Invaders at The Gates: Last Minute Defenses for Impending Attacks

Mohammed ALDOUB
Computer Engineer

OWASP Kuwait chapter leader

@Voulnet

Introduction

- OWASP is an organization of security volunteers with focus on openness and education.

- +30,000 subscribers, +190 chapters, +140 projects.
- Vendor neutral. Really.

- Focus on open source tools

  https://www.owasp.org

The Defender's Dilemma

- Defender: must protect everything at all times, and keep an eye on everything.
- Attacker: needs just one weakness. One entry is enough.
-
- Advantage: Attackers
- However, with the right tools and skills, you can turn the defender's dilemma into…:

The Intruder's Dilemma*

- Defender: Needs to detect just one attack attempt (even unsuccessful ones) to block attacker.
- Attacker: Needs to hide all of his attack attempts.
- Advantage: Defenders

- * Defender's Dilemma vs Intruder's Dilemma, Richard Bejtlich

Reactive Defense

- Few defenders plan and install defenses ahead of time:
  - Project deadlines
  - Slow patching process:
  - Budgets
- In reality, perfection is never the goal. The goal is to just fend off current attacks, buy time, and limit any possible damage.
- Defenders must ***buy time*** and pinpoint attacks.

Buying Time

- Buying time for the defender is probably the best possible method to deal with surprise/ incoming attacks.
- A longer response window allows better reactive defense. Think **Tower Defense**.
- Give yourself more time to defend & detect.

Impending Attacks

- A hacking group declares war against your enterprise.
- Or you receive notification on an incoming attack.
- You are not prepared, possibly with lack of tools and policy.
- Not all hope is lost, you can still save yourself!

First Things First

- Inform the other sysadmins, some lead developers, and possibly a manager.
- Ask for the **glaring** holes:
  - Do we have something that is *very insecure*?
  - Any online systems *(even if for testing)* with weak credentials? *(9/10 chance there are)*
  - Is logging turned on? *(you'll need it soon)*
- You **can't** buy time with these problems.

Locking Down the Perimeter

- If all of the working sysadmins are on-site, turn off remote access (SSH, RDP, VPN).
- Turn off Remote Desktop anyways!
- If sysadmins are not onsite, and need to work remotely:
  - Only allow their remote IP addresses
  - If passwords are weak, change them and send them out of band (Make sure they're temporary!)
  - If there is a need to communicate, don't use corporate email.

Know Your Borders

- Check all exposed ports and applications, and their versions. This will allow you to map the possible attack vectors and know your ground.

- Expect: FTP, SMTP, test websites on port 8080, SQL exposed ports, old Wordress versions.
- Don’t just use **netstat**, also **nmap** your machines from outside; this will give you a realistic result.

- If possible, apply all security patches. If not possible, try Virtual Patching (coming later)

DNS

- Always overlooked!
- Check your DNS zone. Take down any old, unnecessary or known-vulnerable domain.
- Disable zone transfers except for trusted servers.
- Don’t give attackers the luxury of knowing all of your domains.

Defaults Are Deadly

- Inquire about and remove any default accounts/ passwords on your systems. People get compromised daily for this!
- For IIS: Remove IISSamples, IISAdmin, IISHelp. Disable WebDAV and FPSE.
- Wordpress: Remove install.php
- Oracle systems have MANY default accounts!
- Attackers always check defaults (using scripts)

Unconventional Defense

- Always think in the context of buying time and confusing attackers.

- If your attackers are exchanging attack plans online (Twitter, IRC) join them and:

1. Know their plans.
2. Disrupt it.
3. Redirect it.
4. Spread false info.
5. Submit false URLs -> then block IPs that access it.

- Just buy time.

Unconventional Defense

- Confuse your attackers (Or their tools) with false data.
- Providing false data buys more time than no data.
- Provide false server version and DB type.
- Set server version info to an old vulnerable version:
  - Enjoy as hackers try old non-working exploits.
  - Buy yourself more time (and fun)
  - Allows you to better filter their IP addresses.
- It’s okay to lie to attackers.

