Road to Confidence in IT Systems: SAMATE's SATE and SRD projects

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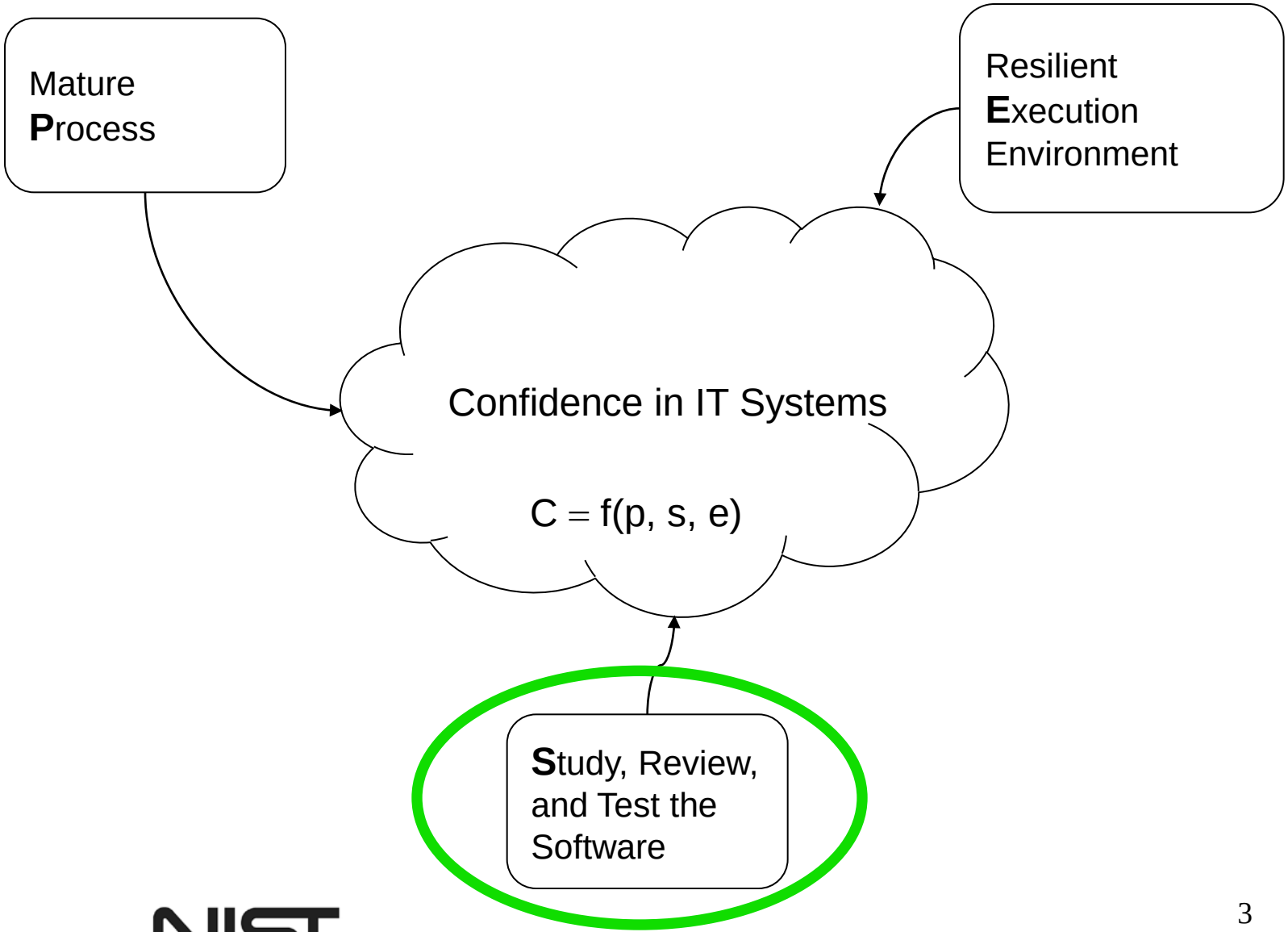
Software Assurance Metrics And Tool Evaluation (SAMATE) project

