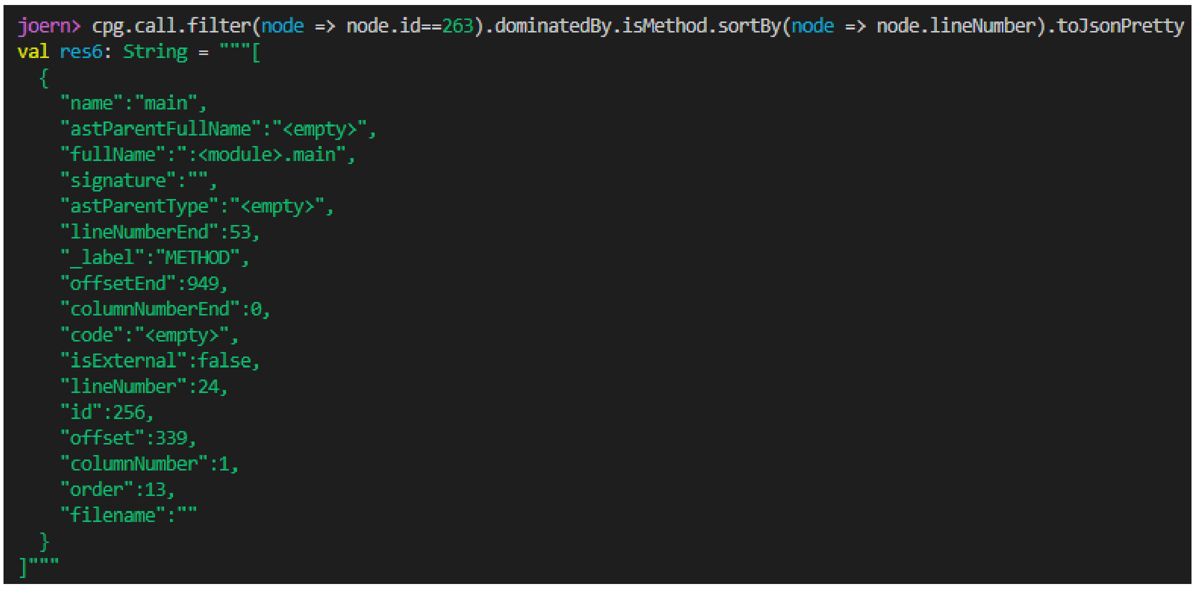
```
joern> cpg.call.filter(node => node.id==73597).dominatedBy.isMethod.sortBy(node => node.lineNumber).toJsonPretty
val res24: String = """[
  {
    "name":"getip",
    "astParentFullName":"inc/functions.php:<global>",
    "fullName":"getip",
    "signature":"<unresolvedSignature>(0)",
    "astParentType":"METHOD",
    "_label":"METHOD",
    "code":"function getip()",
    "isExternal":false,
    "lineNumber":1345,
    "id":73549,
    "order":47,
    "filename":"inc/functions.php"
  }
]"""
```



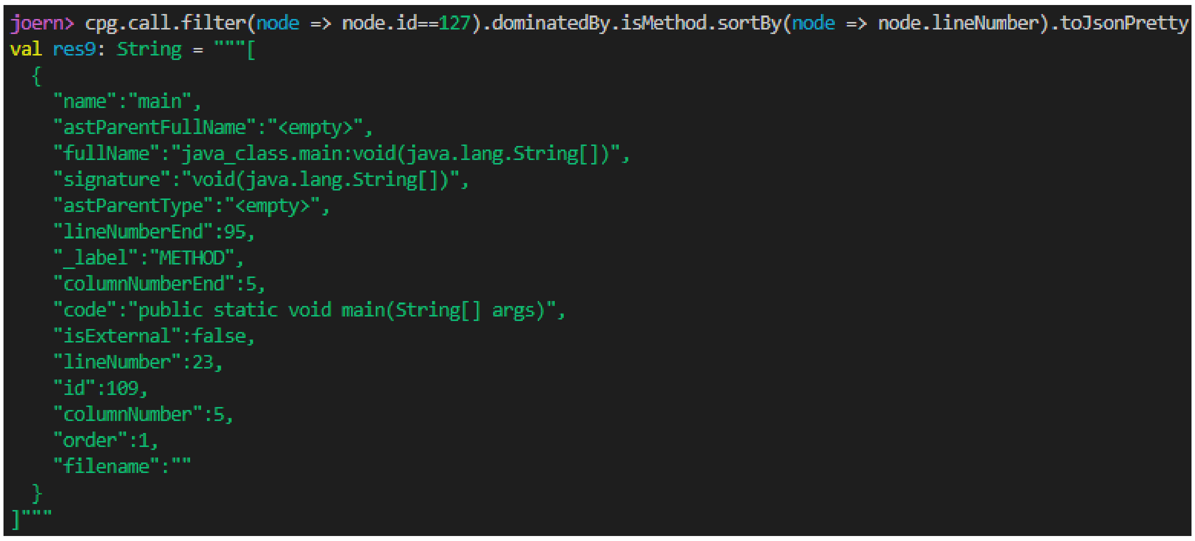
```
joern> cpg.call.filter(node => node.id==65369).dominatedBy.isMethod.sortBy(node => node.lineNumber).toJsonPretty
val res62: String = """[
  {
    "name":"init",
    "astParentFullName":"session",
    "fullName":"session->init",
    "signature":"<unresolvedSignature>(0)",
    "astParentType":"TYPE_DECL",
    "_label":"METHOD",
    "code":"function init(this)",
    "isExternal":false,
    "lineNumber":36,
    "id":65355,
    "order":9,
    "filename":"inc/class_session.php"
  }
]"""
```



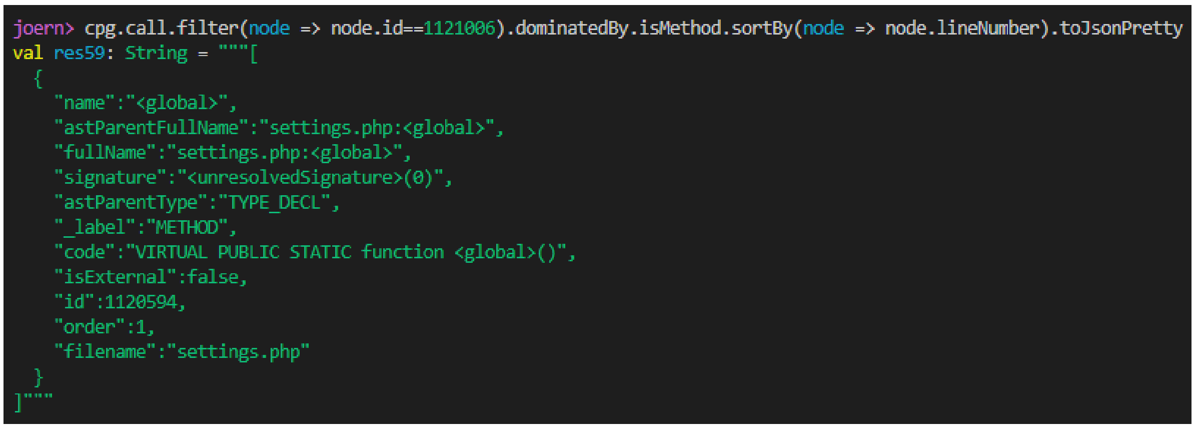
```
joern> cpg.call.filter(node => node.id==757).dominatedBy.isMethod.sortBy(node => node.lineNumber).toJsonPretty
val res2: String = """[
  {
    "name":"makeonoffcode",
    "astParentFullName":"admin/adminfunctions.php:<global>",
    "fullName":"makeonoffcode",
    "signature":"<unresolvedSignature>(3)",
    "astParentType":"METHOD",
    "_label":"METHOD",
    "code":"function makeonoffcode($title,$name,$value)",
    "isExternal":false,
    "lineNumber":223,
    "id":750,
    "order":21,
    "filename":"admin/adminfunctions.php"
  }
]"""
```



```
joern> cpg.call.filter(node => node.id==263).dominatedBy.isMethod.sortBy(node => node.lineNumber).toJsonPretty
val res6: String = """[
  {
    "name":"main",
    "astParentFullName":"<empty>",
    "fullName":":<module>.main",
    "signature":"",
    "astParentType":"<empty>",
    "lineNumberEnd":53,
    "_label":"METHOD",
    "offsetEnd":949,
    "columnNumberEnd":0,
    "code":"<empty>",
    "isExternal":false,
    "lineNumber":24,
    "id":256,
    "offset":339,
    "columnNumber":1,
    "order":13,
    "filename":""
  }
]"""
```



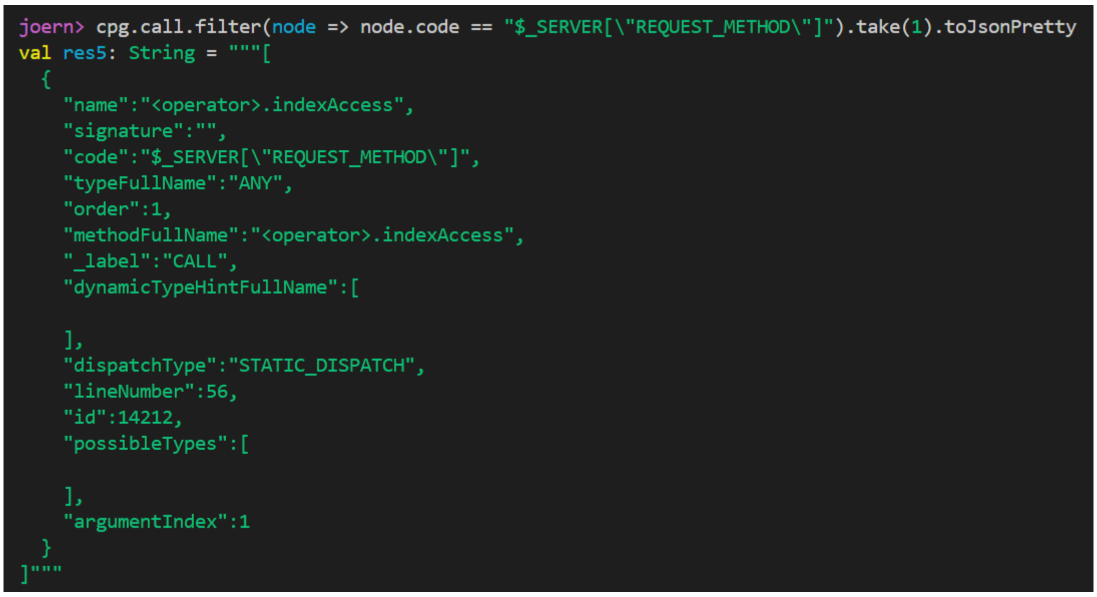
```
joern> cpg.call.filter(node => node.id==127).dominatedBy.isMethod.sortBy(node => node.lineNumber).toJsonPretty
val res9: String = """[
  {
    "name":"main",
    "astParentFullName":"<empty>",
    "fullName":"java_class.main:void(java.lang.String[])",
    "signature":"void(java.lang.String[])",
    "astParentType":"<empty>",
    "lineNumberEnd":95,
    "_label":"METHOD",
    "columnNumberEnd":5,
    "code":"public static void main(String[] args)",
    "isExternal":false,
    "lineNumber":23,
    "id":109,
    "columnNumber":5,
    "order":1,
    "filename":""
  }
]"""
```



```
joern> cpg.call.filter(node => node.id==1121006).dominatedBy.isMethod.sortBy(node => node.lineNumber).toJsonPretty
val res59: String = """[
  {
    "name":"<global>",
    "astParentFullName":"settings.php:<global>",
    "fullName":"settings.php:<global>",
    "signature":"<unresolvedSignature>(0)",
    "astParentType":"TYPE_DECL",
    "_label":"METHOD",
    "code":"VIRTUAL PUBLIC STATIC function <global>()",
    "isExternal":false,
    "id":1120594,
    "order":1,
    "filename":"settings.php"
  }
]"""
```

30.限制查询结果数量（TODO：使用该方法优化joern查询速度）

```
cpg.call.filter(node => node.code == "$_SERVER[\"REQUEST_METHOD\"]").take(1).toJsonPretty
```



```
joern> cpg.call.filter(node => node.code == "$_SERVER[\"REQUEST_METHOD\"]").take(1).toJsonPretty
val res5: String = """[
  {
    "name":"<operator>.indexAccess",
    "signature":"",
    "code":"$_SERVER[\"REQUEST_METHOD\"]",
    "typeFullName":"ANY",
    "order":1,
    "methodFullName":"<operator>.indexAccess",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":56,
    "id":14212,
    "possibleTypes":[

    ],
    "argumentIndex":1
  }
]"""
```

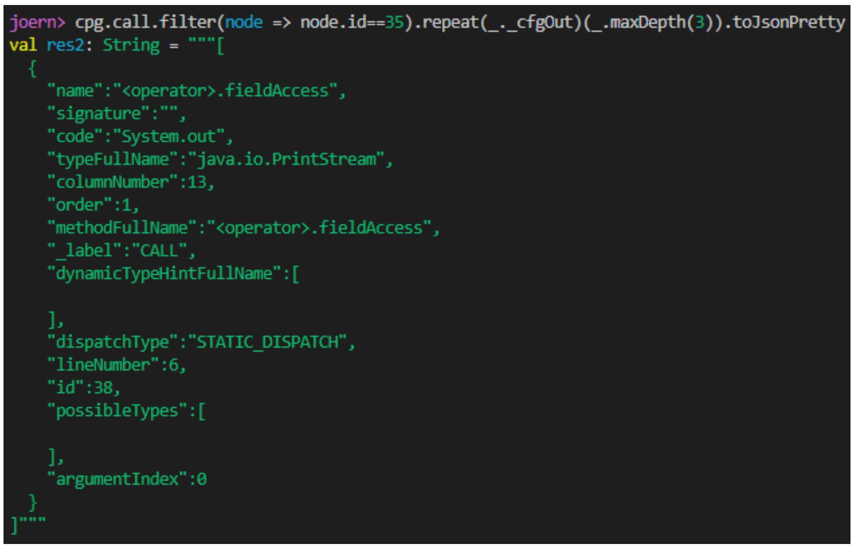
31.重复执行某一操作

源码：

```
for (int i = 0; i < 5; i++) { // "int i = 0": 26, "i < 5": 29, "i++": 32
                a++; // 35
                System.out.println("a1:" + a); // 37
          }
```

