Design & Operational Review

Penetration Testing & Vulnerability Analysis

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Agenda

- What are Design Flaws?
- Example Design Flaws
- Performing Design Review
- Setting up Implementation Review

- What are Operation Security concerns?
- Example operational security concerns
- Thinking about operational security

Design Flaws

What are design flaws (vulnerabilities)?

- "A design vulnerability is a problem that arises from a fundamental mistake or oversight in the software's design" – The Art of Software Security Assessment

- Lack of security forethought
- Intrinsic to the app's architecture
- Can be subtle
- Are often devastating

Design Flaws = Ownage

- Reliable!
  - Work seamlessly across OSes/versions
  - Do not corrupt memory!
  - Usually have little/no preventative protection mechanisms
  - Rarely alarm detection tools
  - Do not crash on failure ☺
- Easily fingerprinted
- Work well in symphony
- Difficult to fix, so they hang around for a while ☺

Design Flaws Commonly Affect

- Authentication
  - Bypasses
  - Lack of Authentication
- Authorization
  - Lack of Authorization
  - Giving higher privileges to lower privileged users
- Cryptography
  - Storing key with plaintext
  - Improper use
- Business Logic

Design Flaws Examples

- RealVNC NULL Authentication Method, Authentication Bypass in 2006

```
switch(authentication_type)
{
    case USE_PASSWORD:
        getCredentials(&creds.password);
        if (validateCreds(creds))
        {
            auth_flag = 1;
        }
        break;

    case USE_NULL_AUTH:
        auth_flag = 1;
        break;
}
```

Design Flaws Examples

- Vendor inserted Backdoors
  - Barnaby Jack's ATM Jackpotting attack

- Debugging/QA hardcoded usernames/passwords

```
if (!strcmp(password, "8==D"))
{
        auth_flag = 1;
        break;
}
```

Design Flaws Examples

- Authorization oversights
  - Java deserialization vulnerabilities

```
try {
        ZoneInfo zi = (ZoneInfo)

        AccessController.doPrivileged(
            new PrivilegedExceptionAction() {
            public Object run() throws Exception {
               return input.readObject();
            }
});

if (zi != null) {
         zone = zi;
     }
} catch (Exception e) { }
```

Design Flaws Examples

- Authorization oversights
  - Checks not performed on portions of a web application (forced browsing)
- Cryptographic misunderstandings
  - Hardcoded keys
  - Storing/Sending key with cipher text

Finding Design Flaws, Steps

- Collect Information
- Model the Application
- Understand Business Logic, Intention & Architecture
- Use Above to Target Areas
- Busticate the Application

Information Collection

- Application Specs, RFCs, etc
- Architectural Documentation
- Data Flow Diagrams
- *Especially anything on security relevant matters*

Modeling the application

- **Identify Resources**

  Resources are anything used by the application which may be useful to an attacker

  - Data (Creds? Personal info?) used by the application
  - Control the application has or grants access to

- All of resources combined represent every piece of access to data or functionality offered by a system

Modeling the application

- **Examine Input**
  - What type of input does the application get?
  - Where/Who does the data come from?
  - What is the purpose of the input?
  - Track the input data flow
  - How trusted is the data?
  - How much validation is performed on the data?

Modeling the application

- **Something to think about**

Any external influence you can provide which affects the program is input!

Modeling the application

- **Examine Output**
  - What type of output data is there? (Is it sensitive?)
  - Where does the output go?
  - How does the input result in output?
  - How can the data be leveraged by an attacker?

Modeling the application

- **Something to think about**

Any observation of a program response that can be measured is output

Modeling the application

- **What type of External Components are there?**
  - Network Services used by the application?
  - Libraries?
  - Databases?
  - Anything the application relies on that is not part of the application itself

Modeling the application

- **User Roles**
  - What are the various roles of users?
  - What types of users can exist?
  - How do they identify themselves?
  - How is a user authenticated?
  - How are privilege levels defined?
  - Where are user roles unclear?

Modeling the application

- **Trust Boundaries**
  - Given the user roles, and the resources, where should trust boundaries lie?
  - Where is trust granted by the application to external components
  - Are these trust boundaries enforced uniformly?
  - Are there unclear areas of trust?

Modeling the application

- **After reviewing each area, combine your observations**
- **Use the above to identify targets**
- **Yes, it's cliché, but "Think Like an Attacker"**
  - Where was security not considered?
  - Where do the security considerations fall short?
  - Edge cases?
  - Logical flaws?
  - Think about what the app can do beyond what it was intended to
  - How can the application deviate from the intent?

Modeling the application

- **Review the target components**
- **Think about the logic of the application**
- **Try and think beyond the intentions of the developer**
- **Even if no architectural or design flaws are found, take notes and keep the information…**

All of the gathered information will be useful for implementation reviews!!!

Operational Review

What are operational flaws (vulnerabilities)?