Current Areas of Concentration

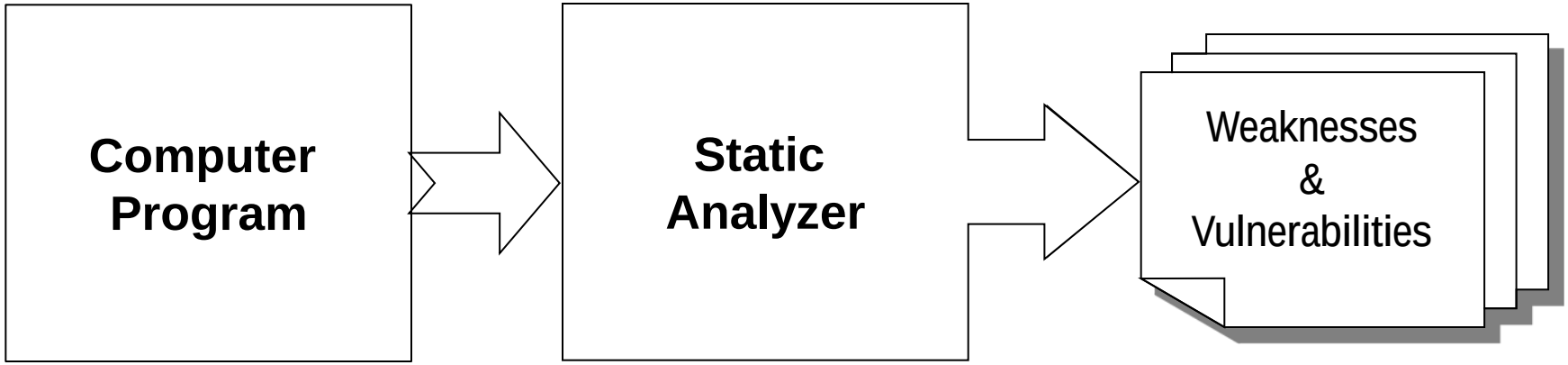
- Static source code security analyzers
- Static Analysis Tool Exposition (SATE)
- SAMATE Reference Dataset (SRD)
- Vote tools evaluation methodology
- Studies

http://samate.nist.gov/

SAMATE's Niche



What is a Static Analyzer?



- **Static analyzers check programs for bugs.**
- **They can't catch everything**
  - **e.g. sending data: should it be encrypted?**

How Good are Static Analyzers?

- **Does this analyzer find all bugs?**
  - **without too many false positives …**
- **Does it find all the bugs we know about?**
- **How well does it do for important bugs?**
- **How much is my confidence increased by using it?**
- **Is running it a good use of my time?**

Static Analysis Tool Exposition SATE

- **Goals:**
  - **Gather large test sets to enable empirical research**
  - **Encourage improvement of tools**
  - **Speed adoption of tools by objectively demonstrating their use on real software**
- **Steps**
  - **We choose open source programs with security implications**
  - **Participants run tools and return reports**
  - **We analyze reports**
  - **Everyone shares observations at a workshop**
  - **We release final reports and data later**