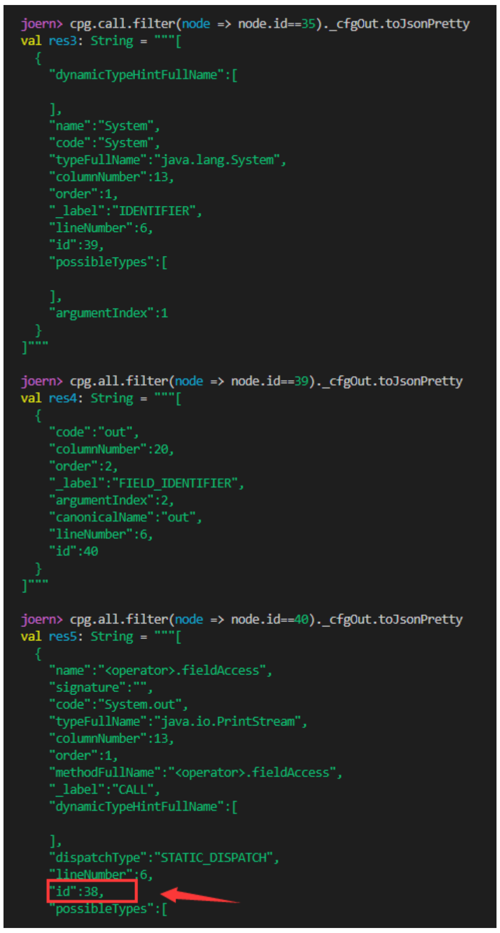
示例一：

```
cpg.call.filter(node => node.id==35).repeat(_._cfgOut)(_.maxDepth(3)).toJsonPretty
```



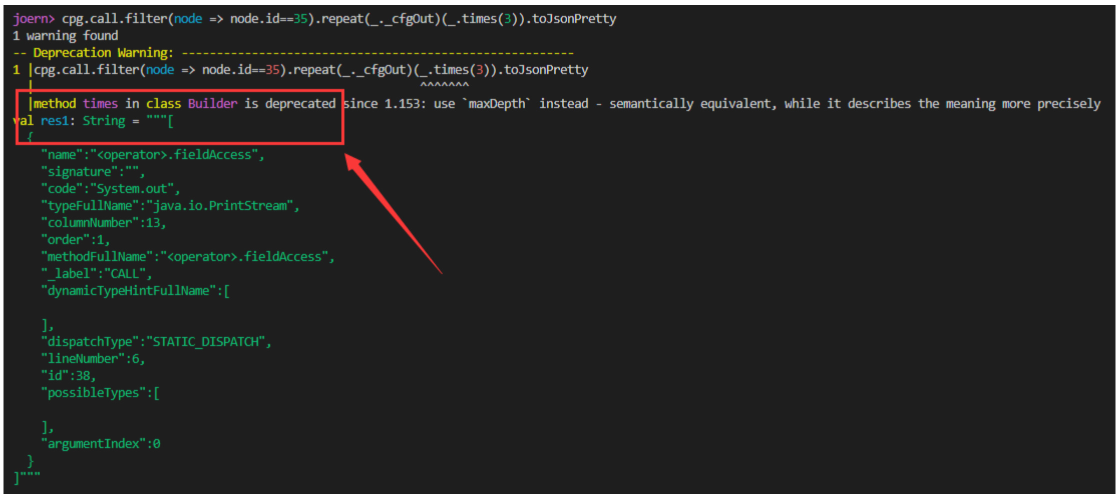
```
joern> cpg.call.filter(node => node.id==35).repeat(_._cfgOut)(_.maxDepth(3)).toJsonPretty
val res2: String = """[
  {
    "name":"<operator>.fieldAccess",
    "signature":"",
    "code":"System.out",
    "typeFullName":"java.io.PrintStream",
    "columnNumber":13,
    "order":1,
    "methodFullName":"<operator>.fieldAccess",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":6,
    "id":38,
    "possibleTypes":[

    ],
    "argumentIndex":0
  }
]"""
```

等价于执行了三次**_cfgOut**方法：



```
joern> cpg.call.filter(node => node.id==35)._cfgOut.toJsonPretty
val res3: String = """[
  {
    "dynamicTypeHintFullName":[

    ],
    "name":"System",
    "code":"System",
    "typeFullName":"java.lang.System",
    "columnNumber":13,
    "order":1,
    "_label":"IDENTIFIER",
    "lineNumber":6,
    "id":39,
    "possibleTypes":[

    ],
    "argumentIndex":1
  }
]"""

joern> cpg.all.filter(node => node.id==39)._cfgOut.toJsonPretty
val res4: String = """[
  {
    "code":"out",
    "columnNumber":20,
    "order":2,
    "_label":"FIELD_IDENTIFIER",
    "argumentIndex":2,
    "canonicalName":"out",
    "lineNumber":6,
    "id":40
  }
]"""

joern> cpg.all.filter(node => node.id==40)._cfgOut.toJsonPretty
val res5: String = """[
  {
    "name":"<operator>.fieldAccess",
    "signature":"",
    "code":"System.out",
    "typeFullName":"java.io.PrintStream",
    "columnNumber":13,
    "order":1,
    "methodFullName":"<operator>.fieldAccess",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":6,
    "id":38,
    "possibleTypes":[
```

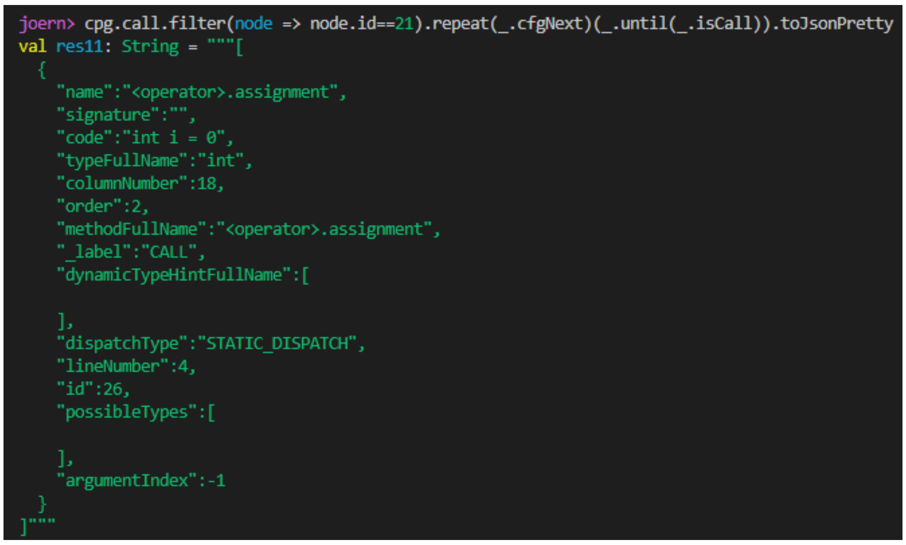
注意：这里不应该使用**times**方法，因为这个方法已经被废弃了



```
joern> cpg.call.filter(node => node.id==35).repeat(_._cfgOut)(_.times(3)).toJsonPretty
1 warning found
-- Deprecation Warning: --------------------------------------------------------
1 |cpg.call.filter(node => node.id==35).repeat(_._cfgOut)(_.times(3)).toJsonPretty
  |                                                        ^^^^^^^
  |method times in class Builder is deprecated since 1.153: use `maxDepth` instead - semantically equivalent, while it describes the meaning more precisely
val res1: String = """[
  {
    "name":"<operator>.fieldAccess",
    "signature":"",
    "code":"System.out",
    "typeFullName":"java.io.PrintStream",
    "columnNumber":13,
    "order":1,
    "methodFullName":"<operator>.fieldAccess",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":6,
    "id":38,
    "possibleTypes":[

    ],
    "argumentIndex":0
  }
]"""
```

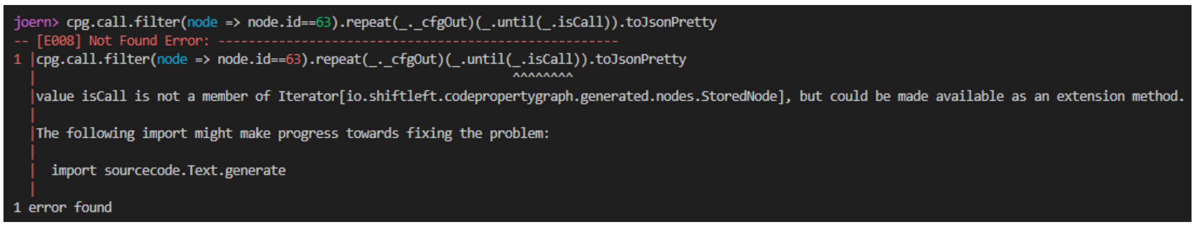
示例二：

```
cpg.call.filter(node => node.id==21).repeat(_.cfgNext)(_.until(_.isCall)).toJsonPretty
```



```
joern> cpg.call.filter(node => node.id==21).repeat(_.cfgNext)(_.until(_.isCall)).toJsonPretty
val res11: String = """[
  {
    "name":"<operator>.assignment",
    "signature":"",
    "code":"int i = 0",
    "typeFullName":"int",
    "columnNumber":18,
    "order":2,
    "methodFullName":"<operator>.assignment",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":4,
    "id":26,
    "possibleTypes":[

    ],
    "argumentIndex":-1
  }
]"""
```

注意：这里不能使用**_cfgOut**方法，原因不清楚。



```
joern> cpg.call.filter(node => node.id==63).repeat(_._cfgOut)(_.until(_.isCall)).toJsonPretty
-- [E008] Not Found Error: ----------------------------------------------------
1 |cpg.call.filter(node => node.id==63).repeat(_._cfgOut)(_.until(_.isCall)).toJsonPretty
  |                                                               ^^^^^^^^
  |value isCall is not a member of Iterator[io.shiftleft.codepropertygraph.generated.nodes.StoredNode], but could be made available as an extension method.
  |
  |The following import might make progress towards fixing the problem:
  |
  |  import sourcecode.Text.generate
  |
1 error found
```

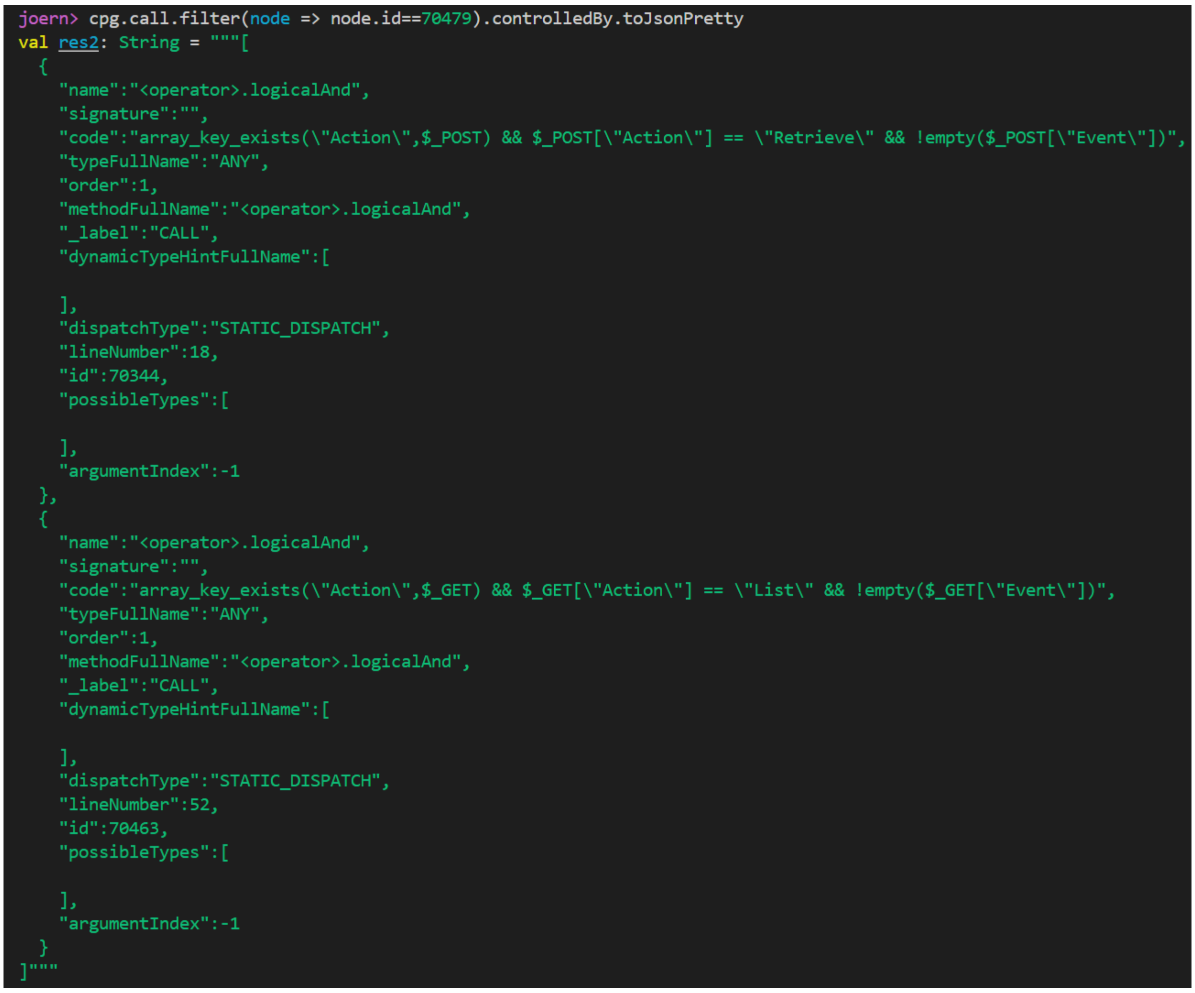
32.查找语句所属控制结构

源码：

```
if (array_key_exists('Action', $_POST) && $_POST['Action'] == 'Retrieve' && !empty($_POST['Event'])) {
    ......
} elseif (array_key_exists('Action', $_GET) && $_GET['Action'] == 'List' && !empty($_GET['Event'])) {
      $sSQL = 'SELECT * FROM events_event WHERE event_type = '.$_GET['Event'].' ORDER BY event_start';
// 70479
      $sPageTitle = gettext('All Events of Type').': '.$_GET['Type'];
} else {
      $sSQL = 'SELECT * FROM events_event ORDER BY event_start';
}
```