- "Operational vulnerabilities are the result of issues in an application's configuration or deployment environment. " – The Art of Software Security Assessment

- Infrastructure supporting the application
- Environmental concerns

Operational Concerns

- Operational issues happen outside the scope of the application
- Not problems which will be indicated in the source itself
- Possible concerns can be inferred by thinking about what the application does, and how it is likely deployed

Operational Review

- Poor configuration?
- External components…
  - Databases setup with open ports, default passwords
  - Default scripts left around web servers
  - Anonymous logins allowed on ftp servers
  - Unpatched components
- Failure to use secure technologies around the application's deployment
  - Lack of SSL on web servers exchanging creds
  - Poorly generated certificates/bad random data (Debian is an example)

Operational Review

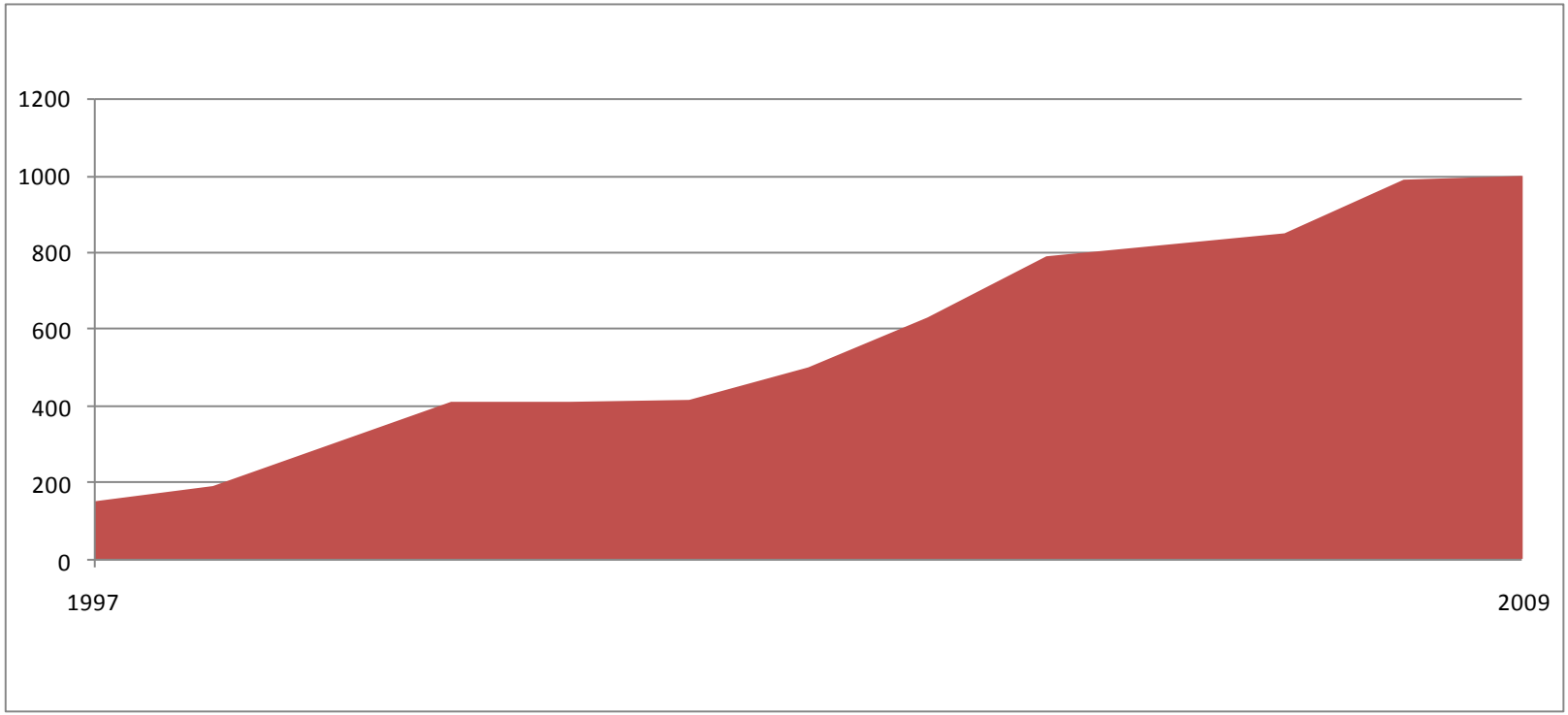
- Security Hardening Mechanisms
  - DEP
  - Stack Cookies
  - Hardened Heap
  - SEH validation
  - Address Space Layout Randomization
- Policy, security in depth
  - Network segmentation
  - System user roles
  - Chroot jails
  - Firewalls, application firewalls

Operational Review

- Think about the application is probably deployed
- How can it be abused?
- What do admins notoriously fail at in this way?

Graph Slide that shows NOTHING

LOL THIS IS MEANINGLESS



This data is useless

Questions?