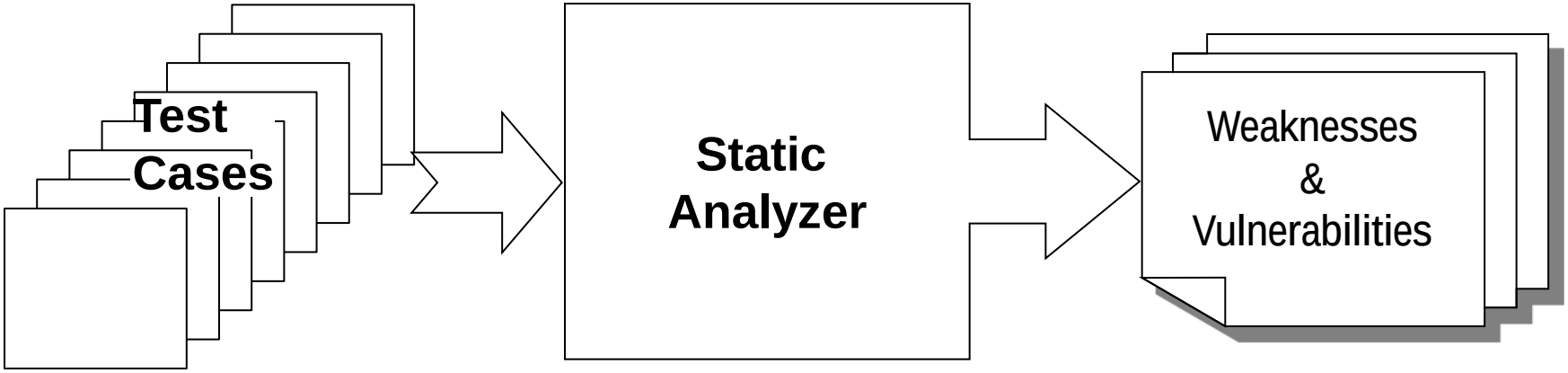
http://samate.nist.gov/SATE.html

SATE Overview

- **We held four SATEs since 2008.**
- **Test sets were in C/C++, Java, and PHP and consisted of about 26,000,000 LoC.**
- **19 teams on 4 continents participated.**
- **We received a combined 128,043 warnings***

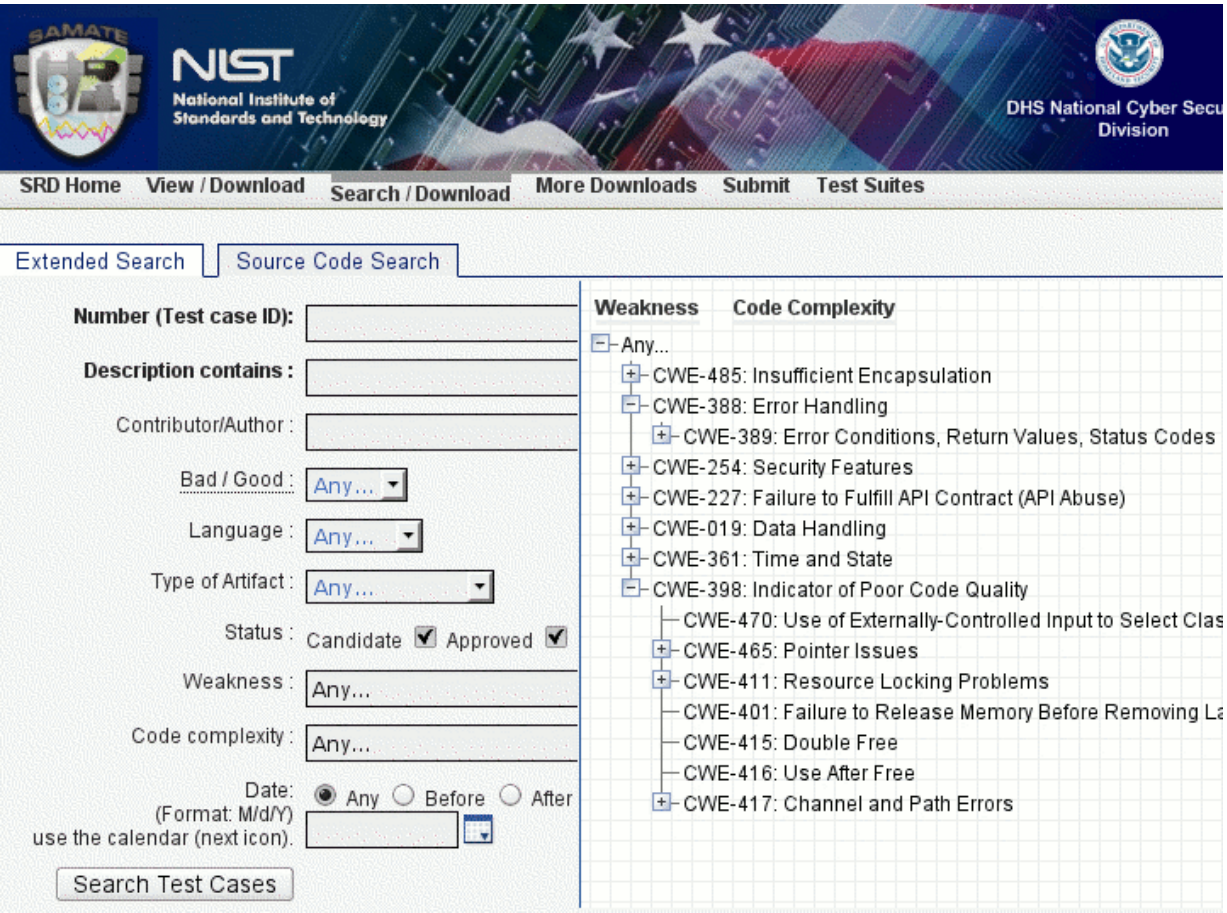
- **We better understand subtleties of finding, designating, and counting weaknesses.**