示例一：

```
cpg.call.filter(node => node.id==70479).controlledBy.toJsonPretty
```



```
joern> cpg.call.filter(node => node.id==70479).controlledBy.toJsonPretty
val res2: String = """[
  {
    "name":"<operator>.logicalAnd",
    "signature":"",
    "code":"array_key_exists(\"Action\",$_POST) && $_POST[\"Action\"] == \"Retrieve\" && !empty($_POST[\"Event\"])",
    "typeFullName":"ANY",
    "order":1,
    "methodFullName":"<operator>.logicalAnd",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":18,
    "id":70344,
    "possibleTypes":[

    ],
    "argumentIndex":-1
  },
  {
    "name":"<operator>.logicalAnd",
    "signature":"",
    "code":"array_key_exists(\"Action\",$_GET) && $_GET[\"Action\"] == \"List\" && !empty($_GET[\"Event\"])",
    "typeFullName":"ANY",
    "order":1,
    "methodFullName":"<operator>.logicalAnd",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":52,
    "id":70463,
    "possibleTypes":[

    ],
    "argumentIndex":-1
  }
]"""
```

33.如何判断语句处于控制结构的哪一分支?

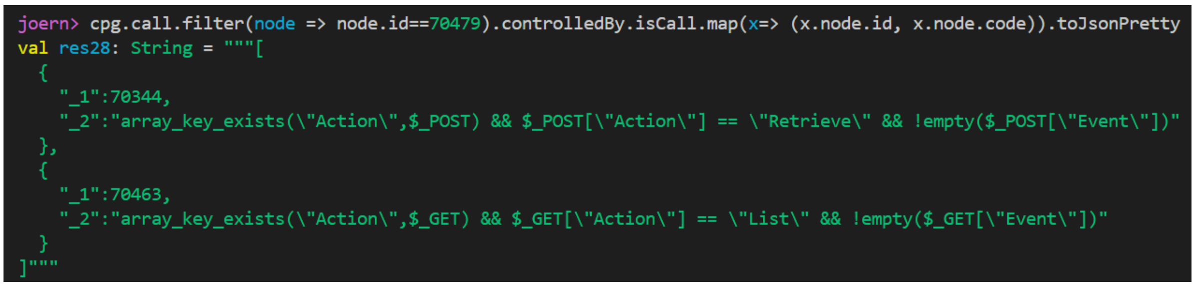
对于处于控制结构之下的一条语句，例如**IF**控制结构，这条语句可能处于**True/False**分支，为了探索该语句所处的具体分支，可以采用如下语句：

源码：

```
if (array_key_exists('Action', $_POST) && $_POST['Action'] == 'Retrieve' && !empty($_POST['Event'])) {
    ......
} elseif (array_key_exists('Action', $_GET) && $_GET['Action'] == 'List' && !empty($_GET['Event'])) {
      $sSQL = 'SELECT * FROM events_event WHERE event_type = '.$_GET['Event'].' ORDER BY event_start';
// 70479
      $sPageTitle = gettext('All Events of Type').': '.$_GET['Type'];
} else {
      $sSQL = 'SELECT * FROM events_event ORDER BY event_start';
}
```

（1）首先需要找到这一条语句所属的控制结构语句

```
cpg.call.filter(node => node.id==70479).controlledBy.isCall.map(x=> (x.node.id,
x.node.code)).toJsonPretty
cpg.call.filter(node => node.id==70479).controlledBy.isCall.map(x=> (x.node.id,
x.node.code)).toJsonPretty
```

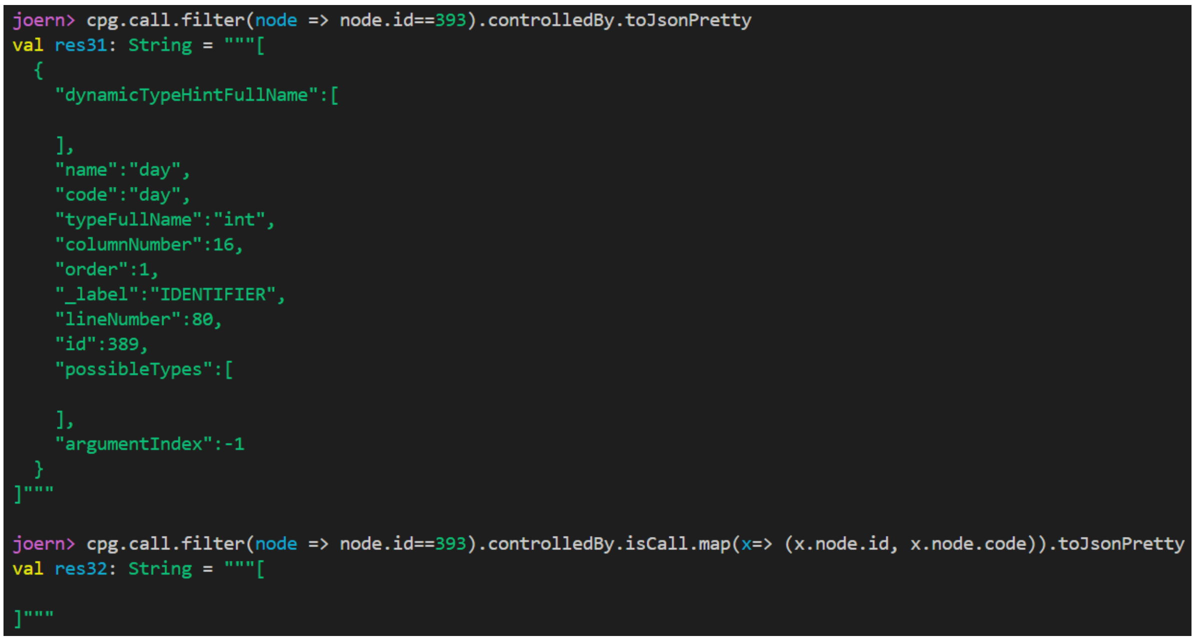


```
joern> cpg.call.filter(node => node.id==70479).controlledBy.isCall.map(x=> (x.node.id, x.node.code)).toJsonPretty
val res28: String = """[
  {
    "_1":70344,
    "_2":"array_key_exists(\"Action\",$_POST) && $_POST[\"Action\"] == \"Retrieve\" && !empty($_POST[\"Event\"])"
  },
  {
    "_1":70463,
    "_2":"array_key_exists(\"Action\",$_GET) && $_GET[\"Action\"] == \"List\" && !empty($_GET[\"Event\"])"
  }
]"""
```

注意：调用isCall方法的目的在于可以调用map方法，但是如果要采用这种方法，控制结构的条件必须是一个Call语句。在下面这个例子中，就不应该采用此方法。

源码：

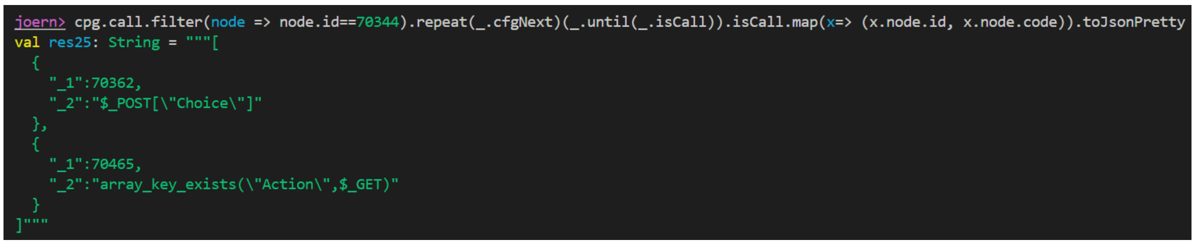
```
switch(day) { // day:350 switch: 349
      case 1: //
            System.out.println("Monday"); // 393
            break; //
      case 2: //
            System.out.println("Tuesday"); // 401
            break; //
      case 3: //
            System.out.println("Wednesday"); // 409
            break; //
      default: //
            System.out.println("Invalid day"); // 416
}
```



```
joern> cpg.call.filter(node => node.id==393).controlledBy.toJsonPretty
val res31: String = """[
  {
    "dynamicTypeHintFullName":[

    ],
    "name":"day",
    "code":"day",
    "typeFullName":"int",
    "columnNumber":16,
    "order":1,
    "_label":"IDENTIFIER",
    "lineNumber":80,
    "id":389,
    "possibleTypes":[

    ],
    "argumentIndex":-1
  }
]"""

joern> cpg.call.filter(node => node.id==393).controlledBy.isCall.map(x=> (x.node.id, x.node.code)).toJsonPretty
val res32: String = """[

]"""
```

（2）找到控制结构语句的子分支语句

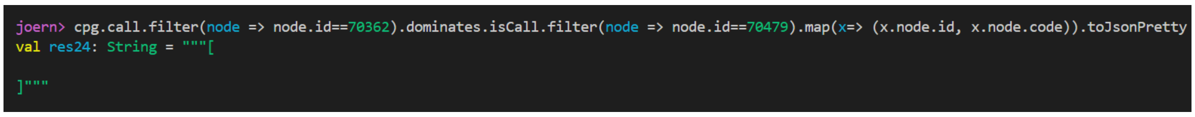
```
cpg.call.filter(node => node.id==70344).repeat(_.cfgNext)(_.until(_.isCall)).toJsonPretty
cpg.call.filter(node => node.id==70344).repeat(_.cfgNext)(_.until(_.isCall)).isCall.map(x=> (x.node.id,
x.node.code)).toJsonPretty
cpg.call.filter(node => node.id==70482).repeat(_.cfgNext)(_.until(_.isCall)).isCall.map(x=> (x.node.id,
x.node.code)).toJsonPretty
```



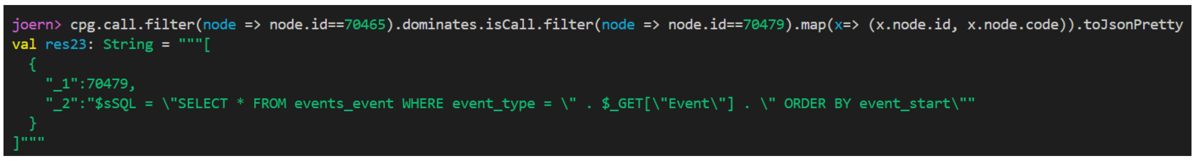
```
joern> cpg.call.filter(node => node.id==70344).repeat(_.cfgNext)(_.until(_.isCall)).isCall.map(x=> (x.node.id, x.node.code)).toJsonPretty
val res25: String = """[
  {
    "_1":70362,
    "_2":"$_POST[\"Choice\"]"
  },
  {
    "_1":70465,
    "_2":"array_key_exists(\"Action\",$_GET)"
  }
]"""
```

（3）检查两个分支子语句所主导的语句中有没有目标语句

```
// 检查True分支
cpg.call.filter(node => node.id==70362).dominates.filter(node => node.id==70479).toJsonPretty
cpg.call.filter(node => node.id==70362).dominates.isCall.filter(node => node.id==70479).map(x=>
(x.node.id, x.node.code)).toJsonPretty
// 检查False分支
cpg.call.filter(node => node.id==70465).dominates.filter(node => node.id==70479).toJsonPretty
cpg.call.filter(node => node.id==70465).dominates.isCall.filter(node => node.id==70479).map(x=>
(x.node.id, x.node.code)).toJsonPretty
```



```
joern> cpg.call.filter(node => node.id==70362).dominates.isCall.filter(node => node.id==70479).map(x=> (x.node.id, x.node.code)).toJsonPretty
val res24: String = """[

]"""
```



```
joern> cpg.call.filter(node => node.id==70465).dominates.isCall.filter(node => node.id==70479).map(x=> (x.node.id, x.node.code)).toJsonPretty
val res23: String = """[
  {
    "_1":70479,
    "_2":"$sSQL = \"SELECT * FROM events_event WHERE event_type = \" . $_GET[\"Event\"] . \" ORDER BY event_start\""
  }
]"""
```

