Implementing Test Coverage in Epsilon

Thomas Wormald

May 7, 2014

Introduction - Model Driven Engineering

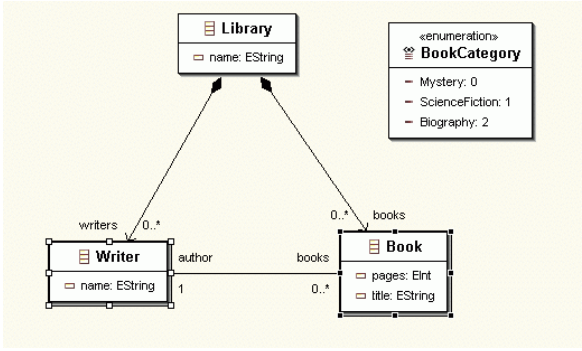


Figure : A sample model [Eclipse, 2014]

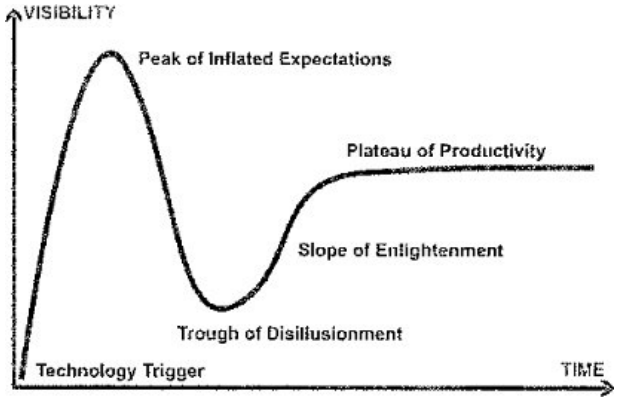


Figure : The technology hype cycle [M. Brambilla, 2012]

Introduction - Model Driven Engineering

Introduction - Software Testing Metrics

```
public Object executeAST(AST ast, IEolContext context) throws EolRuntimeException{

    if (ast == null) return null;
    activeAst = ast;

    if (executionController != null){
        if (executionController.isTerminated()) throw new EolTerminationException(ast);
        try {
            executionController.control(ast, context);
        }
        catch (Exception ex) { throw new EolInternalException(ex); }
    }
```

Figure : EclEmma [EclEmma.org, 2014]

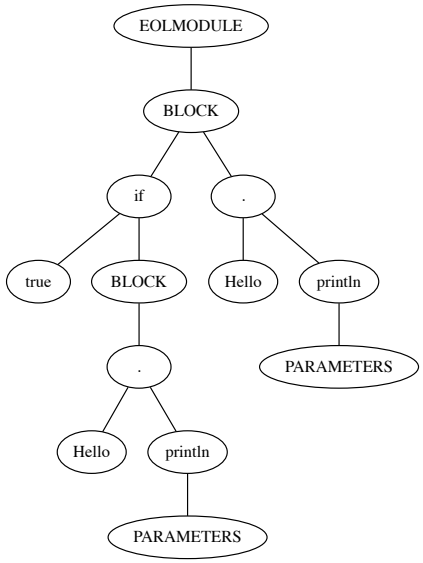
Introduction - Software Testing Metrics

```
if ((err = ReadyHash(&SSLHashSHA1, &hashCtx)) != 0)
    goto fail;
if ((err = SSLHashSHA1.update(&hashCtx, &clientRandom)) != 0)
    goto fail;
if ((err = SSLHashSHA1.update(&hashCtx, &serverRandom)) != 0)
    goto fail;
if ((err = SSLHashSHA1.update(&hashCtx, &signedParams)) != 0)
    goto fail;
    goto fail;
if ((err = SSLHashSHA1.final(&hashCtx, &hashOut)) != 0)
    goto fail;
```

Figure : Apple's SSL Bug [Imperial Violet, 2014]

Introduction - Software Testing Metrics

```
1  if (true) {
2    "Hello".println();
3  }
4
5  "Hello".println();
```



