SV2016 정적 분석 보고서

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Contents

1 Abstract

이 문서는 2016년 봄 건국대학교 소프트웨어 검증[1] 과목의 과제로 작성되었다.
이 보고서에서는 소프트웨어 모델링 및 분석[2] 과목의 과제로 개발되는, "다수의 C 프로그램을 대상으로 상호 cheating 여부를 정량적으로 판단하고, 해당 내용을 OOO 하게 알려주는 프로그램"에 대한 정적 분석을 진행한다.

2 Infer

2.1 Eradicate

```
$ infer -analyzer eradicate  -gradle jar
Running and capturing gradle compilation...
Starting analysis (Infer version v0.8.1)
FFFFF..............................................
Analyzed 5 files

Found 19 issues

src/main/java/Analyze.java:16: error:
    ERADICATE_FIELD_NOT_INITIALIZED
  Field 'Analyze.tempFolderPath' is not initialized in
      the constructor and is not declared '@Nullable'
  14.           ArrayList<String> listType = new
      ArrayList();
  15.
  16. >        public Analyze(ArrayList<String> source){
  17.               this.source = source;
  18.               this.listType.add("void");
  19.

src/main/java/Calculate.java:13: error:
    ERADICATE_FIELD_NOT_INITIALIZED
  Field 'Calculate.SyncRate' is not initialized in the
      constructor and is not declared '@Nullable'
  11.           ArrayList <Files> files = new ArrayList()
      ;
  12.
  13. >        public Calculate(ArrayList<Files> files)
  14.           {
  15.               this.files = files;
  16.

src/main/java/Controller.java:20: error:
    ERADICATE_FIELD_NOT_NULLABLE
```

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Field 'Controller.fileName' can be null but is not
    declared '@Nullable'. (Origin: null constant at line
    20)
```
18.    {
19.            private String folderPath;
20. >          private String fileName = null;
21.            private ArrayList<Files> files = new
    ArrayList();
22.            ArrayList<String> source = new ArrayList
    ();
23.
```

src/main/java/Controller.java:39: error:
    ERADICATE_FIELD_NOT_INITIALIZED
  Field 'Controller.folderPath' is not initialized in the
      constructor and is not declared '@Nullable'
```
37.            //
38.
39. >          public Controller() {
40.                    DisplayMain();
41.            }
42.
```

src/main/java/Controller.java:39: error:
    ERADICATE_FIELD_NOT_INITIALIZED
  Field 'Controller.pnResult' is not initialized in the
    constructor and is not declared '@Nullable'
```
37.            //
38.
39. >          public Controller() {
40.                    DisplayMain();
41.            }
42.
```

src/main/java/Controller.java:39: error:
    ERADICATE_FIELD_NOT_INITIALIZED
  Field 'Controller.ct' is not initialized in the
    constructor and is not declared '@Nullable'
```
37.            //
38.
39. >          public Controller() {
40.                    DisplayMain();
41.            }
42.
```

src/main/java/Controller.java:39: error:

ERADICATE_FIELD_NOT_INITIALIZED
Field 'Controller.lbChooseFile' is not initialized in
    the constructor and is not declared '@Nullable'
37.   //
38.
39. >   public Controller() {
40.   DisplayMain();
41.   }
42.

src/main/java/Controller.java:39: error:
    ERADICATE_FIELD_NOT_INITIALIZED
Field 'Controller.lbCenterCircle' is not initialized in
    the constructor and is not declared '@Nullable'
37.   //
38.
39. >   public Controller() {
40.   DisplayMain();
41.   }
42.

src/main/java/Controller.java:39: error:
    ERADICATE_FIELD_NOT_INITIALIZED
Field 'Controller.btFolder' is not initialized in the
    constructor and is not declared '@Nullable'
37.   //
38.
39. >   public Controller() {
40.   DisplayMain();
41.   }
42.

src/main/java/Controller.java:39: error:
    ERADICATE_FIELD_NOT_INITIALIZED
Field 'Controller.pnCloud' is not initialized in the
    constructor and is not declared '@Nullable'
37.   //
38.
39. >   public Controller() {
40.   DisplayMain();
41.   }
42.