（4）根据是否有结果生成，就可以判断是否位于对应分支中

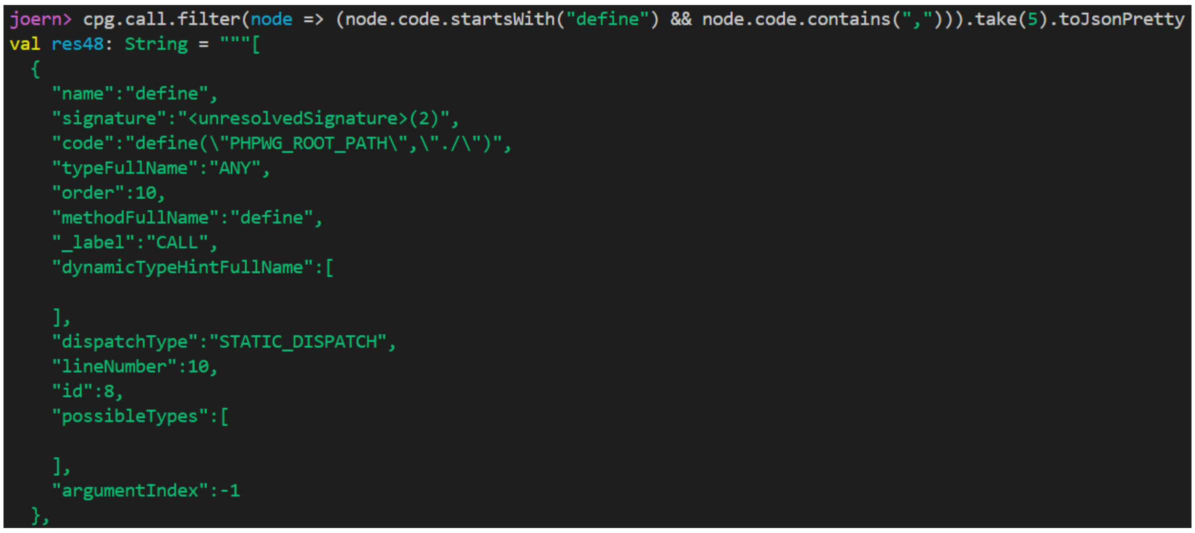
34.查询代码以特殊字符开头的CPG节点

以查找define语句为例，源码

```
define("IN_WS",true);
```

查询语句（比起使用contains查询，这样能够节省后续所需的处理）：

```
cpg.call.filter(node => (node.code.startsWith("define") && node.code.contains(","))).toJsonPretty
```



```
joern> cpg.call.filter(node => (node.code.startsWith("define") && node.code.contains(","))).take(5).toJsonPretty
val res48: String = """[
  {
    "name":"define",
    "signature":"<unresolvedSignature>(2)",
    "code":"define(\"PHPWG_ROOT_PATH\",\"./\")",
    "typeFullName":"ANY",
    "order":10,
    "methodFullName":"define",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":10,
    "id":8,
    "possibleTypes":[

    ],
    "argumentIndex":-1
  },
```

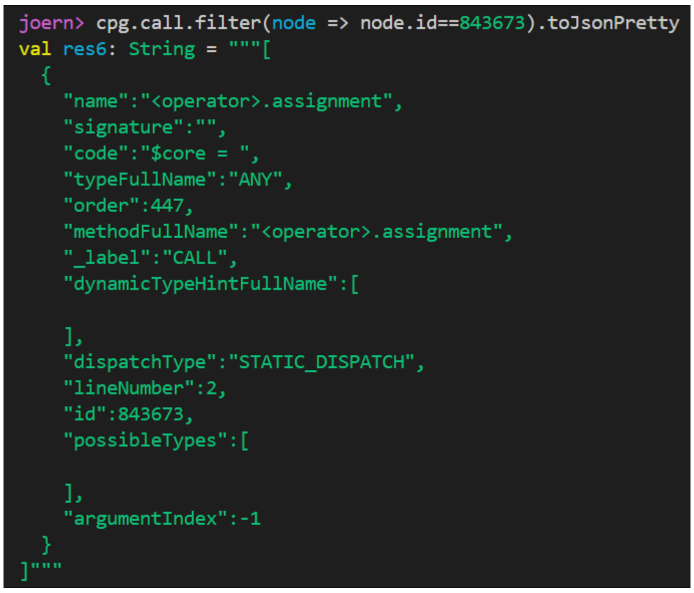
35.Joern解析PHP时存在的问题

（1）处理array问题

Joern对array处理时会发生很多混乱的问题，例如在处理**piwigo/tools/triggers_list.php**时，`$core = array(...` 中含有许多的array操作，Joern将它们错误识别为了赋值语句的target和source，最终生成的赋值语句的左值、右值都有1247个。

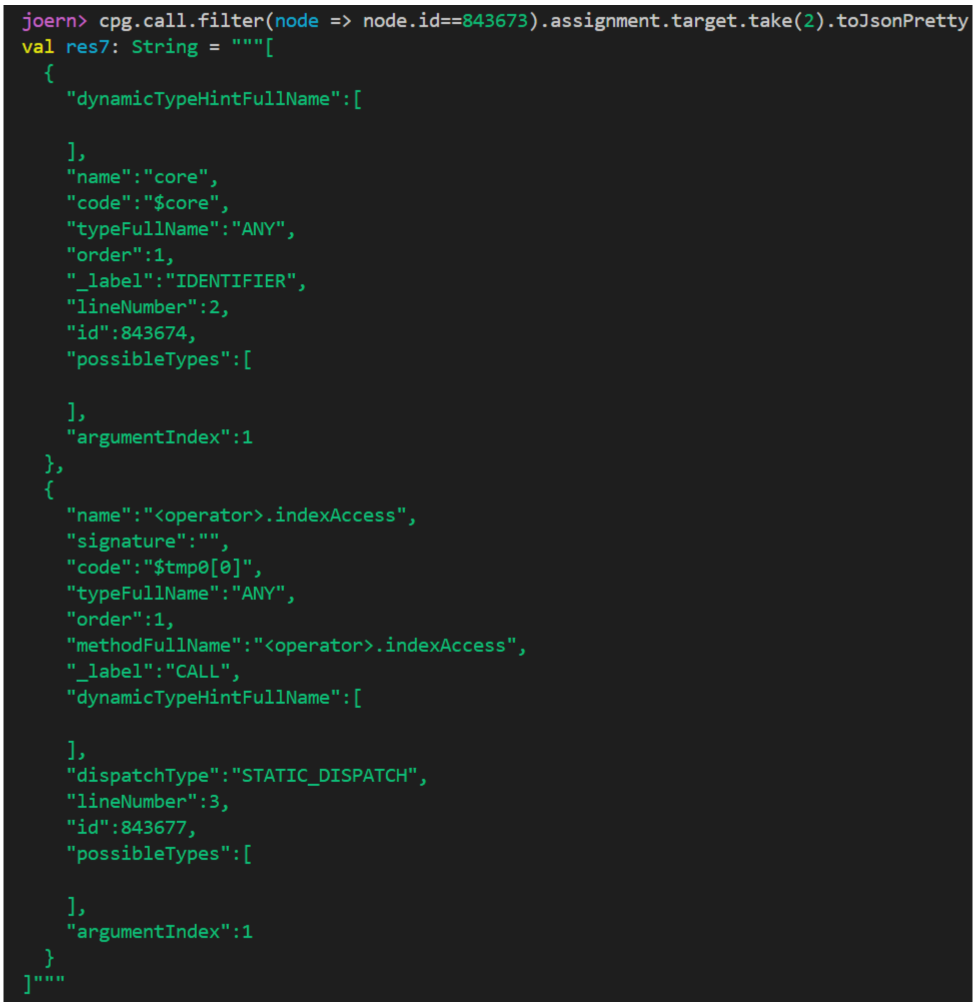
```
<?php
$core = array(
array(
   'name' => 'allow_increment_element_hit_count',
   'type' => 'trigger_change',
   'vars' => array('bool', 'content_not_set'),
   'files' => array('picture.php'),
),
array(
   'name' => 'batch_manager_perform_filters',
   'type' => 'trigger_change',
   'vars' => array('array', 'filter_sets', 'array', 'bulk_manager_filter'),
   'files' => array('admin\batch_manager.php'),
   'infos' => 'New in 2.7',
),...
```

```
cpg.call.filter(node => node.id==843673).toJsonPretty
```



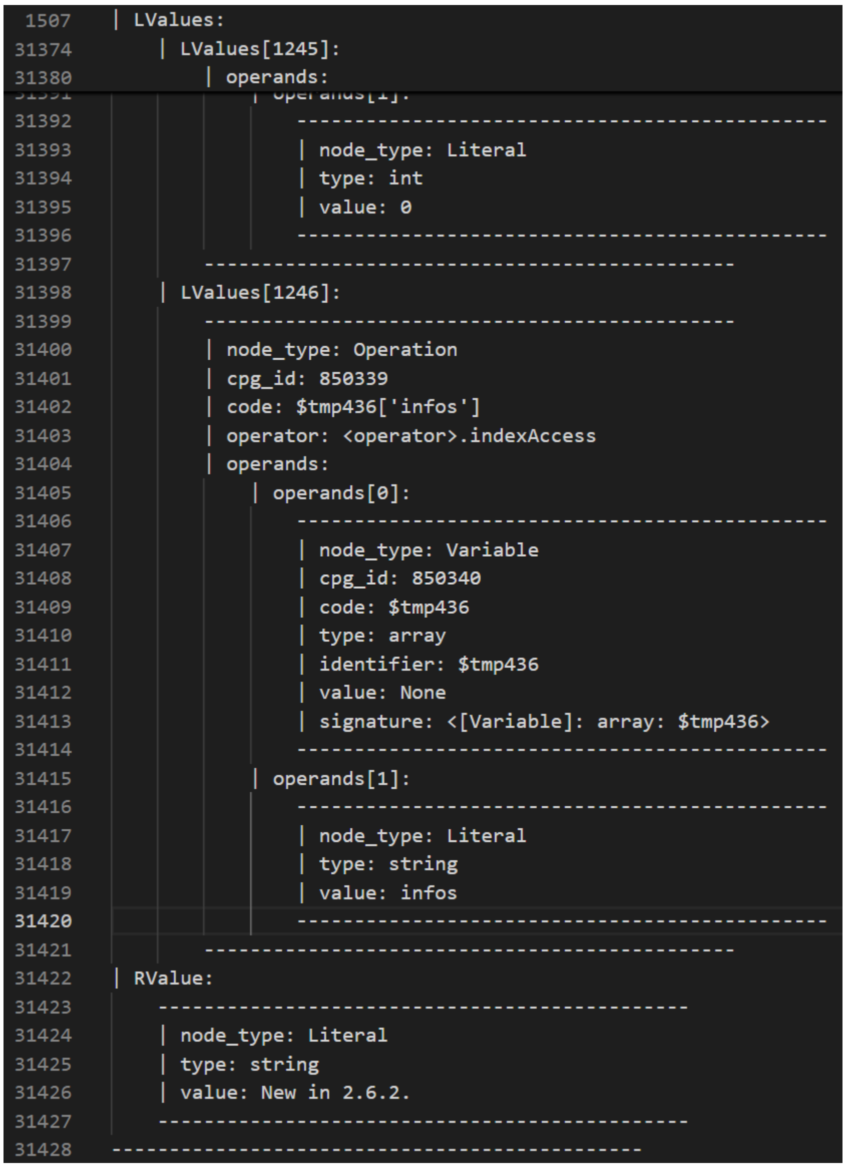
```
joern> cpg.call.filter(node => node.id==843673).toJsonPretty
val res6: String = """[
  {
    "name":"<operator>.assignment",
    "signature":"",
    "code":"$core = ",
    "typeFullName":"ANY",
    "order":447,
    "methodFullName":"<operator>.assignment",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":2,
    "id":843673,
    "possibleTypes":[

    ],
    "argumentIndex":-1
  }
]"""
```

```
cpg.call.filter(node => node.id==843673).assignment.target.take(2).toJsonPretty
```



```
joern> cpg.call.filter(node => node.id==843673).assignment.target.take(2).toJsonPretty
val res7: String = """[
  {
    "dynamicTypeHintFullName":[

    ],
    "name":"core",
    "code":"$core",
    "typeFullName":"ANY",
    "order":1,
    "_label":"IDENTIFIER",
    "lineNumber":2,
    "id":843674,
    "possibleTypes":[

    ],
    "argumentIndex":1
  },
  {
    "name":"<operator>.indexAccess",
    "signature":"",
    "code":"$tmp0[0]",
    "typeFullName":"ANY",
    "order":1,
    "methodFullName":"<operator>.indexAccess",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":3,
    "id":843677,
    "possibleTypes":[

    ],
    "argumentIndex":1
  }
]"""
```

日志文件中保存的此赋值语句的String：



```
| LValues:
    | LValues[1245]:
        | operands:
            | operands[1]:
                ----------------------------------------------
                | node_type: Literal
                | type: int
                | value: 0
                ----------------------------------------------
        ----------------------------------------------
    | LValues[1246]:
        ----------------------------------------------
        | node_type: Operation
        | cpg_id: 850339
        | code: $tmp436['infos']
        | operator: <operator>.indexAccess
        | operands:
            | operands[0]:
                ----------------------------------------------
                | node_type: Variable
                | cpg_id: 850340
                | code: $tmp436
                | type: array
                | identifier: $tmp436
                | value: None
                | signature: <[Variable]: array: $tmp436>
                ----------------------------------------------
            | operands[1]:
                ----------------------------------------------
                | node_type: Literal
                | type: string
                | value: infos
                ----------------------------------------------
        ----------------------------------------------
| RValue:
    ----------------------------------------------
    | node_type: Literal
    | type: string
    | value: New in 2.6.2.
    ----------------------------------------------
----------------------------------------------
```

