Toshi’s Approach to Runtime Analysis

Black Box Scanning Tool

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White Box Testing Tool

Toshi's Black Box Scanning Tool

- **Same approach as:**
  - **Cenzic**
  - **SPI Dynamics**
  - **Watchfire**
- **Toshi's tool is unique because:**
  - **Built on Microsoft Visual Studio 2005 platform**
  - **Reuses Web application testing capabilities**
  - **Builds on existing test scripts**
    (not useful today; we didn't give him any scripts)

Black Box Scanning

1) **Traversing the application**
   - **Manual**
   - **Automated**

2) Testing the application
   - Signature analysis
   - Behavioral analysis

Traversing: Manual Crawl

- Manually map the application's interface
- Advantages
  - Can often achieve higher coverage
- Disadvantages
  - Time consuming

Traversing: Automated Crawl

- Enter starting URL and map the interface automatically
- Advantages
  - Easy to use
  - Sometimes comprehensive
- Disadvantages
  - Cannot crawl complex web applications
  - Make take a long time, looping redundant pages

Black Box Scanning

1) Traversing the application
   - Manual
   - Automated

2) **Testing the application**
   - **Signature analysis**
   - **Behavioral analysis**

Testing: Signature Analysis

- Search for specific strings in the HTTP response
- Example: SQL injection
  - “SQLException”
  - “OLE DB Provider”

Testing: Behavioral Analysis

- Identify behavior indicative of a vulnerability

- Example: Blind SQL Injection
  1. Inject original clause: id=3
  2. Inject true clause: id=3 AND 1=1
  3. Inject false clause: id=3 AND 1=0
  4. If

     (original==true && true != false)

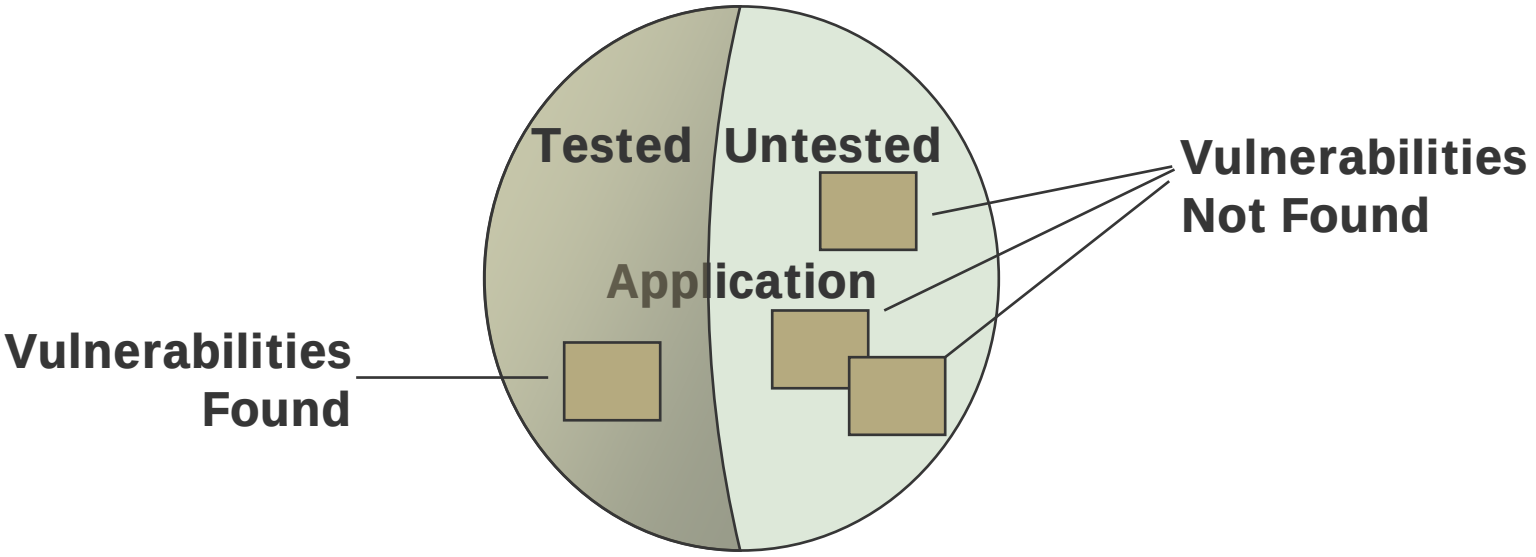
     then report SQL injection

Advantages Black Box Scanning

- **Advantages**
  - **If you have a running application, you can test it**
  - **Bugs are easy to verify (reproduce)**