src/main/java/Controller.java:39: error:
    ERADICATE_FIELD_NOT_INITIALIZED
Field 'Controller.btStart' is not initialized in the

```
              constructor and is not declared '@Nullable'
  37.                //
  38.
  39. >          public Controller() {
  40.                   DisplayMain();
  41.              }
  42.
```

src/main/java/Controller.java:39: error:
   ERADICATE_FIELD_NOT_INITIALIZED
  Field 'Controller.lbLogoSmall' is not initialized in
     the constructor and is not declared '@Nullable'

```
  37.                //
  38.
  39. >          public Controller() {
  40.                   DisplayMain();
  41.              }
  42.
```

src/main/java/Controller.java:39: error:
   ERADICATE_FIELD_NOT_INITIALIZED
  Field 'Controller.pnFileList' is not initialized in the
      constructor and is not declared '@Nullable'

```
  37.                //
  38.
  39. >          public Controller() {
  40.                   DisplayMain();
  41.              }
  42.
```

src/main/java/Controller.java:39: error:
   ERADICATE_FIELD_NOT_INITIALIZED
  Field 'Controller.lbList' is not initialized in the
     constructor and is not declared '@Nullable'

```
  37.                //
  38.
  39. >          public Controller() {
  40.                   DisplayMain();
  41.              }
  42.
```

src/main/java/Controller.java:39: error:
   ERADICATE_FIELD_NOT_INITIALIZED
  Field 'Controller.pnMain' is not initialized in the
     constructor and is not declared '@Nullable'

```
  37.                //
```

```
38.
39. >          public Controller () {
40.                   DisplayMain () ;
41.               }
42.
```

src/main/java/Controller.java:39: error:
   ERADICATE_FIELD_NOT_INITIALIZED
   Field 'Controller.ltFile' is not initialized in the
      constructor and is not declared '@Nullable'
```
37.           //
38.
39. >          public Controller () {
40.                   DisplayMain () ;
41.               }
42.
```

src/main/java/Controller.java:39: error:
   ERADICATE_FIELD_NOT_INITIALIZED
   Field 'Controller.lbTip' is not initialized in the
      constructor and is not declared '@Nullable'
```
37.           //
38.
39. >          public Controller () {
40.                   DisplayMain () ;
41.               }
42.
```

src/main/java/Controller.java:39: error:
   ERADICATE_FIELD_NOT_INITIALIZED
   Field 'Controller.lbLogo' is not initialized in the
      constructor and is not declared '@Nullable'
```
37.           //
38.
39. >          public Controller () {
40.                   DisplayMain () ;
41.               }
42.
```

src/main/java/Controller.java:391: error:
   ERADICATE_FIELD_NOT_INITIALIZED
   Field 'Controller$5.lbTempTotalSyncRate' is not
      initialized in the constructor and is not declared '
      @Nullable'
```
389.                                    {
390.                                             sw = true
```

```
          ;
   391.  >
          lbTempCloud.setBounds(new Random().nextInt(800  -(int
             )sizeTempName.getWidth()) + 100, new Random().
             nextInt(350  -((int)sizeTempName.getHeight() + 12)) +
              70,
   392.
                   (int)sizeTempName.getWidth(), (int)
             sizeTempName.getHeight() + (int)sizeTempPercent.
             getHeight() + 3);
   393.
   394.
```

Summary of the reports

   ERADICATE_FIELD_NOT_INITIALIZED: 18
        ERADICATE_FIELD_NOT_NULLABLE: 1

2.2   Infer

```
$ infer -analyzer infer  -gradle jar
Running and capturing gradle compilation...
Starting analysis (Infer version v0.8.1)
FF..FF.F...............................................
    ...............................
Analyzed 5 files

Found 1 issue

src/main/java/Controller.java:48: error: NULL_DEREFERENCE
  object fileList last assigned on line 46 could be null
     and is dereferenced at line 48
  46.                   File [] fileList = dir.listFiles
     ();
  47.
  48. >                 for(File f : fileList)
  49.                   {
  50.                         if(!f.isHidden() && f.
     getName().endsWith(".c"))
  51.
```