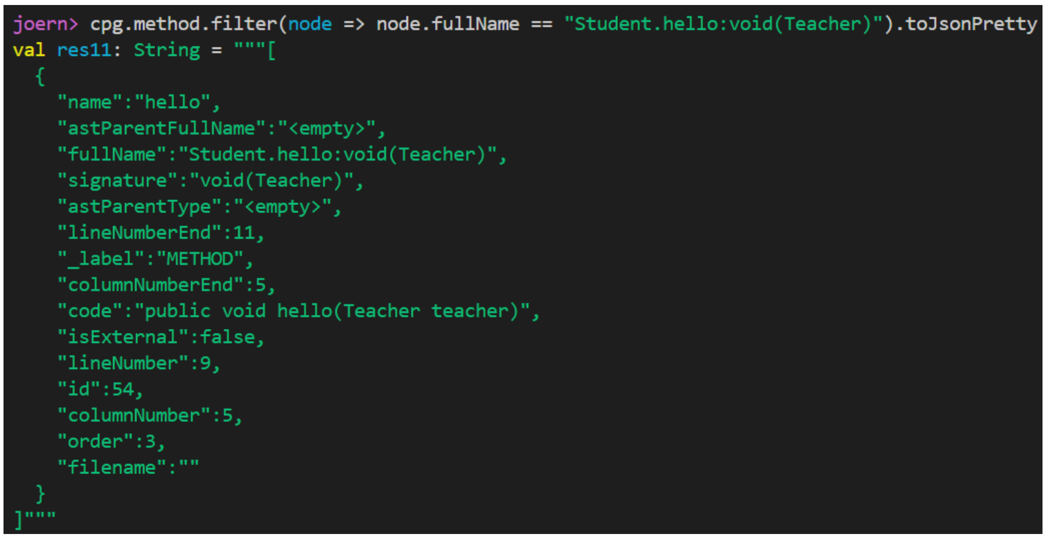
（2）两种filter语句存在差异

源码：

```
class Student {
      String name;
      int age;

      public void hello(Teacher teacher) {
            System.out.println("Hello! teacher " + teacher.name);
      }

      public void hello(Student student) {
            System.out.println("Hello! student " + student.name);
      }
}
```

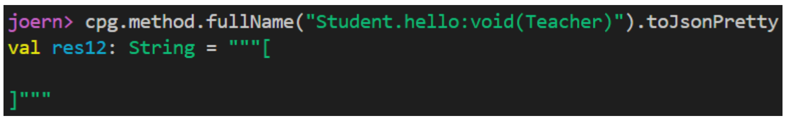
示例一：

```
cpg.method.filter(node => node.fullName == "Student.hello:void(Teacher)").toJsonPretty
```


```
joern> cpg.method.filter(node => node.fullName == "Student.hello:void(Teacher)").toJsonPretty
val res11: String = """[
  {
    "name":"hello",
    "astParentFullName":"<empty>",
    "fullName":"Student.hello:void(Teacher)",
    "signature":"void(Teacher)",
    "astParentType":"<empty>",
    "lineNumberEnd":11,
    "_label":"METHOD",
    "columnNumberEnd":5,
    "code":"public void hello(Teacher teacher)",
    "isExternal":false,
    "lineNumber":9,
    "id":54,
    "columnNumber":5,
    "order":3,
    "filename":""
  }
]"""
```

示例二：

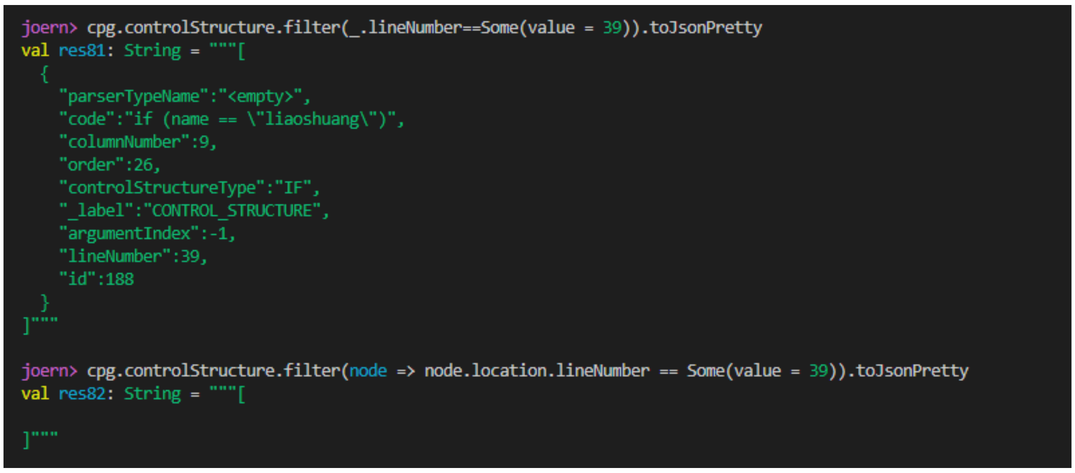
```
cpg.method.fullName("Student.hello:void(Teacher)").toJsonPretty
```


```
joern> cpg.method.fullName("Student.hello:void(Teacher)").toJsonPretty
val res12: String = """[

]"""
```

为什么两条语句执行有不同的结果？

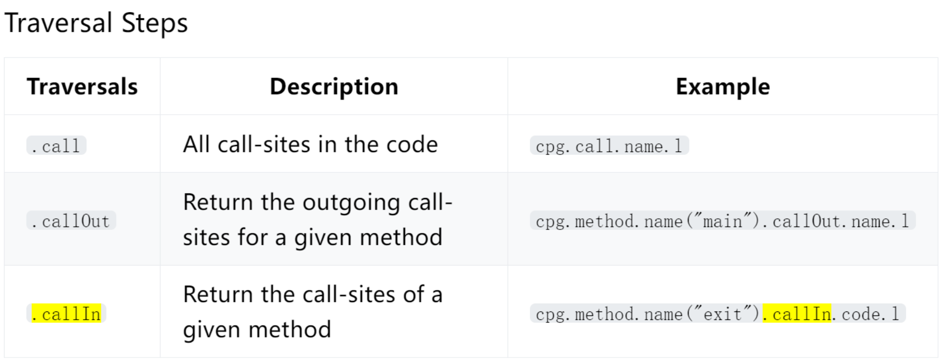
下面这两条语句执行也有区别

```
cpg.controlStructure.filter(_.lineNumber==Some(value = 39)).toJsonPretty
cpg.controlStructure.filter(node => node.location.lineNumber == Some(value = 39)).toJsonPretty
```


```
joern> cpg.controlStructure.filter(_.lineNumber==Some(value = 39)).toJsonPretty
val res81: String = """[
  {
    "parserTypeName":"<empty>",
    "code":"if (name == \"liaoshuang\")",
    "columnNumber":9,
    "order":26,
    "controlStructureType":"IF",
    "_label":"CONTROL_STRUCTURE",
    "argumentIndex":-1,
    "lineNumber":39,
    "id":188
  }
]"""

joern> cpg.controlStructure.filter(node => node.location.lineNumber == Some(value = 39)).toJsonPretty
val res82: String = """[

]"""
```

（3）函数调用点获取失败

在**Joern**的官方文档中给出了**callIn**这个方法：

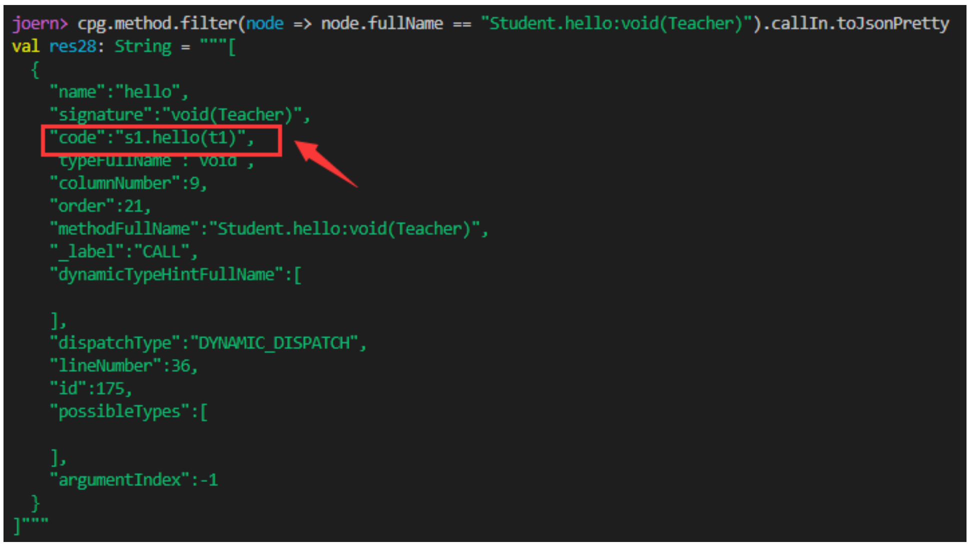

Traversal Steps

Traversals	Description	Example
`.call`	All call-sites in the code	`cpg.call.name.l`
`.callOut`	Return the outgoing call-sites for a given method	`cpg.method.name("main").callOut.name.l`
`.callIn`	Return the call-sites of a given method	`cpg.method.name("exit").callIn.code.l`

在一些简短的代码中测试发现，这个方法可以用来找到函数的调用点。

示例一：

```
cpg.method.filter(node => node.fullName == "Student.hello:void(Teacher)").callIn.toJsonPretty
```

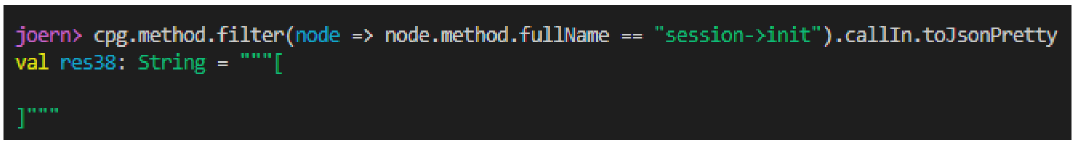


```
joern> cpg.method.filter(node => node.fullName == "Student.hello:void(Teacher)").callIn.toJsonPretty
val res28: String = """[
  {
    "name":"hello",
    "signature":"void(Teacher)",
    "code":"s1.hello(t1)",
    "typeFullName":"void",
    "columnNumber":9,
    "order":21,
    "methodFullName":"Student.hello:void(Teacher)",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"DYNAMIC_DISPATCH",
    "lineNumber":36,
    "id":175,
    "possibleTypes":[

    ],
    "argumentIndex":-1
  }
]"""
```

但是在不同文件中存在函数调用时，使用**callIn**方法就行不通了，例如CVE-2007-1963。

示例二：

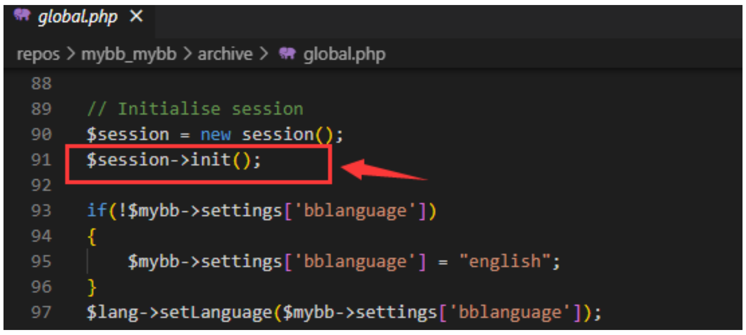
```
cpg.method.filter(node => node.method.fullName == "session->init").callIn.toJsonPretty
```



```
joern> cpg.method.filter(node => node.method.fullName == "session->init").callIn.toJsonPretty
val res38: String = """[

]"""
```

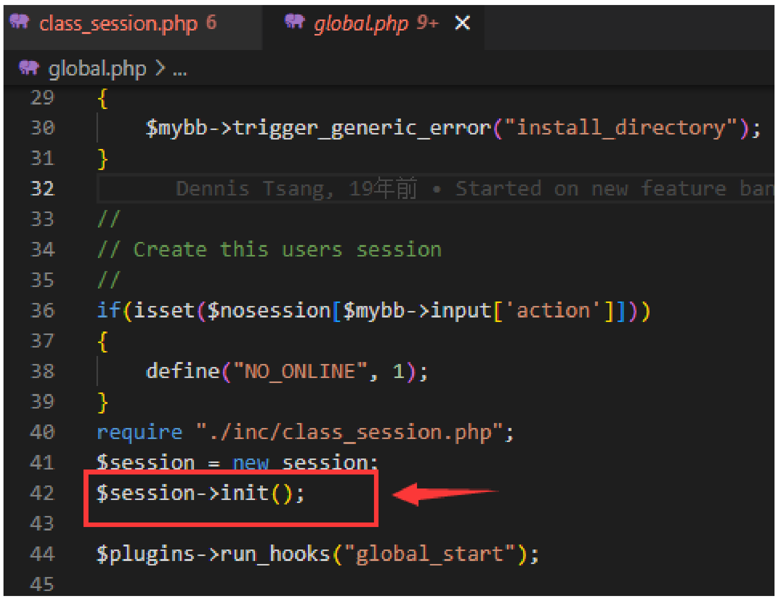
这个函数是存在调用点的，例如：

（1）archive/global.php

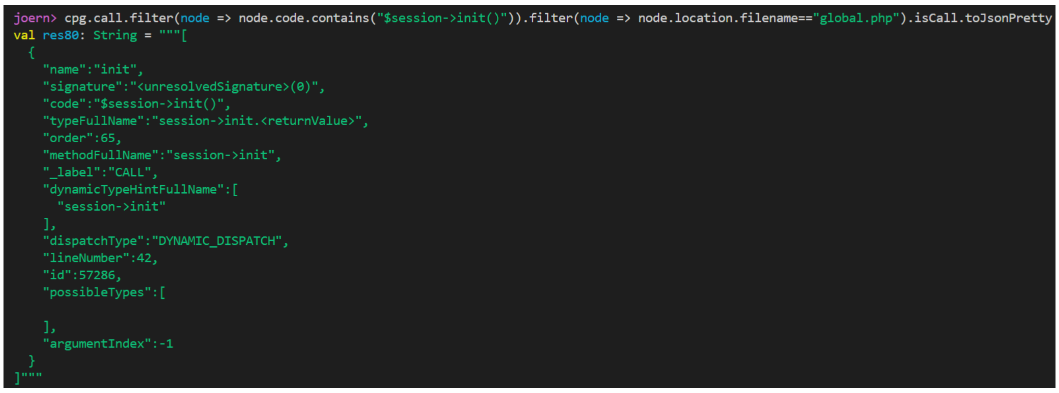


```

// Initialise session
$session = new session();
$session->init();

if(!$mybb->settings['bblanguage'])
{
    $mybb->settings['bblanguage'] = "english";
}
$lang->setLanguage($mybb->settings['bblanguage']);
```