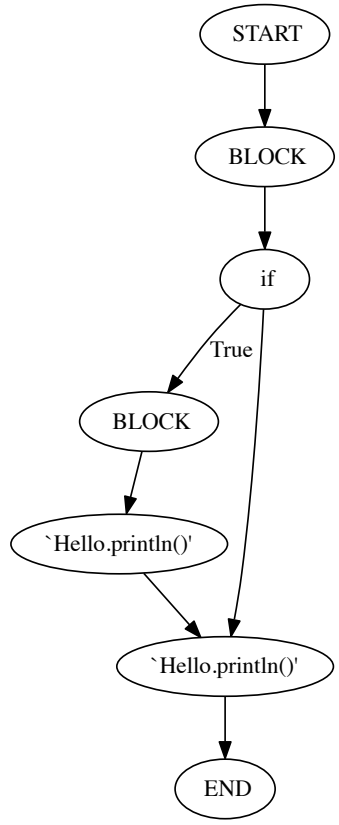


Figure : From left to right: Code for an if statement, its AST and its CFG

Implementing Statement Coverage

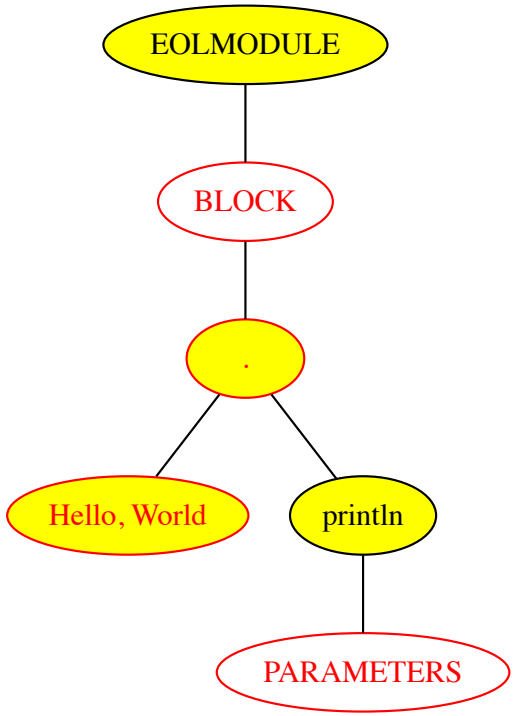


Figure : The executed AST for the Hello, World program

Implementing Statement Coverage

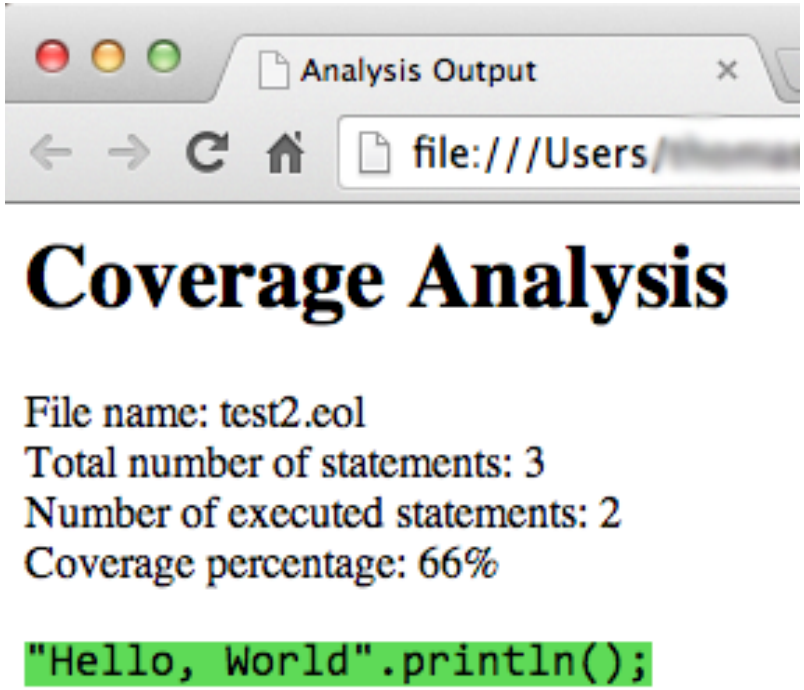


Figure : The HTML output from test ST-01, shown in Google Chrome

Implementing Statement Coverage

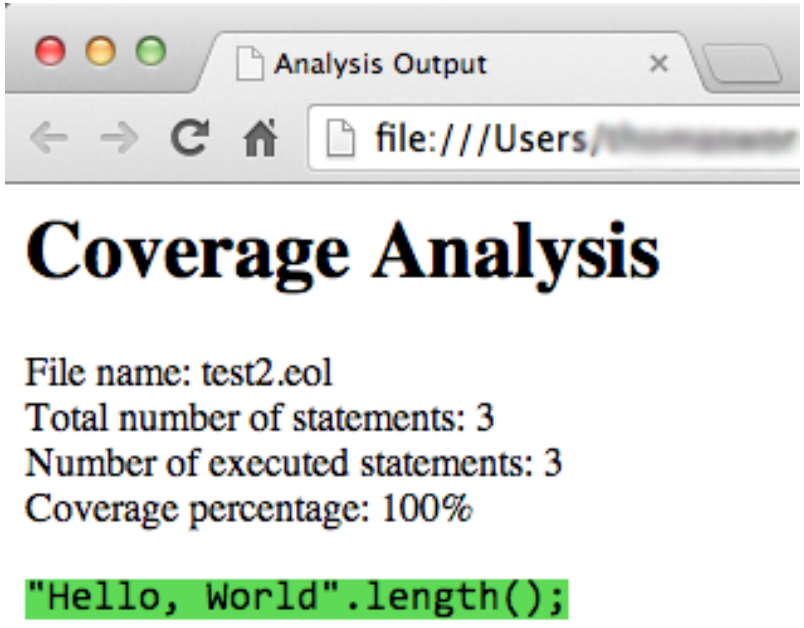


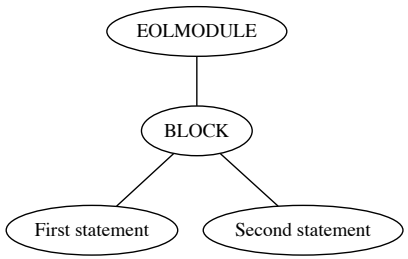
Figure : The fixed HTML output from test ST-01, shown in Google Chrome

Implementing Branch Coverage

- Need to count the number of branches executed
- Could consider each child of an AST, but there are some branches that we don't want to count