Virtual Patching

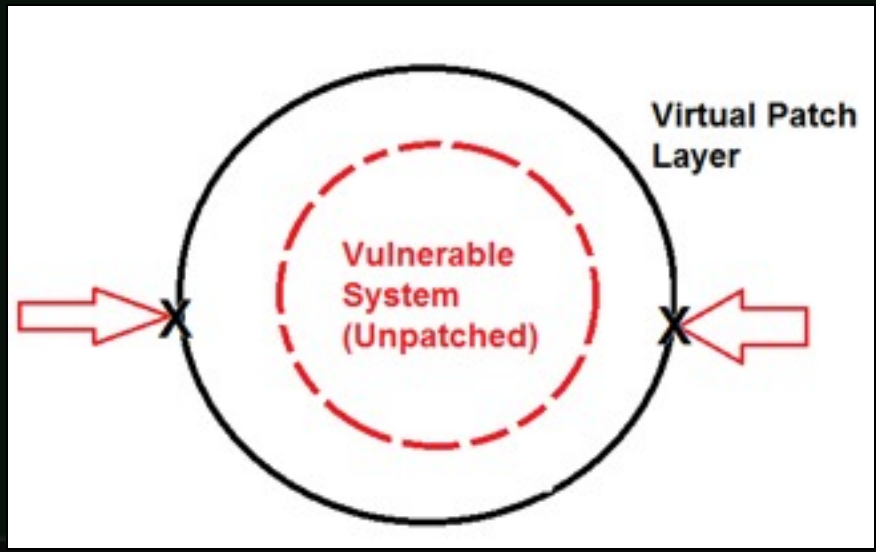
- Actual patching is not always feasible:
  - Updates may break dependencies.
  - Code updates take a long time
- Enter Virtual Patching:
  - A security policy enforcement layer which prevents the exploitation of a known vulnerability.
- OWASP has great resources on Virtual Patching:
  - **Virtual Patching Best Practices**
  - **Virtual Patching Cheat Sheet**

Virtual Patching

- Virtual Patching protects vulnerable, unpatched applications by blocking attacks before they go through.
- “50% security in 10 minutes is better than 100% security in 48 hours”

- Usually Implemented with Web App Firewalls.

- We will focus on:
  - ModSecurity



ModSecurity

- ModSecurity is a Web Application Firewall from Trustwave that detects attack patterns and blocks malicious requests before they reach an application.
- ModSecurity works on Apache, IIS and Nginx.
- ModSecurity needs rules to work.
- OWASP publishes excellent rules.

OWASP ModSecurity Core Rule Set Project

- OWASP provides an excellent list of free rules for ModSecurity, protecting you against SQL Injection, XSS, Command Injection…etc
- Easy to install on any system, and easy to configure. Can be done in 5 minutes!
- A **very** important addition to your defenses!
- You must try ModSecurity!

OWASP ModSecurity Core Rule Set Project

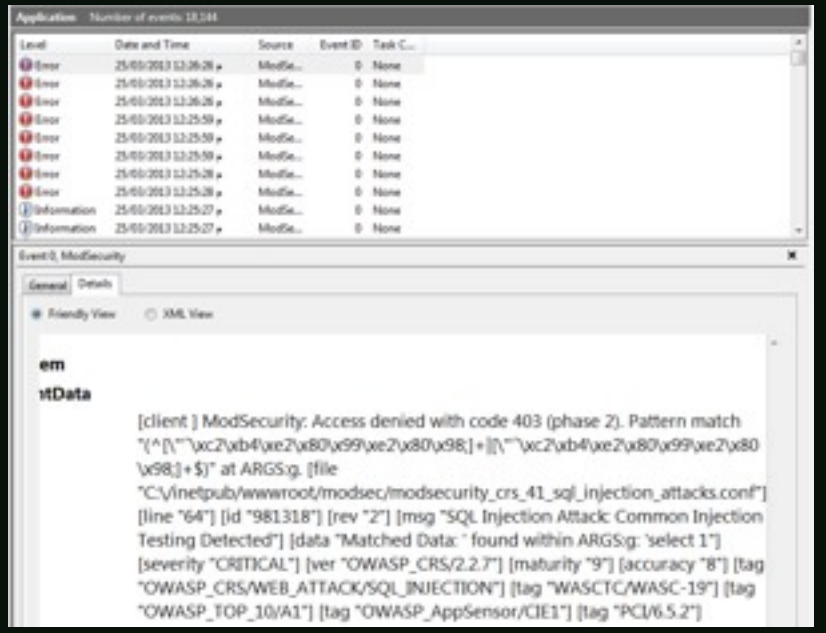
- Components:
  - A *modsecurity.conf-recommended* file to bootstrap ModSecurity rules.
  - The rest of the ModSecurity rules (We will use OWASP CRS rules)
  - The ModSecurity log files.
- Setting up:
  - Windows: Use official installer.
  - Linux: Source or distro repositories.