Summary of the reports

   NULL_DEREFERENCE: 1

2.3   Tracing

```
$ infer -analyzer tracing -gradle jar
Running and capturing gradle compilation...
Starting analysis (Infer version v0.8.1)
FFFF..F..........................................
   ............................
Analyzed 5 files

Found 3 issues

src/main/java/Calculate.java:24: warning:
    PRECONDITION_NOT_MET
  in call to calLine() at line 24
  22.                     for(fileNum=0;fileNum<this.
    numOfFile;fileNum++)
  23.                     {
  24. >                          calLine();
  25.                            calFunction();
  26.                            calVariable();
  27.

src/main/java/Controller.java:48: error: NULL_DEREFERENCE
  object fileList last assigned on line 46 could be null
      and is dereferenced at line 48
  46.               File [] fileList = dir.listFiles
    ();
  47.
  48. >                for(File f : fileList)
  49.                  {
  50.                       if(!f.isHidden() && f.
    getName().endsWith(".c"))
  51.

src/main/java/Controller.java:366: warning:
    PRECONDITION_NOT_MET
  in call to getTotalSync(...) at line 366
  364.                     final JLabel lbTempCloud
    = lbCloud.get(i);
  365.
  366. >                      if(i != pointerNum && (
    int)cal.getTotalSync(i) > 52) {
  367.                           temp = "" + files
    .get(i).getName();
  368.                           final JLabel
    lbTempName = new JLabel(temp.substring(0, 9));
  369.
    I
```

Summary of the reports

PRECONDITION_NOT_MET: 2
NULL_DEREFERENCE: 1

3 PMD

3.1 Design

$ pmd pmd -dir src/main/java/ -R java-design
Analyze.java:1: Possible God class (WMC=66, ATFD=19, TCC
    =0.09090909090909091)
Analyze.java:62:   Deeply nested if..then statements
     are hard to read
Calculate.java:10:   Perhaps 'numOfFile' could be
    replaced by a local variable.
Controller.java:1:   Possible God class (WMC=63, ATFD
    =204, TCC=0.05789473684210526)
Controller.java:21:   Private field 'files' could be
    made final; it is only initialized in the declaration
    or constructor.
Controller.java:40:   Overridable method 'DisplayMain'
    called during object construction
Controller.java:99:   Avoid unnecessary comparisons in
    boolean expressions
Controller.java:257:   Avoid unnecessary comparisons in
    boolean expressions
Controller.java:327:   New exception is thrown in catch
    block, original stack trace may be lost
Controller.java:331:   New exception is thrown in catch
    block, original stack trace may be lost
Controller.java:335:   New exception is thrown in catch
    block, original stack trace may be lost
Controller.java:338:   New exception is thrown in catch
    block, original stack trace may be lost
Controller.java:344:   Avoid unnecessary comparisons in
    boolean expressions
Controller.java:394:   Avoid unnecessary comparisons in
    boolean expressions
Controller.java:399:   Avoid unnecessary comparisons in
    boolean expressions
Controller.java:404:   Avoid unnecessary comparisons in
    boolean expressions
Controller.java:413:   Avoid unnecessary comparisons in
    boolean expressions

Controller.java:457:   Avoid reassigning parameters such
    as 'lbTempTotalSyncRate'
Controller.java:457:   Consider using varargs for
  methods or constructors which take an array the last
  parameter.
Main.java:2:   All methods are static. Consider using a
    utility class instead. Alternatively, you could add a
    private constructor or make the class abstract to
  silence this warning.
Main.java:4:   Consider using varargs for methods or
  constructors which take an array the last parameter.

3.2 Optimizations

$ pmd pmd -dir src/main/java/ -R java-optimizations
Analyze.java:6: Avoid using redundant field initializer
    for 'numOfLine'
Analyze.java:7: Avoid using redundant field initializer
    for 'numOfFunction'
Analyze.java:8: Avoid using redundant field initializer
    for 'numOfVariable'
Analyze.java:9: Avoid using redundant field initializer
    for 'numOfPreprocessor'
Analyze.java:10:   Avoid using redundant field
  initializer for 'numOfAnnotation'
Analyze.java:16:   Parameter 'source' is not
  assigned and could be declared final
Analyze.java:28:   Parameter 'file' is not assigned
  and could be declared final
Calculate.java:8:   Avoid using redundant field
  initializer for 'centerNum'
Calculate.java:9:   Avoid using redundant field
  initializer for 'fileNum'
Calculate.java:10:   Avoid using redundant field
  initializer for 'numOfFile'
Calculate.java:13:   Parameter 'files' is not assigned
   and could be declared final
Calculate.java:85:   Avoid instantiating new objects
    inside loops
Calculate.java:85:   Local variable 'str1' could be
    declared final
Calculate.java:89:   Avoid instantiating new objects
    inside loops
Calculate.java:89:   Local variable 'str2' could be
    declared final
Calculate.java:147:   Avoid instantiating new objects