How can We Test Static Analyzers?



- **Come up with a small set of test programs with known bugs.**
- **The result of running a tool on the set is correlated with the result on large, real-world programs.**

SAMATE Reference Dataset (SRD)



- **Public repository of over 60,000 test cases in C++, C, Java, C#, PHP, etc. covering 147 classes of weaknesses.**
- **User can search by language, weakness, code construct, etc.**
- **Contributions from Fortify, Defence R&D Canada, Klocwork, MIT Lincoln Laboratory, Praxis, Secure Software, and others.**

samate.nist.gov/SRD

58	2005-11-02	Java	Source Code	SecureSoftware	C	Not using a a random initialization vector with Cipher Block ...	✗
71	2005-11-07	Java	Source Code	SecureSoftware	C	Omitting a break statement so that one may fall through is often ...	✗
1552	2006-06-22	Java	Source Code	Jeff Meister	C	Tainted input allows arbitrary files to be read and written.	✗
1553	2006-06-22	Java	Source Code	Jeff Meister	C	Tainted input allows arbitrary files to be read and written. ...	✓
1554	2006-06-22	Java	Source Code	Jeff Meister	C	Two file operations are performed on a filename, allowing a filenamer	✗
1567	2006-06-22	Java	Source Code	Jeff Meister	C	The credentials for connecting to the database are hard-wired ...	✗
1568	2006-06-22	Java	Source Code	Jeff Meister	C	The credentials for connecting to the database are hard-wired ...	✓
1569	2006-06-22	Java	Source Code	Jeff Meister	C	The credentials for connecting to the database are hard-wired ...	✓
1570	2006-06-22	Java	Source Code	Jeff Meister	C	An exception leaks internal path information to the user.	✗
1571	2006-06-22	Java	Source Code	Jeff Meister	C	An exception leaks internal path information to the user. (fixed ...	✓
1579	2006-06-22	Java	Source Code	Jeff Meister	C	Tainted output allows log entries to be forged.	✗

```
public class File1_bad extends HttpServlet
{
    public void doGet(HttpServletRequest req, HttpServletResponse res)
        throws ServletException, IOException
    {
        res.setContentType("text/html");
        ServletOutputStream out = res.getOutputStream();
        out.println("<HTML><HEAD><TITLE>Test</TITLE></HEAD><BODY><blockquote><pre>");

                String name = req.getParameter("name");
                String msg = req.getParameter("msg");
                if(name != null) {
                        try {
                                File f = new File("/tmp", name);                    /* BAD */
                                if(msg != null) {
                                        FileWriter fw = new FileWriter(f);          /* BAD */
                                        fw.write(msg, 0, msg.length());
                                        fw.close();
                                        out.println("message stored");
                                } else {
                                        String line;
                                        BufferedReader fr = new BufferedReader(new FileReader(f));
                                        while((line = fr.readLine()) != null)
                                                out.println(line);
                                }
                        } catch(Exception e) {
                                throw new ServletException(e);
                        }
                } else {
```