OWASP ModSecurity Core Rule Set Project

- After installing ModSecurity, copy the OWASP CRS rule files into location (apache conf or IIS inetpub).
- Set SecRuleEngine to DetectionOnly as a safe start in *modsecurity.conf-recommended* file.
  - When all is okay, set it to On to start blocking.
- Copy or symlink the desired rules to activated_rules directory.
- Include them in the *modsecurity.conf-recommended* file by adding:
  - Include modsecurity_crs_10_setup.conf
  - Include activated_rules*.conf

OWASP ModSecurity Core Rule Set Project

- Installation steps might differ depending on your OS, but it shouldn't take more than 5 minutes.
- Logs can be found in apache log folders, or the Application Event Log for the IIS version.
- Modify the logging directories to something writable.
- You're good to go!



Augmented Virtual Patching

- Instead of hoping your ModSecurity rules just work, you can augment it with dynamically-created rules.
- More ModSecurity rules can be created out of Security Scanners results!
- Scan with Arachni, OWASP ZAP Proxy and others.
- Use arachni2modsec.pl and zap2modsec.pl scripts to generate rules based on your web app vulns.

OWASP Zed Attack Proxy

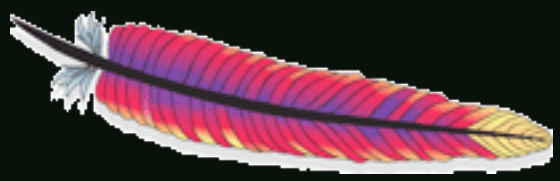
- An excellent, easy to use integrated security testing tool by OWASP.
- Features: Active/Passive scanning, crawling, bruteforcing, spidering, fuzzing, smartcard support… etc
- Use it against your web applications, then generate ModSecurity rules with the zap2modsec.pl script to block attacks.
- An easy method to add another defense

You still have to Secure It

- Even with virtual patching, WAFs, and security patches, you still have to secure your configurations and watch your logs.
- We will discuss quick and dirty security notes for Apache, IIS, Linux and Windows.
- We won’t focus on hardening tips that take a lot of time and planning. If you had time, you shouldn’t be in trouble!
- Understand what you do. Don’t screw your systems.

Apache

- Make sure it runs under its own user (apache or www-data), definitely NOT root!
  - grep -ir 'APACHE_RUN_USER' /etc/apache2
- Check permissions in web root. Web files shouldn't be writable by apache, unless by design (logs, file upload feature..etc) chmod & chown the rest to root.
- Apache doesn't need shell access, remove its shell:
  - chsh -s /dev/null www-data [or apache]
- Update Apache if possible.



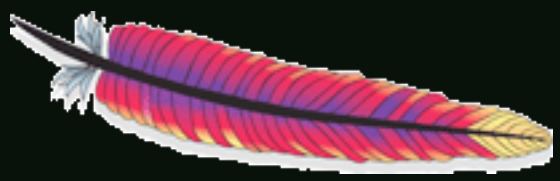
Apache

- Disable Server Side Includes (if not used) with Options –Includes
- Disable CGI scripts (if not used) with Options –ExecCGI
- Disable directory browsing with Options –Indexes (← They always forget that!)
- Disable Apache mod_status, mod_userdir, mod_info, mod_autoindex.
  - a2dismod autoindex
  - a2dismod status