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```
                inside loops
Calculate.java:147:       Local variable 'str1' could be
    declared final
Calculate.java:151:       Avoid instantiating new objects
    inside loops
Calculate.java:151:       Local variable 'str2' could be
    declared final
Calculate.java:203:       Local variable 'PreDiff' could be
     declared final
Calculate.java:204:       Local variable 'PreDiff1' could
    be declared final
Calculate.java:221:       Avoid instantiating new objects
    inside loops
Calculate.java:221:       Local variable 'str1' could be
    declared final
Calculate.java:225:       Avoid instantiating new objects
    inside loops
Calculate.java:225:       Local variable 'str2' could be
    declared final
Calculate.java:298:       Parameter 'pointerNum' is not
    assigned and could be declared final
Calculate.java:302:       Parameter 'pointerNum' is not
    assigned and could be declared final
Calculate.java:306:       Parameter 'pointerNum' is not
    assigned and could be declared final
Calculate.java:310:       Parameter 'pointerNum' is not
    assigned and could be declared final
Calculate.java:314:       Parameter 'pointerNum' is not
    assigned and could be declared final
Calculate.java:318:       Parameter 'pointerNum' is not
    assigned and could be declared final
Calculate.java:322:       Parameter 'pointerNum' is not
    assigned and could be declared final
Controller.java:20:       Avoid using redundant field
    initializer for 'fileName'
Controller.java:23:       Avoid using redundant field
    initializer for 'pointerNum'
Controller.java:24:       Avoid using redundant field
    initializer for 'fileNum'
Controller.java:25:       Avoid using redundant field
    initializer for 'numOfFile'
Controller.java:45:       Local variable 'dir' could be
    declared final
Controller.java:46:       Local variable 'fileList' could
    be declared final
Controller.java:48:       Local variable 'f' could be
```

```
declared final
Controller.java:80:      Local variable 'f' could be
    declared final
Controller.java:85:      Avoid instantiating new objects
    inside loops
Controller.java:85:      Local variable 'file' could be
    declared final
Controller.java:97:      Avoid instantiating new objects
    inside loops
Controller.java:97:      Local variable 'br' could be
    declared final
Controller.java:105:     Avoid instantiating new objects
    inside loops
Controller.java:105:     Local variable 'analyze' could be
    declared final
Controller.java:154:     Local variable 'alFolder' could
    be declared final
Controller.java:155:     Parameter 'e' is not assigned and
    could be declared final
Controller.java:170:     Local variable 'alStart' could be
    declared final
Controller.java:171:     Parameter 'e' is not assigned and
    could be declared final
Controller.java:207:     Do not add empty strings
Controller.java:235:     Local variable 'fileList' could
    be declared final
Controller.java:237:     Local variable 'temp' could be
    declared final
Controller.java:252:     Local variable 'renderer' could
    be declared final
Controller.java:254:     Local variable 'mlFile' could be
    declared final
Controller.java:255:     Parameter 'e' is not assigned and
    could be declared final
Controller.java:263:     Local variable 'klFile' could be
    declared final
Controller.java:264:     Parameter 'e' is not assigned and
    could be declared final
Controller.java:343:     Parameter 'tempPointerNum' is not
    assigned and could be declared final
Controller.java:355:     Do not add empty strings
Controller.java:363:     Avoid instantiating new objects
    inside loops
Controller.java:367:     Do not add empty strings
Controller.java:368:     Avoid instantiating new objects
    inside loops
```

