CIS 4163: Application Security Technologies

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Vulnerability scanning programs

Introduction

- Today, **data is the most active thing in organizations and the circular Internet**.
- The **attacker also travels across the Internet and is becoming more sophisticated bias**.
- Often administrators **can not identify the vulnerabilities of the system due to lack of means**.
- Mainly due to **the high cost of proprietary software solutions for vulnerability scanning** and **creating reports automatically**

Tools/programs: N**essus**

- is a **tool for vulnerability scanning**.
- it is **a fault verification program / security vulnerabilities** (ports, vulnerabilities, exploits).
- **It consists of a client and server**, and the **scan itself is done by the server (Nessus server).**
- Nessus **helps identify and resolve vulnerabilities some problems.**
- The **Server part executes the tests while the client part allows configuration and reporting**.
- Nessus is distributed under the terms of the **GNU General Public License**.

Skipfish

- This tool for **security test to fully automated sites and is very light and very fast** (can run 2,000 requests per second).

- As well as other security tools, **it has several types of safety tests, including Blind SQL Injection.**

- The program works on **Windows, Linux and Mac OS X.**

Wireshark:

- Formerly known as **Ethereal** **is a program that analyzes network traffic and organizes for protocols**.

- The features of **Wireshark are similar to tcpdump but with a GUI interface**, with **more information and the possibility of using filters.**

- It is then **possible to control the traffic of a network and know everything that goes in and out of the computer**, in different protocols, or network to which the computer is connected

For verification programs for security vulnerabilities visit:

- http://sectools.org/tag/sniffers/
- http://webresourcesdepot.com/10-free-web-application-security-testing-tools/
- http://insecure.org/tools/tools-pt.html

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Packet Sniffers

- A packet sniffer is **a wire-tap devices or software that plugs into computer networks and eavesdrops on the network traffic**.
- It basically **allows you to listen to other peoples conversations**.
- **This is done using a sniffing program**.
- The packet sniffer **can intercept and log traffic passing over a digital network or part of a network**.
- When **data streams moves with networks, the sniffer captures each packet and eventually decoded and analyzes it's content according with any specifications.**

How a packet sniffer works

- Ethernet was built around a principle known as **a shared principle where all machines on a local network share the same medium like same wire**.
- **This means that all machines can see and hear all the traffic that is transmitted over the same medium like same wire**.
- To avoid this issue, **the Ethernet hardware is built with a filter that ignores all traffic that does not belong to it.**
- This is **done by avoiding all frames whose MAC address doesn't match**.
- So in **order for a sniffer program to operate in these circumstances, it turns off this filter from the Ethernet hardware**.
- By turning the filter off, it puts the Ethernet hardware into a mode known as **promiscuous mode**.
- **This makes all the traffic visible from all machines that are sharing the same medium.**

The uses of a packet sniffer

- Packet Sniffer programs have been existing for such a long time and can be used in two forms:

➢ **Commercial packet sniffers**: These can be used to help maintain networks

➢ **Underground Packet sniffers**: These are used to break into computers

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- This nature of packet sniffers means it can be used to do different things like:

- Analysing network problems
- Detecting network intrusion attempts
- Gaining information for effecting a network intrusion
- Gather and report network statistics
- Filter suspect content from network traffic
- Debug client/server communication

Components of a packet sniffer

- The components of a packet sniffer include:

- **The hardware:** Most **products work from the standard network hardware adapters, even though some require special hardware**. **The reason for special hardware is that they have the capability to analyze hardware faults like CRC errors, voltage problems, cable programs, jitter, etc**

- **Capture Driver**: This is the most important part. **It captures the network traffic from the medium like the wire, filters it for the particular traffic you want, then stores it in a buffer**

- **Buffer**: **Once the frames are captured from the network, they are stored in a buffer**

- **Decode**: This **displays the contents of the network traffic with descriptive text so that an analysis can figure out what is going on**.

- **Packet editing/transmission**: **Some products contain features that allow you to edit your own network packets and transmit them onto the network**

Vulnerability Scanners

- A vulnerability scanner is **software application that assesses security vulnerabilities in networks or host systems and produces a set of scan results.**

- However, because both administrators and attackers can use the same tool for fixing or exploiting a system, **administrators need to conduct a scan and fix problems before an attacker can do the same scan and exploit any vulnerabilities found.**

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- A vulnerability **scanner can assess a variety of vulnerabilities across information systems (including computers, network systems, operating systems, and software applications)** that may have originated from a vendor, system administration activities, or general day to-day user activities:

- **Vendor-originated:** this includes **software bugs, missing operating system patches, vulnerable services, insecure default configurations**, and web application vulnerabilities.

- **System administration-originated:** this includes **incorrect or unauthorised system configuration changes, lack of password protection policies, and so on.**

- **User-originated:** this includes **sharing directories to unauthorised parties, failure to run virus scanning software**, and malicious activities, such as deliberately introducing system backdoors.

The Benefits of Vulnerability Scanners

- Firstly, **a vulnerability scanner allows early detection and handling of known security problems.** By employing ongoing security assessments using vulnerability scanners, it is easy to identify security vulnerabilities that may be present in the network, from both the internal and external perspective.