Apache

- Check it doesn't have a UID of 0:
  - grep www-data <or apache> /etc/passwd
- Lock the Apache user, it doesn't need to login:
  - passwd -l www-data (or apache)
- Install the **Sohusin** and **PHPIDS** security plugins.
- Prevent .htaccess modification with:

```
<Directory />
AllowOverride None
</Directory>
```



Apache

- PHP hardening options in php.ini file:
  - display_errors = Off
  - disable_functions = system, exec, passthru, shell_exec, show_source, dl…etc
  - open_base_dir = '/var/www/html' #web root
  - allow_url_fopen = Off
  - allow_url_include = Off
  - file_uploads = Off (if not used!)

IIS

- Install ModSecurity for IIS.
- Remove unneeded ISAPI filters.
- In machine.config, disable tracing debug:
  - <trace enable="false" />
  - <compilation debug="false" explicit="true" ..>
  - <deployment retail="true" />
- Use IISLockdown, IIS URLScan, or its easier open source equivalent: AQTRONIX WebKnight

IIS

- Verify Directory browsing is disabled with:
  - %systemroot%\system32\inetsrv\appcmd list config /section:directoryBrowse /enabled:false
  - Output: <directoryBrowse enabled="false" />
- ApplicationPool Identities are the real users running the web applications. The best security practice is to use ApplicationPoolIdentity.
- Set DefaultAppPool's type = ApplicationPoolIdentity
- Stop double-encoding attacks by editing web.config:
  - <security><requestFiltering allowDoubleEscaping="false"></requestFiltering></security>

MySQL

- Check that no users with empty passwords exist:
  - Select user, password from mysql.user where length(password) = 0 or password is null;
- Check that no anonymous user exists:
  - select user from mysql.user where user = '';
- Check FILE permissions, only admins need it:
  - select user, host from mysql.user where File_priv = 'Y';
- Disable LOCAL INFILE, in my.cnf file:
  - set-variable=local-infile=0
- Drop ‘test’ database.

ORACLE

- Change the default passwords for many users: apex_040000, system, dbsnmp, mdsys, appqossys

  … and many others!

- Remove Oracle test users:
  - DROP USER BI CASCADE;
  - The same for HR,OE,PM,IX,SH, SCOTT

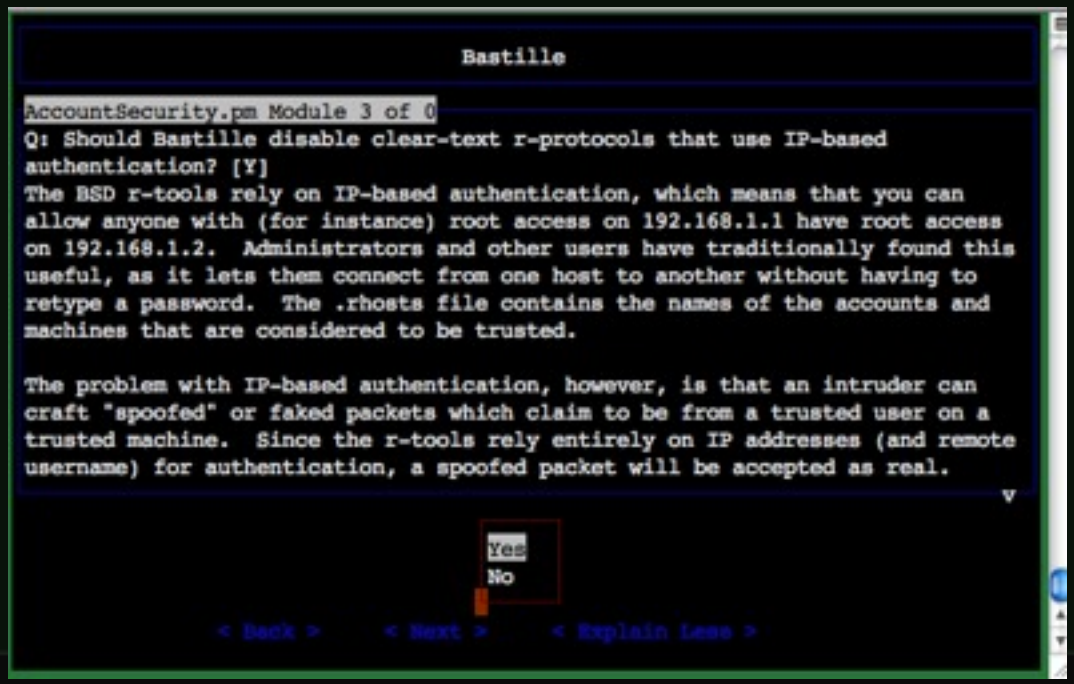
- Check for updates: select * from DBA_REGISTRY_HISTORY;
  - ^ If this returns nothing, you have no security patches!