```
Controller.java:369:      Avoid  instantiating  new  objects
    inside  loops
Controller.java:369:      Local  variable  'lbTempPercent'
    could  be  declared  final
Controller.java:371:      Avoid  instantiating  new  objects
    inside  loops
Controller.java:372:      Avoid  instantiating  new  objects
    inside  loops
Controller.java:373:      Local  variable  'sizeTempName'
    could  be  declared  final
Controller.java:376:      Avoid  instantiating  new  objects
    inside  loops
Controller.java:377:      Avoid  instantiating  new  objects
    inside  loops
Controller.java:378:      Local  variable  'sizeTempPercent'
    could  be  declared  final
Controller.java:382:      Avoid  instantiating  new  objects
    inside  loops
Controller.java:391:      Avoid  instantiating  new  objects
    inside  loops
Controller.java:391:      Avoid  instantiating  new  objects
    inside  loops
Controller.java:398:      Local  variable  'lbAnotherCloud'
    could  be  declared  final
Controller.java:406:      Avoid  instantiating  new  objects
    inside  loops
Controller.java:406:      Local  variable  'mlTempName'  could
     be  declared  final
Controller.java:412:      Parameter  'e'  is  not  assigned  and
     could  be  declared  final
Controller.java:426:      Parameter  'e'  is  not  assigned  and
     could  be  declared  final
Controller.java:440:      Parameter  'e'  is  not  assigned  and
     could  be  declared  final
Controller.java:457:      Parameter  'cal'  is  not  assigned
    and  could  be  declared  final
Controller.java:457:      Parameter  'lbTempSync'  is  not
    assigned  and  could  be  declared  final
Controller.java:457:      Parameter  'pointerNum'  is  not
    assigned  and  could  be  declared  final
Controller.java:477:      Avoid  instantiating  new  objects
    inside  loops
Controller.java:478:      Avoid  instantiating  new  objects
    inside  loops
Controller.java:487:      Parameter  'lbTempA'  is  not
    assigned  and  could  be  declared  final
```

Controller.java:487:   Parameter 'lbTempB' is not
    assigned and could be declared final
Controller.java:488:   Local variable 'lbTempC' could be
    declared final
Controller.java:491:   Local variable 'areaA' could be
    declared final
Controller.java:492:   Local variable 'areaB' could be
    declared final
Controller.java:501:   Parameter 'c' is not assigned and
    could be declared final
Controller.java:501:   Parameter 'g' is not assigned and
    could be declared final
Controller.java:506:   Parameter 'c' is not assigned and
    could be declared final
Controller.java:506:   Parameter 'g' is not assigned and
    could be declared final
Controller.java:506:   Parameter 'height' is not
    assigned and could be declared final
Controller.java:506:   Parameter 'width' is not assigned
    and could be declared final
Controller.java:506:   Parameter 'x' is not assigned and
    could be declared final
Controller.java:506:   Parameter 'y' is not assigned and
    could be declared final
Controller.java:507:   Local variable 'g2d' could be
    declared final
Controller.java:513:   Parameter 'c' is not assigned and
    could be declared final
Controller.java:517:   Parameter 'c' is not assigned and
    could be declared final
Controller.java:517:   Parameter 'insets' is not
    assigned and could be declared final
Files.java:15: Parameter 'fileName' is not assigned and
    could be declared final
Files.java:57: Parameter 'tempName' is not assigned and
    could be declared final
Files.java:61: Parameter 'tempNumOfLine' is not assigned
    and could be declared final
Files.java:65: Parameter 'tempNumOfFunction' is not
    assigned and could be declared final
Files.java:69: Parameter 'tempNumOfVariable' is not
    assigned and could be declared final
Files.java:73: Parameter 'tempNumOfPreprocessor' is not
    assigned and could be declared final
Files.java:77: Parameter 'tempNumOfAnnotation' is not
    assigned and could be declared final

```
Files.java:81:    Parameter 'tempFunctionName' is not
    assigned and could be declared final
Files.java:85:    Parameter 'tempVariableName' is not
    assigned and could be declared final
Files.java:89:    Parameter 'tempPreprocessorName' is not
    assigned and could be declared final
Main.java:4:     Parameter 'args' is not assigned and
    could be declared final
```

3.3 Imports