- Secondly, **a new device or even a new system may be connected to the network without authorisation. A vulnerability scanner can help identify rogue machines, which might endanger overall system and network security.**

- Thirdly, **a vulnerability scanner helps to verify the inventory of all devices on the network.** The inventory includes the device type, operating system version and patch level, hardware configurations and other relevant system information. This information is useful in security management and tracking.

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The Limitations of Vulnerability Scanners

- The drawbacks of vulnerability scanners are:

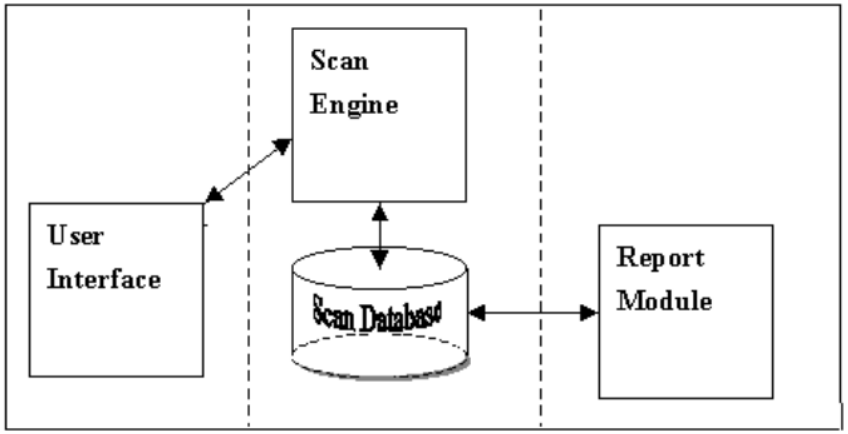
➢ **Snapshot only**: a **vulnerability scanner can only assess a "snapshot of time" in terms of a system or network's security status**. Therefore, scanning needs to be conducted regularly, as new vulnerabilities can emerge, or system configuration changes can introduce new security holes.

➢ **Human judgement is needed**: **Vulnerability scanners can only report vulnerabilities according to the plug-ins installed in the scan database**. They cannot determine whether the response is a false negative or a false positive. Human judgement is always needed in analysing the data after the scanning process.

➢ **Others: a vulnerability scanner is designed to discover known vulnerabilities only. It cannot identify other security threats**, such as those related to physical, operational or procedural issues.

Architecture of Vulnerability Scanners

- In general, a vulnerability scanner is made up of four main modules, namely, **a Scan Engine, a Scan Database, a Report Module and a User Interface**



Components of Scanner

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- The **Scan Engine** **executes security checks according to its installed plug-ins, identifying system information and vulnerabilities**. It can scan more than one host at a time and compares the results against known vulnerabilities.

- The **Scan Database** **stores vulnerability information, scan results, and other data used by scanner**. The number of available plug-ins, and the updating frequency of plug-ins will vary depending on the corresponding vendor. Each plug-in might contain not only the test case itself, but also a vulnerability description, a Common Vulnerabilities and Exposures (CVE) identifier; and even fixing instructions for a detected vulnerability. Scanners with an "auto-update" feature can download and install the latest set of plug-ins to the database automatically.

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- The **Report Module** **provides different levels of reports on the scan results, such as detailed technical reports with suggested remedies for system administrators**, summary reports for security managers, and high-level graph and trend reports for executives.
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- The **User Interface** **allows the administrator to operate the scanner.** It may be either a Graphical User Interface (GUI), or just a command line interface.

Types of Vulnerability Scanners

- Vulnerability scanners can be divided broadly into two groups:

➢ **Network-based scanners that run over the network**

➢ **Host-based scanners that run on the target host itself**.

Network-Based Scanners

- A network-based scanner is **usually installed on a single machine that scans a number of other hosts on the network.**

- It helps **detect critical vulnerabilities such as mis-configured firewalls, vulnerable web servers,** risks associated with vendor-supplied software, and risks associated with network and systems administration.

Different types of network-based scanners include:

- **Port Scanners** that **determine the list of open network ports in remote systems**
- **Web Server Scanners** that **assess the possible vulnerabilities (e.g. potentially dangerous files) in remote web servers**
- **Web Application Scanners** that **assess the security aspects of web applications (such as cross site scripting and SQL injection) running on web servers**. It should be noted that web application scanners cannot provide comprehensive security checks on every aspect of a target web application. Additional manual checking (such as whether a login account is locked after a number of invalid login attempts) might be needed in order to supplement the testing of web applications.

Host-Based Scanners

- A host-based scanner **is installed in the host to be scanned, and has direct access to low level data, such as specific services and configuration details of the host's operating system**.
- **It can therefore provide insight into risky user activities** such as using **easily guessed passwords or even no password**.
- **It can also detect signs that an attacker has already compromised a system**, including looking for suspicious file names, unexpected new system files or device files, and unexpected privileged programs.
- Host-based scanners **can also perform baseline (or file system) checks**. Network-based scanners cannot perform this level of security check because they do not have direct access to the file system on the target host.

Type of Host-based scanner

- **A database scanner** is an example of a host-based vulnerability scanner.

- **It performs detailed security analysis of the authorisation, authentication, and integrity of database systems**, and can identify any potential security exposures in database systems, ranging from weak passwords and security mis-configurations to Trojan horses.

Thank You

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