- Could consider all of the blocks of the AST, but there aren't always blocks (case statement, if statement).
- Need to consider path coverage

Implementing Branch Coverage - Creating a CFG

```
1  "First statement";
2  "Second statement";
```



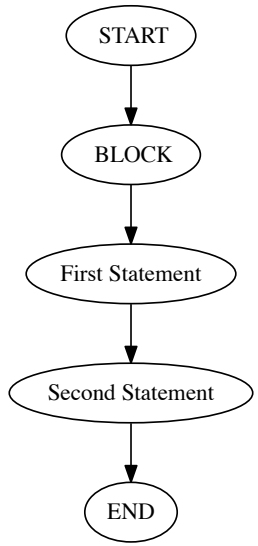
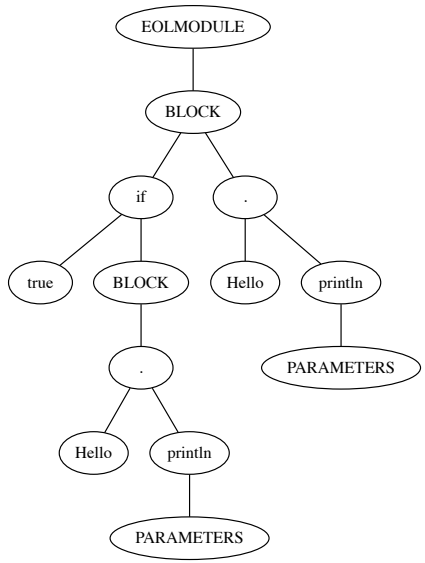


Figure : From left to right: The block's code, AST and desired CFG

Implementing Branch Coverage - Creating a CFG

```
1  if (true) {
2    "Hello".println();
3  }
4
5  "Hello".println();
```



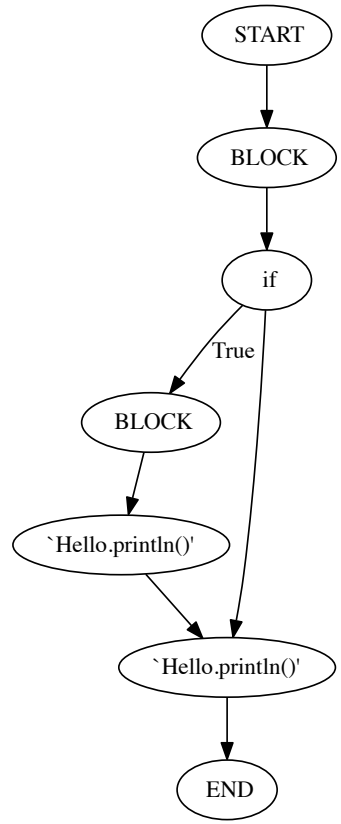
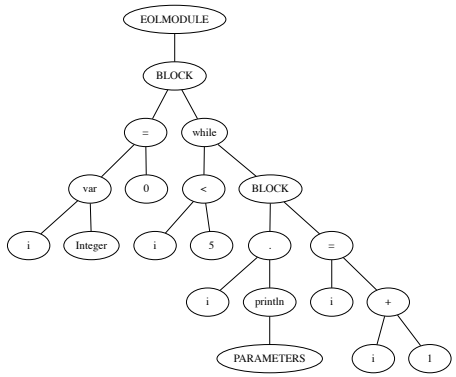


Figure : From left to right: Code for an if statement, its AST and desired CFG

Implementing Branch Coverage - Creating a CFG

```
1  var i : Integer = 0;
2
3   while (i < 5) {
4    i.println();
5    i = i+1;
6  }
```