（2）global.php



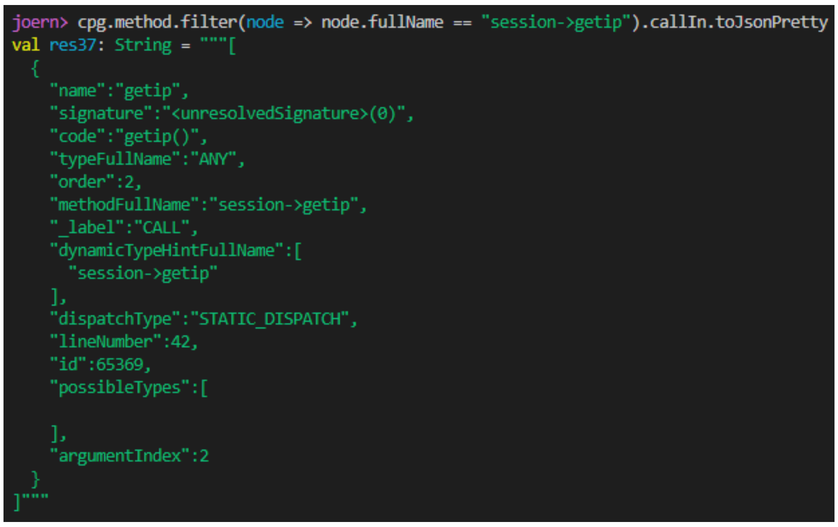
```php
{
    $mybb->trigger_generic_error("install_directory");
}

//
// Create this users session
//
if(isset($nosession[$mybb->input['action']]))
{
    define("NO_ONLINE", 1);
}
require "./inc/class_session.php";
$session = new session;
$session->init();

$plugins->run_hooks("global_start");
```



```
joern> cpg.call.filter(node => node.code.contains("$session->init()")).filter(node => node.location.filename=="global.php").isCall.toJsonPretty
val res80: String = """[
  {
    "name":"init",
    "signature":"<unresolvedSignature>(0)",
    "code":"$session->init()",
    "typeFullName":"session->init.<returnValue>",
    "order":65,
    "methodFullName":"session->init",
    "_label":"CALL",
    "dynamicTypeHintFullName":[
      "session->init"
    ],
    "dispatchType":"DYNAMIC_DISPATCH",
    "lineNumber":42,
    "id":57286,
    "possibleTypes":[

    ],
    "argumentIndex":-1
  }
]"""
```

一些函数是能够找到其函数调用点的，例如CVE-2007-1963中的 `session->getip()` 函数示例三：

```
cpg.method.filter(node => node.fullName == "session->getip").callIn.toJsonPretty
```

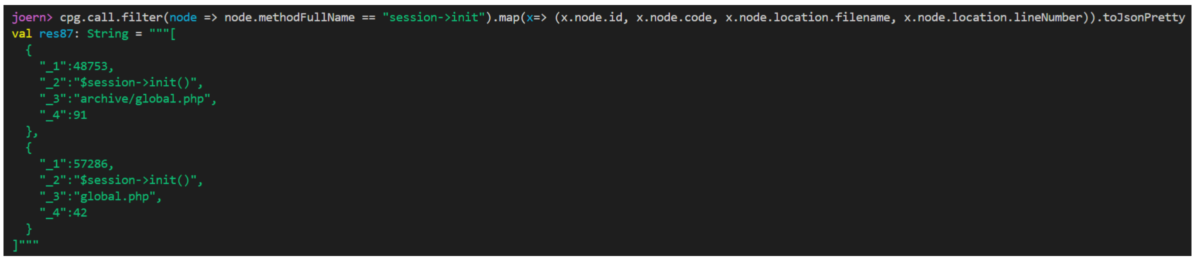


```
joern> cpg.method.filter(node => node.fullName == "session->getip").callIn.toJsonPretty
val res37: String = """[
  {
    "name":"getip",
    "signature":"<unresolvedSignature>(0)",
    "code":"getip()",
    "typeFullName":"ANY",
    "order":2,
    "methodFullName":"session->getip",
    "_label":"CALL",
    "dynamicTypeHintFullName":[
      "session->getip"
    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":42,
    "id":65369,
    "possibleTypes":[

    ],
    "argumentIndex":2
  }
]"""
```

可能的**解决方法**：对于找不到**callIn**的函数，检查其是否是类的函数，随后找到所有定义该类的语句，根据类的名称进行搜索，例如 `session->init` 对应的类为 `class session` ，那么我们首先找到定义该类的语句，其左值就是对象实例的名称，根据该名称+函数名称（ `session->getip` ）就能再找到对应的函数调用点了。

现在的临时解决方案：使用**methodFullName**进行过滤，查找所有函数调用点。

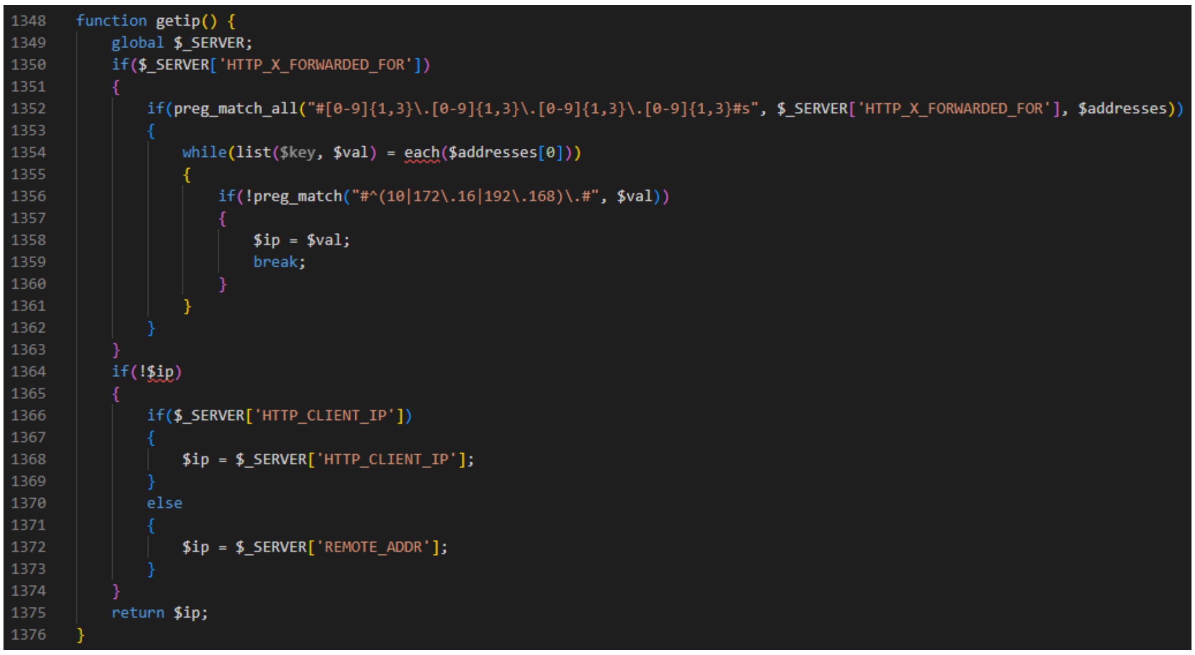
```
cpg.call.filter(node => node.methodFullName == "session->init").map(x=> (x.node.id, x.node.code,
x.node.location.filename, x.node.location.lineNumber)).toJsonPretty
```



```
joern> cpg.call.filter(node => node.methodFullName == "session->init").map(x=> (x.node.id, x.node.code, x.node.location.filename, x.node.location.lineNumber)).toJsonPretty
val res87: String = """[
  {
    "_1":48753,
    "_2":"$session->init()",
    "_3":"archive/global.php",
    "_4":91
  },
  {
    "_1":57286,
    "_2":"$session->init()",
    "_3":"global.php",
    "_4":42
  }
]"""
```

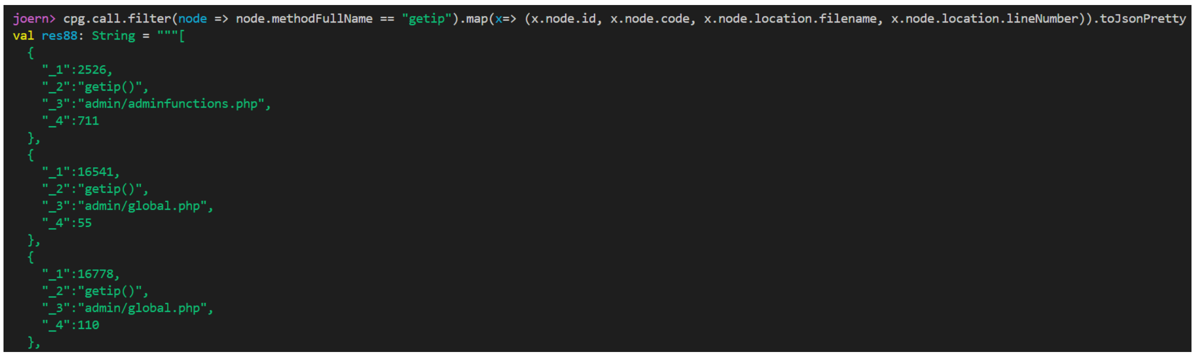
（4）global函数被错误识别

在CVE-2007-1963中 `inc\functions.php` 的 `getip()` 函数能够获取用户输入，这个函数可以被其它PHP调用：



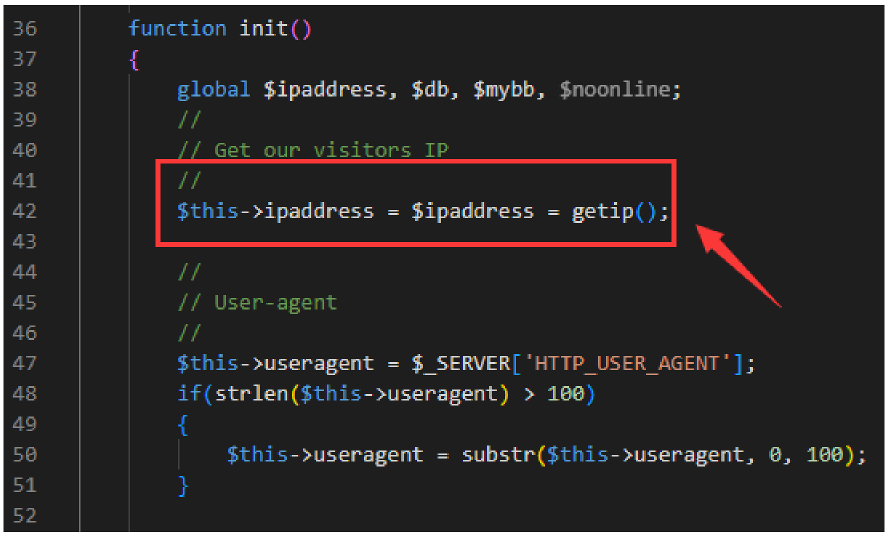
```php
function getip() {
    global $_SERVER;
    if($_SERVER['HTTP_X_FORWARDED_FOR'])
    {
        if(preg_match_all("#[0-9]{1,3}\.[0-9]{1,3}\.[0-9]{1,3}\.[0-9]{1,3}#s", $_SERVER['HTTP_X_FORWARDED_FOR'], $addresses))
        {
            while(list($key, $val) = each($addresses[0]))
            {
                if(!preg_match("#^(10|172\.16|192\.168)\.#", $val))
                {
                    $ip = $val;
                    break;
                }
            }
        }
    }
    if(!$ip)
    {
        if($_SERVER['HTTP_CLIENT_IP'])
        {
            $ip = $_SERVER['HTTP_CLIENT_IP'];
        }
        else
        {
            $ip = $_SERVER['REMOTE_ADDR'];
        }
    }
    return $ip;
}
```