```
$ pmd pmd -dir src/main/java/ -R java-imports
Controller.java:7:      Avoid duplicate imports such as '
    java.io.BufferedReader'
Controller.java:8:      Avoid duplicate imports such as '
    java.io.File'
Controller.java:9:      Avoid duplicate imports such as '
    java.io.FileNotFoundException'
Controller.java:10:     Avoid duplicate imports such as '
    java.io.FileReader'
Controller.java:11:     Avoid duplicate imports such as '
    java.io.IOException'
Controller.java:12:     Avoid importing anything from the
     package java.lang
Controller.java:198:    Unnecessary use of fully
    qualified name 'java.io.File' due to existing import '
    java.io.*'
```

3.4 Unnecessary

```
$ pmd pmd -dir src/main/java/ -R java-unnecessary
Analyze.java:84:       Useless parentheses.
Calculate.java:100:    Useless parentheses.
Calculate.java:103:    Useless parentheses.
Calculate.java:170:    Useless parentheses.
Calculate.java:173:    Useless parentheses.
Calculate.java:236:    Useless parentheses.
Calculate.java:239:    Useless parentheses.
Controller.java:371:   Useless parentheses.
Controller.java:379:   Useless parentheses.
Controller.java:435:   Useless parentheses.
Controller.java:514:   Useless parentheses.
```

3.5 Unused Code

```
$ pmd pmd -dir src/main/java/ -R java-unusedcode
```

```
Calculate.java:203:      Avoid unused local variables such
    as 'PreDiff'.
Calculate.java:204:      Avoid unused local variables such
    as 'PreDiff1'.
```

3.6 Strings

```
$ pmd pmd -dir src/main/java/ -R java-strings
Analyze.java:84:         String.indexOf(char) is faster
    than String.indexOf(String).
Analyze.java:85:         String.indexOf(char) is faster
    than String.indexOf(String).
Analyze.java:219:        String.indexOf(char) is faster
    than String.indexOf(String).
Analyze.java:222:        String.indexOf(char) is faster
    than String.indexOf(String).
Analyze.java:229:        String.indexOf(char) is faster
    than String.indexOf(String).
Analyze.java:256:        The String literal "struct"
    appears 5 times in this file; the first occurrence is
    on line 256
Controller.java:143:     The String literal "Malgun Gothic
    " appears 8 times in this file; the first occurrence
    is on line 143
Controller.java:238:     String.indexOf(char) is faster
    than String.indexOf(String).
Controller.java:325:     Use equals() to compare strings
    instead of '==' or '!='
Controller.java:329:     Use equals() to compare strings
    instead of '==' or '!='
Controller.java:333:     Use equals() to compare strings
    instead of '==' or '!='
```

4 FindBugs

4.1 Results

```
$ findbugs -textui build/libs/clone-checker.jar
M P Dm: Calculate.calFunction() invokes inefficient new
    String(String) constructor  At Calculate.java:[line
    85]
M P Dm: Calculate.calVariable() invokes inefficient new
    String(String) constructor  At Calculate.java:[line
    147]
M P Dm: Calculate.calPreprocessor() invokes inefficient
    new String(String) constructor  At Calculate.java:[
```

line 221]
M D NP: Possible null pointer dereference in Controller.
  mkFileInstance() due to return value of called method
   Dereferenced at Controller.java:[line 48]
M B Nm: The method name Controller.DisplayMain() doesn't
  start with a lower case letter At Controller.java:[
  lines 119-189]
M B Nm: The method name Controller.DisplayResult() doesn'
  t start with a lower case letter At Controller.java:[
  lines 213-289]
H I Dm: Found reliance on default encoding in Controller.
  mkFileInstance(): new java.io.FileReader(String) At
  Controller.java:[line 97]
M C UwF: Unwritten field: Controller$5.
  lbTempTotalSyncRate At Controller.java:[line 437]
M P SIC: Should Controller$RoundedBorder be a _static_
  inner class? At Controller.java:[lines 501-523]
M P UuF: Unused field: Analyze.tempFolderPath In Analyze
  .java
Warnings generated: 10

References

[1] Junbeom Yoo, Eui-Sub Kim, *Software Verification – Introduction to Software Testing & Static Analysis*, `http://dslab.konkuk.ac.kr/Class/2016/16SV/16SV.htm`, 2016.

[2] Junbeom Yoo, Sejin Jung, *Software Modeling & Analysis*, `http://dslab.konkuk.ac.kr/Class/2016/16SMA/16SMA.htm`, 2016.

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