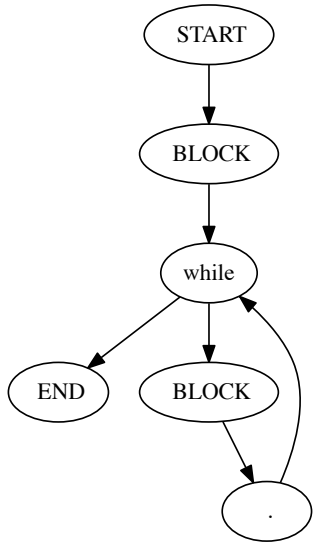


Figure : From left to right: The while loop code (taken from the Epsilon Book), AST and desired CFG

Implementing Branch Coverage - Creating a CFG

```
1  var i : Integer = 0;
2
3  switch (i) {
4    case 0 : "Zero".println();
5    case 1 : "One".println();
6    case 2 : "Two".println();
7    default : "Unknown".
         println();
8  }
```

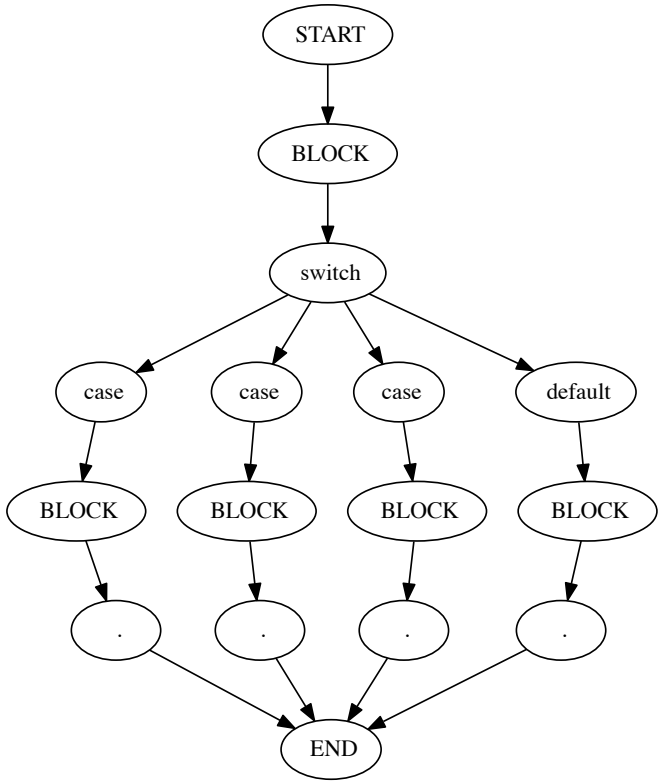


Figure : A switch statement and its CFG.

Implementing Branch Coverage - Conversion Algorithm

- Depth First Search
- Special cases for each statement
- Interface to add new statements

EuGENia Case Study

- EuGENia creates a GMF editor from an Ecore metamodel
- It is written in EOL
- It has an EUnit test suite

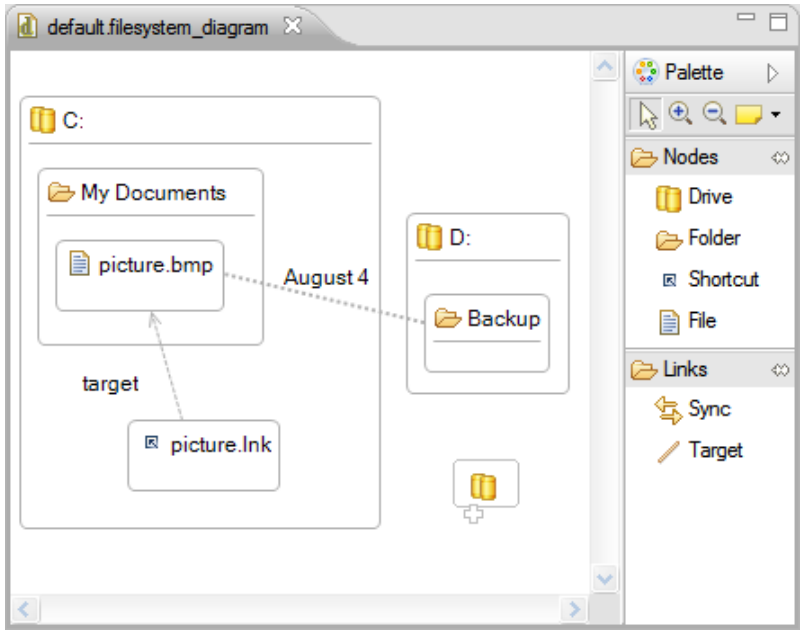


Figure : A sample gmf editor generated by EuGENia