通过 `callIn` 接口或者 `methodFullName` 过滤两种方式，都能得到它的调用点。



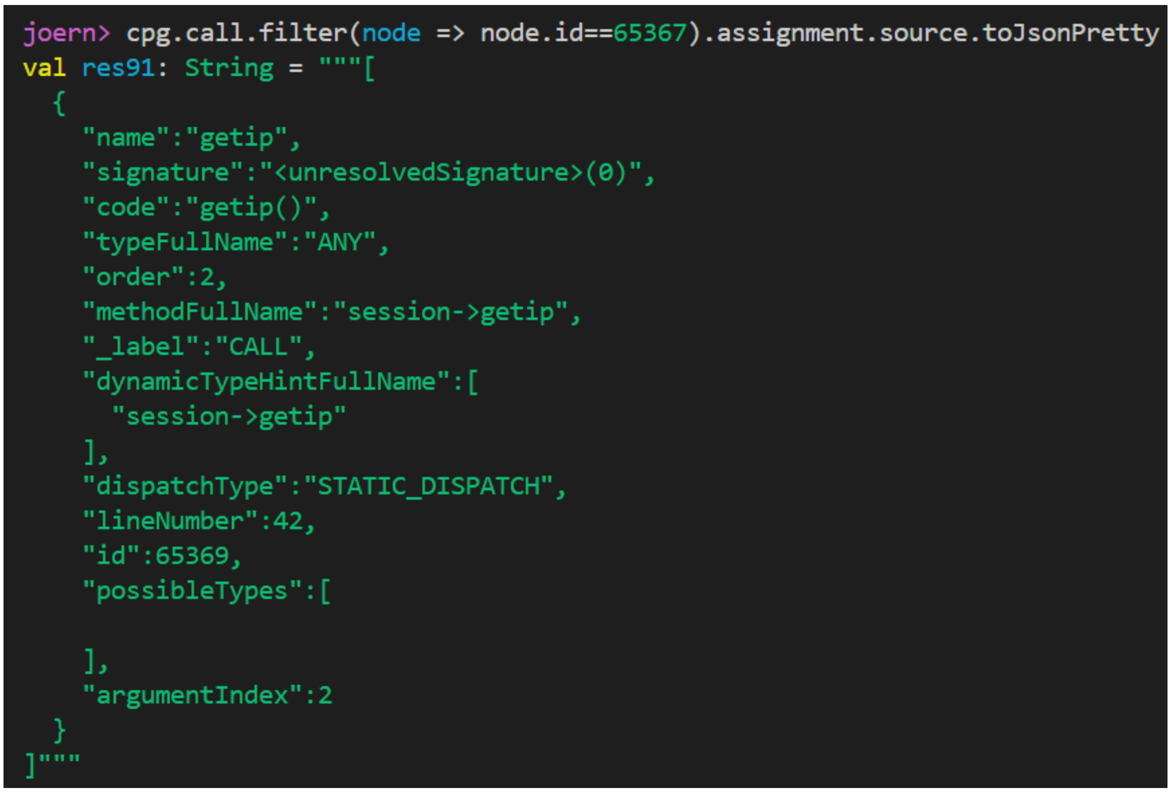
```
joern> cpg.call.filter(node => node.methodFullName == "getip").map(x=> (x.node.id, x.node.code, x.node.location.filename, x.node.location.lineNumber)).toJsonPretty
val res88: String = """[
  {
    "_1":2526,
    "_2":"getip()",
    "_3":"admin/adminfunctions.php",
    "_4":711
  },
  {
    "_1":16541,
    "_2":"getip()",
    "_3":"admin/global.php",
    "_4":55
  },
  {
    "_1":16778,
    "_2":"getip()",
    "_3":"admin/global.php",
    "_4":110
  },
```

但是，在类的函数中如果调用了此函数，这两种方法都不能找到对应的调用点，例如在 `inc\class_session.php` 中就存在这样一个调用点：



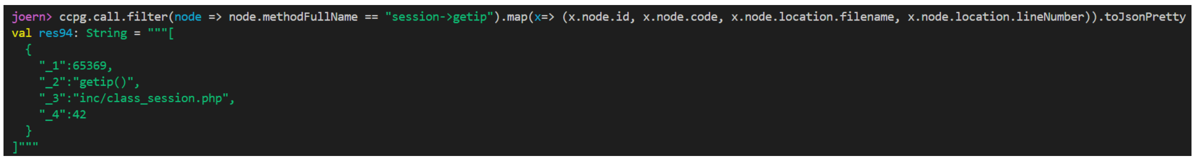
```php
	function init()
	{
		global $ipaddress, $db, $mybb, $noonline;
		//
		// Get our visitors IP
		//
		$this->ipaddress = $ipaddress = getip();

		//
		// User-agent
		//
		$this->useragent = $_SERVER['HTTP_USER_AGENT'];
		if(strlen($this->useragent) > 100)
		{
			$this->useragent = substr($this->useragent, 0, 100);
		}

```

我们检查这个函数，发现其CPG节点：



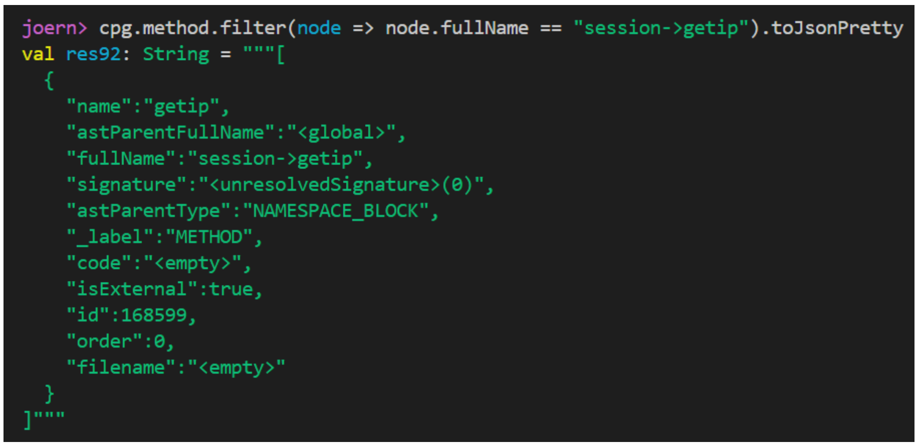
```
joern> cpg.call.filter(node => node.id==65367).assignment.source.toJsonPretty
val res91: String = """[
  {
    "name":"getip",
    "signature":"<unresolvedSignature>(0)",
    "code":"getip()",
    "typeFullName":"ANY",
    "order":2,
    "methodFullName":"session->getip",
    "_label":"CALL",
    "dynamicTypeHintFullName":[
      "session->getip"
    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":42,
    "id":65369,
    "possibleTypes":[

    ],
    "argumentIndex":2
  }
]"""
```

其`"methodFullName"`居然变为了`"session->getip"`，但检查并未在**session**类中发现它自己独立实现了这个方法。通过`"session->getip"`是可以查找到这个调用点的。

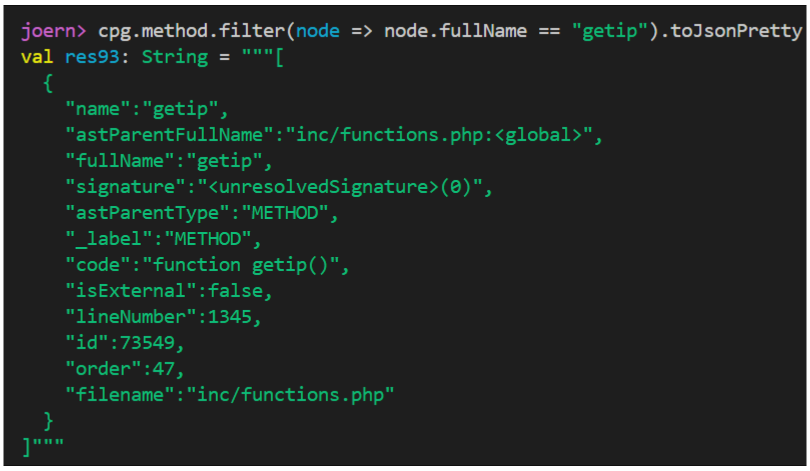


```
joern> ccpg.call.filter(node => node.methodFullName == "session->getip").map(x=> (x.node.id, x.node.code, x.node.location.filename, x.node.location.lineNumber)).toJsonPretty
val res94: String = """[
  {
    "_1":65369,
    "_2":"getip()",
    "_3":"inc/class_session.php",
    "_4":42
  }
]"""
```

比较`"session->getip"`和`"getip"`的CPG节点：

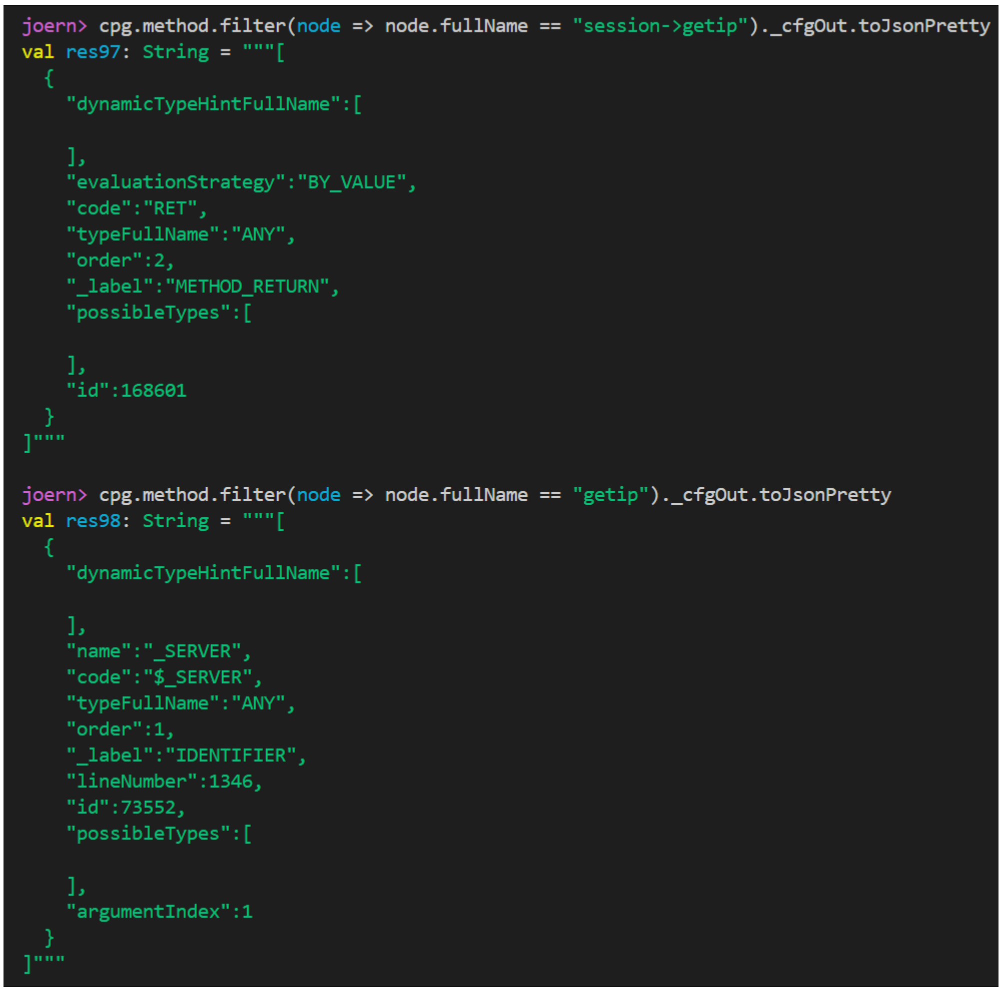


```
joern> cpg.method.filter(node => node.fullName == "session->getip").toJsonPretty
val res92: String = """[
  {
    "name":"getip",
    "astParentFullName":"<global>",
    "fullName":"session->getip",
    "signature":"<unresolvedSignature>(0)",
    "astParentType":"NAMESPACE_BLOCK",
    "_label":"METHOD",
    "code":"<empty>",
    "isExternal":true,
    "id":168599,
    "order":0,
    "filename":"<empty>"
  }
]"""
```



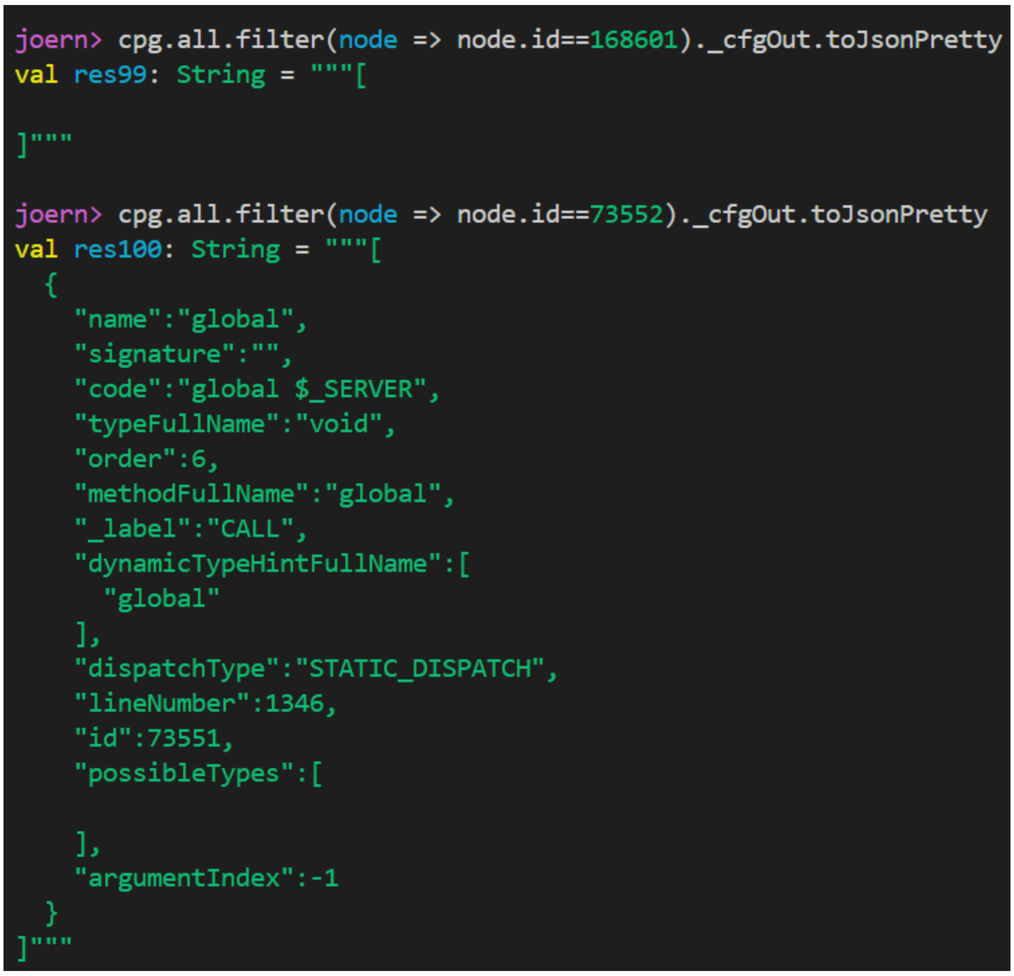
```
joern> cpg.method.filter(node => node.fullName == "getip").toJsonPretty
val res93: String = """[
  {
    "name":"getip",
    "astParentFullName":"inc/functions.php:<global>",
    "fullName":"getip",
    "signature":"<unresolvedSignature>(0)",
    "astParentType":"METHOD",
    "_label":"METHOD",
    "code":"function getip()",
    "isExternal":false,
    "lineNumber":1345,
    "id":73549,
    "order":47,
    "filename":"inc/functions.php"
  }
]"""
```