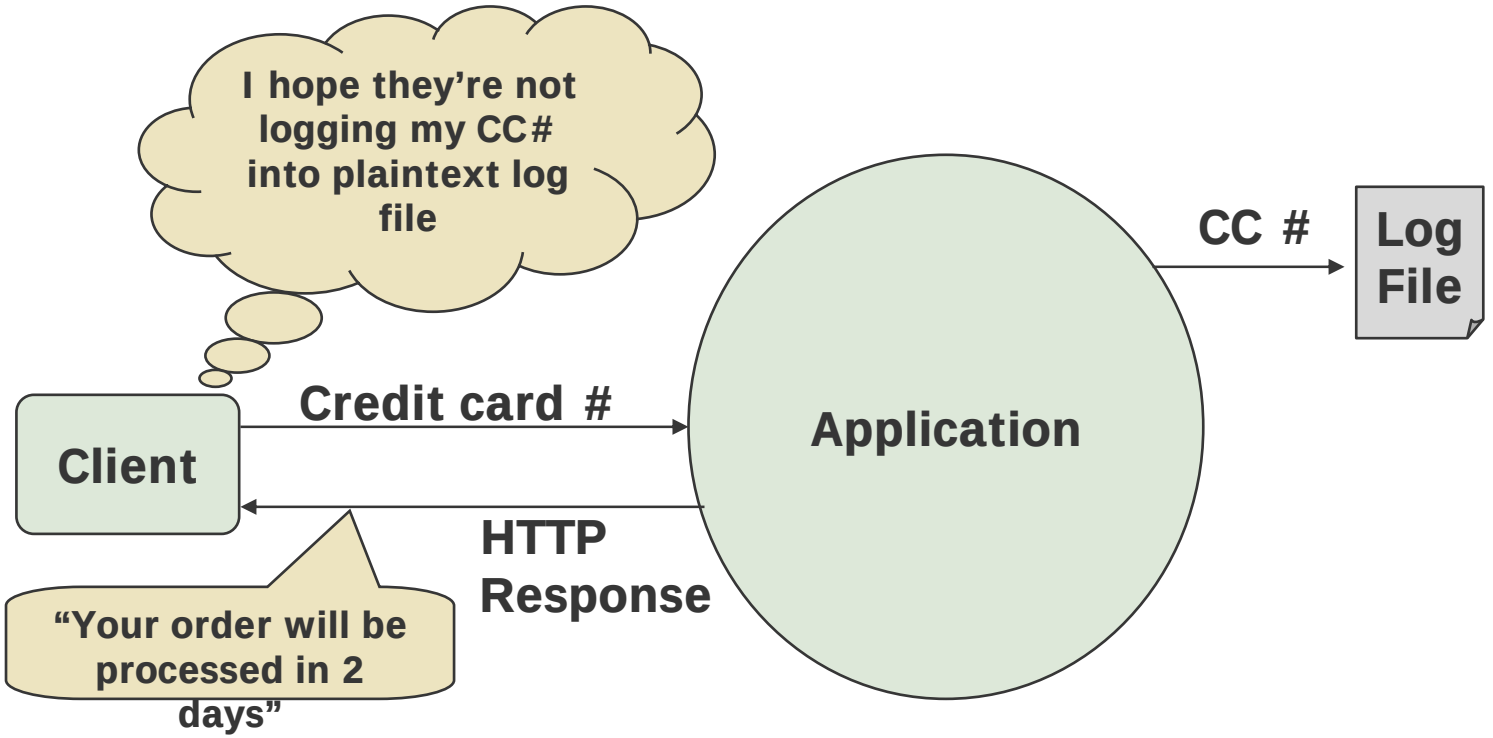
Disadvantages: Low Coverage

- You can't test what you can't reach



Disadvantage: Missing Oracles

- **Some vulnerabilities not visible from Web**



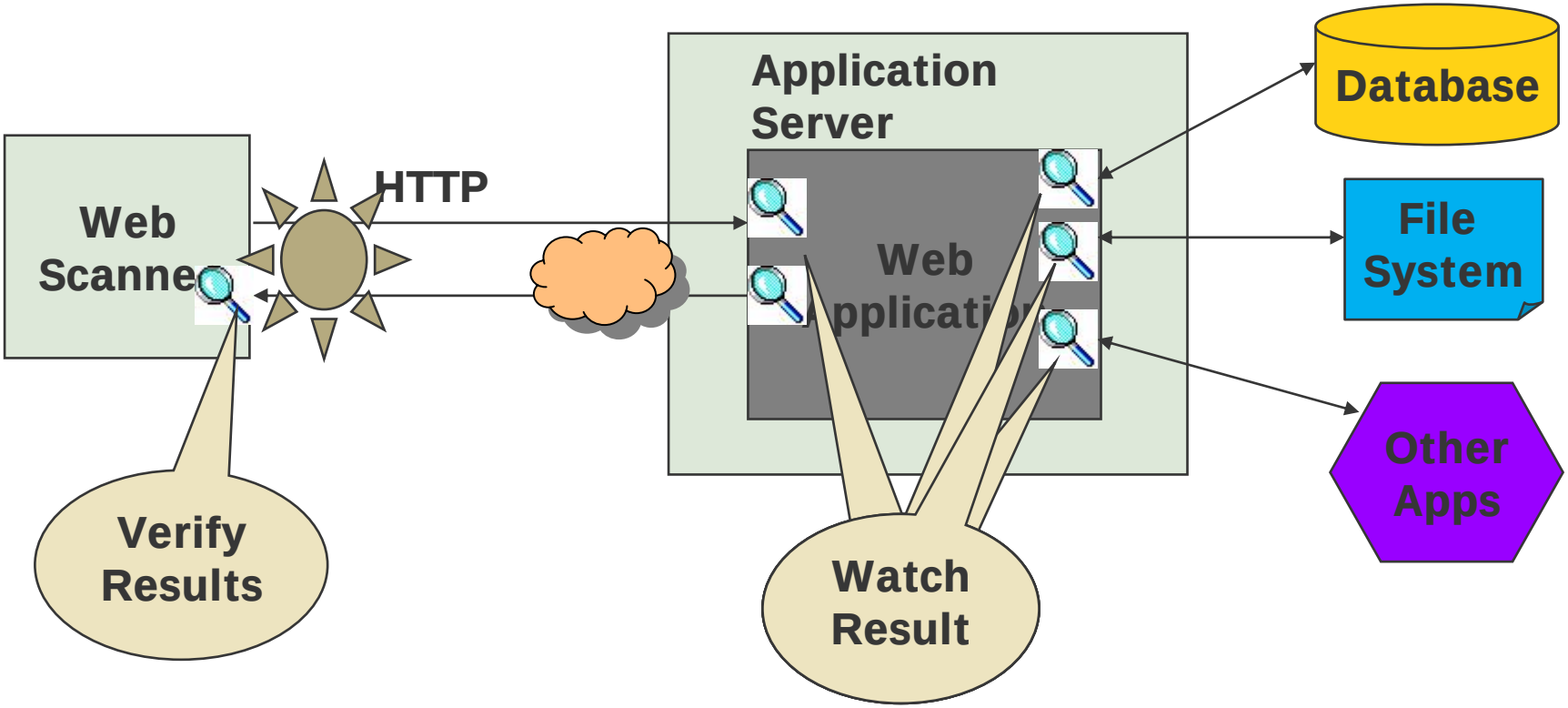
Toshi's Special Sauce: White Box Testing Tool

- **Insert monitors around security-relevant APIs**
  - **Sources of input**
    - **Web: ServletRequest.getParameter(String)**
  - **Sinks**
    - **Database: SQLStatement.executeQuery(String)**
    - **Process: Runtime.exec(String)**
    - **File: Log.log(String)**
- **Look for potential problems**