这两个节点的相同点很明显，它们有着同样的**name**属性，差异之处有许多。另外，这两个函数的内容不一致！



```
joern> cpg.method.filter(node => node.fullName == "session->getip")._cfgOut.toJsonPretty
val res97: String = """[
  {
    "dynamicTypeHintFullName":[

    ],
    "evaluationStrategy":"BY_VALUE",
    "code":"RET",
    "typeFullName":"ANY",
    "order":2,
    "_label":"METHOD_RETURN",
    "possibleTypes":[

    ],
    "id":168601
  }
]"""

joern> cpg.method.filter(node => node.fullName == "getip")._cfgOut.toJsonPretty
val res98: String = """[
  {
    "dynamicTypeHintFullName":[

    ],
    "name":"_SERVER",
    "code":"$_SERVER",
    "typeFullName":"ANY",
    "order":1,
    "_label":"IDENTIFIER",
    "lineNumber":1346,
    "id":73552,
    "possibleTypes":[

    ],
    "argumentIndex":1
  }
]"""
```

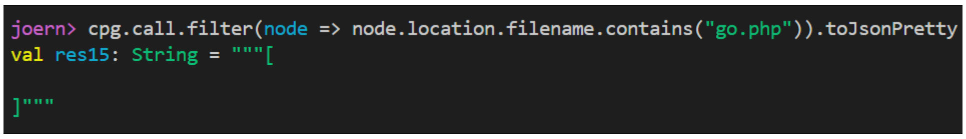
可以看到，由于`"session->getip"`是一个External函数，`"getip"`是一个非External函数，`"session->getip"`内部是没有具体的函数内容的，而`"getip"`却有函数内部的内容，接着往下找**_cfgOut**可以看到其余内容：



```
joern> cpg.all.filter(node => node.id==168601)._cfgOut.toJsonPretty
val res99: String = """[

]"""

joern> cpg.all.filter(node => node.id==73552)._cfgOut.toJsonPretty
val res100: String = """[
  {
    "name":"global",
    "signature":"",
    "code":"global $_SERVER",
    "typeFullName":"void",
    "order":6,
    "methodFullName":"global",
    "_label":"CALL",
    "dynamicTypeHintFullName":[
      "global"
    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":1346,
    "id":73551,
    "possibleTypes":[

    ],
    "argumentIndex":-1
  }
]"""
```

（5）部分文件解析失败

解析domainmod项目（**https://github.com/domainmod/domainmod**）中的`/home/devdata/repos/domainmod_domainmod/install/go.php`时，这个文件内容不能获取到，**猜测**：似乎是Joern在解析整个项目时，未能成功处理此文件，导致它未被加入到CPG中。



```
joern> cpg.call.filter(node => node.location.filename.contains("go.php")).toJsonPretty
val res15: String = """[

]"""
```

（6）魔术变量不当处理

Joern将PHP的**魔术变量**__DIR_、 _*FILE*_ 、__METHOD__等信息建模为了global变量，解析时容易和define定义的全局变量弄混，建议对魔术变量单独建模。

（7）namespace未建模

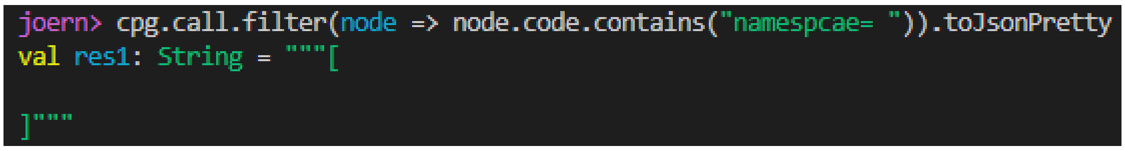
使用Joern查找代码中含有`namespace`的语句时会失败，似乎没有将这些信息记录在CPG中。

源码：

```
<?php
      namespace MyNamespace;
      echo __NAMESPACE__;
?>
```

查询语句：

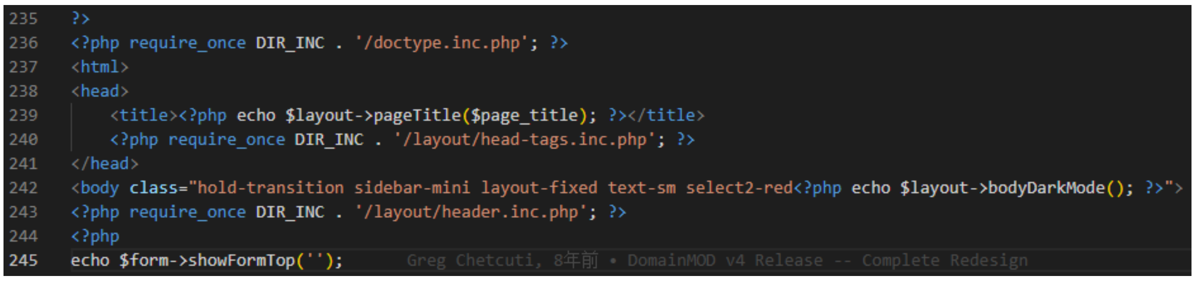
```
cpg.call.filter(node => node.code.contains("namespcae= ")).toJsonPretty
```



```
joern> cpg.call.filter(node => node.code.contains("namespcae= ")).toJsonPretty
val res1: String = """[

]"""
```

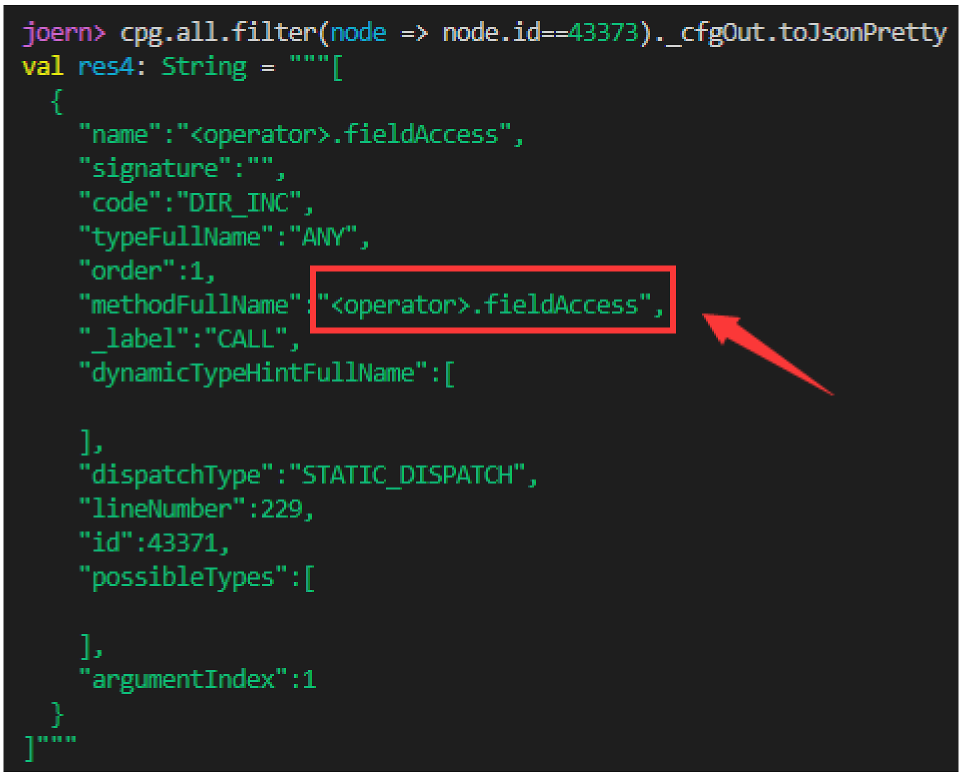
（8）奇怪的define类型

本问题可以说并不是Joern存在的问题，只是一种设计的思想。在CVE-2018-11404的`./assets/edit/ssl-provider-account.php`的第235行往下的代码如下：



```
235  ?>
236  <?php require_once DIR_INC . '/doctype.inc.php'; ?>
237  <html>
238  <head>
239      <title><?php echo $layout->pageTitle($page_title); ?></title>
240      <?php require_once DIR_INC . '/layout/head-tags.inc.php'; ?>
241  </head>
242  <body class="hold-transition sidebar-mini layout-fixed text-sm select2-red<?php echo $layout->bodyDarkMode(); ?>">
243  <?php require_once DIR_INC . '/layout/header.inc.php'; ?>
244  <?php
245  echo $form->showFormTop('');       Greg Chetcuti, 8年前 • DomainMOD v4 Release -- Complete Redesign
```

第236行中的`DIR_INC`是一个宏定义的变量，**直观感受**是，在CPG中这个变量的类型可能是`"IDENTIFIER"`或`"LITERAL"`，但是这个节点的类型却是`<operator>.fieldAccess`，这就导致在实际处理此变量时可能会出现问题。后续发现所有全局变量均被处理为`<operator>.fieldAccess`类型，应该是Joern**有意设计**的。



```
joern> cpg.all.filter(node => node.id==43373)._cfgOut.toJsonPretty
val res4: String = """[
  {
    "name":"<operator>.fieldAccess",
    "signature":"",
    "code":"DIR_INC",
    "typeFullName":"ANY",
    "order":1,
    "methodFullName":"<operator>.fieldAccess",
    "_label":"CALL",
    "dynamicTypeHintFullName":[

    ],
    "dispatchType":"STATIC_DISPATCH",
    "lineNumber":229,
    "id":43371,
    "possibleTypes":[

    ],
    "argumentIndex":1
  }
]"""
```

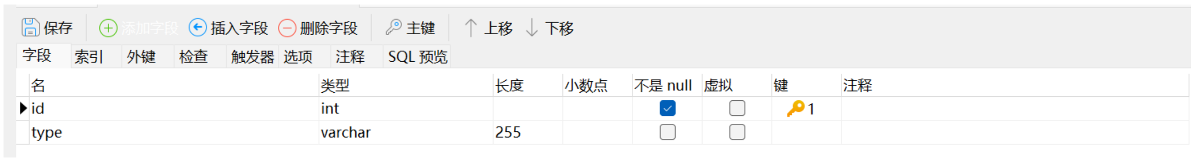
36.PHP内置函数绕过手段

（1）is_numeric

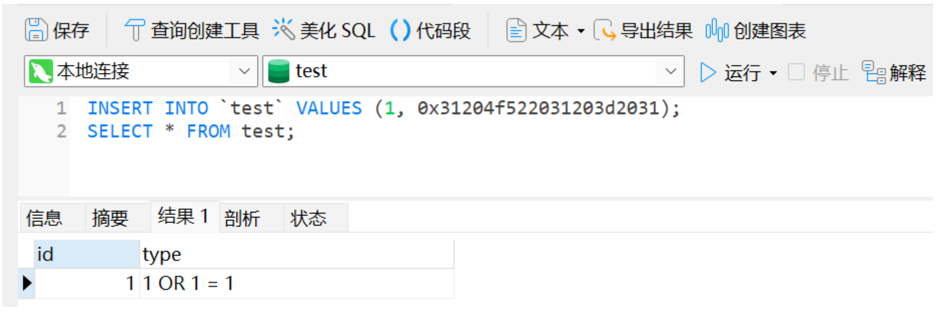
`is_numeric` 主要用于检测数字或数字字符串，使用**科学计数法**（"1e10"）、**负号和小数点**（"-123.45"）、**前导零**（"010"）、**字符串转换为16进制**等手段能够绕过检查。

```
<?php
	$num = "1 OR 1 = 1";
	$num = "0x" + bin2hex($num);
	if (is_numeric($num)) {
	    echo "YES";
	} else {
	    echo "NO";
	}
?>
// 运行结果：YES
```

使用16进制能够造成二阶SQL注入漏洞，例如将 `"1 OR 1 = 1"` 的16进制 `0x31204f522031203d2031` （绕过检查）存入到数据库中，当再次查出此数据并拼接到SQL语句中时（未对查出的字符串检查时），将会造成SQL注入漏洞。



名	类型	长度	小数点	不是 null	虚拟	键	注释
id	int			✓	☐	🔑1	
type	varchar	255		☐	☐		



```
INSERT INTO `test` VALUES (1, 0x31204f522031203d2031);
SELECT * FROM test;
```

id	type
1	1 OR 1 = 1