Combats Black Box Limitations

- **Coverage**
  - Percentage of security-relevant APIs exercised
- **Code-level details**
  - File name, line number and API details for bugs
- **Improved oracles**
  - Vulnerabilities not evidenced on Web

Black Box Scan + White Box Testing Tool

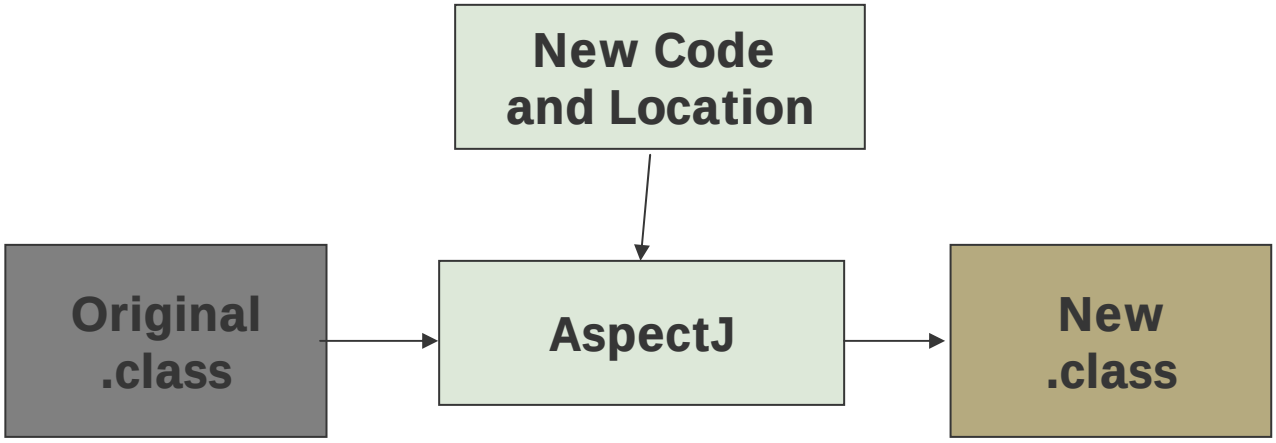


How To Inject Monitors

- Monitor code written as aspects
- Use aspect-oriented technology
  - AspectJ (Java)
  - AspectDNG (.NET)
- Works on bytecode
  - Java class files & .NET MSIL

  (no source code required)

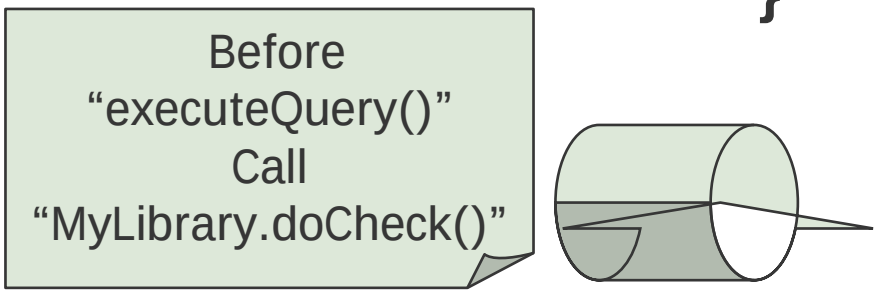
Bytecode Injection: Process



Bytecode Injection: Result

```
List getStuff(String id) {
  List list = new ArrayList();
  try {
   String sql = “select stuff from
   mytable where id=‘” + id + “’”;
   JDBCstmt.executeQuery(sql);
  } catch (Exception ex) {
   log.log(ex);
  }
  return list;
}
```

```
List getStuff(String id) {
  List list = new ArrayList();
  try {
   String sql = “select stuff from
   mytable where id=‘” + id +“’”;
   MyLibrary.doCheck(sql);
   JDBCstmt.executeQuery(sql);
  } catch (Exception ex) {
   log.log(ex);
  }
  return list;
}
```



Summary

- **Black box scanner**
  - Smart fuzzer (uses specific attack strings)
  - Oracles with signatures and behavioral analysis
- **White box testing tool**
  - Inject monitors
  - Provide coverage, code details, enhanced oracle