Reactive Linux Monitoring

- Verify only the root user has UID 0:
  - sudo awk -F: '($3 == "0") {print $1 }' /etc/passwd
- Verify no user has an empty password:
  - sudo awk -F: '($2 == "") {print $1 }' /etc/shadow
- Use Bastille Linux: Bastille Linux is a hardening patch for Linux through an easy and interactive interface. Excellent for experts and beginners!
  - apt-get install perl-Tk
  - apt-get install bastille
  - bastille -c

Reactive Linux Monitoring

- Bastille Linux is the ultimate Linux hardening tool. It explains everything before it does it, allows you to undo, and gives full flexibility.
- You must try it. Seriously. Try it on your linux machine when you return to your room.



Reactive Linux Monitoring

- Check the processes under a user, verify only verified ones are running:
  - top -u apache / top –U www-data
- Check user login activitiy with w, who, last, lastlog
- Check bash history with cat .bash_history
- Check active cron jobs with ls /etc/cron.*
- Check active processes with ps aux, note the ones running under root!

Reactive Linux Monitoring

- Check your network connections with netstat –tulpan
  - Entries with 0.0.0.0 are open to all interfaces.
- Or use lsof –i, it might be clearer for you:
  - root starts just one apache process to bind on port 80, don't be scared by that. It is okay.
  - You might see connections with *.1e100.net. Don't worry, that is not malware. It's just Google.
- Use tcpdump to check connections on unusual ports:
  - tcpdump -i <INTERFACE> port not 80 and port not 443 and not host 127.0.0.1 and not arp and not ip6 and port not ntp and port not ssh and port not 53

Reactive Linux Monitoring

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OSSEC HIDS

- You might want to check out OSSEC Host-based Intrusion Detection System. Free and open source!
  - http://www.ossec.net/
- OSSEC performs excellent functions like file integrity/ changes check, rootkit checks, CIS (Center for Internet Security) benchmark checks, VMware security checks, email alerts…etc
- Works in almost all systems, and is very easy to setup. Give it a try.

Reactive Windows Monitoring

- The easiest way to start to secure your windows installation is by running Microsoft Baseline Security Analyzer (MBSA).
- Use TCPView to check your network connections.
- Use Filemon to check your file activities. Focus on the inetpub/wwwroot directory activities.
- Use sigverif to verify integrity of system files.

Reactive Windows Monitoring

- Check Windows startup folders and registry keys for unauthorized entries:
  - \Software\Microsoft\Windows\CurrentVersion\Run
  - \Software\Microsoft\Windows\CurrentVersion\RunOnce
  - \Software\Microsoft\Windows\CurrentVersion\RunOnceEx
  - … and others.

- Check no guest access or null sessions are allowed.

Error Logging and Monitoring

- The basis of reactive defense is watching errors as they come in. Attackers are very noisy with errors & exceptions. Watch your error logs!
- Many tools exist, from simple grep & awk to commercial offerings.
- Make sure you enabled advanced/detailed logging.
- Watch 5xx HTTP errors, as they usually point to failed attacks or application faults.
- Too many 404, 403, 401 & 400 = possible attacks

Error Logging and Monitoring

- Search or grep for keywords such as authentication, error, access, 404, 403, denied, failed, password, exception, NULL, UNION, OR 1=1, --, *
- You will always find interesting results!
- Be careful about handling sensitive/personal data while checking error logs. If you ever need to submit it to somebody for review & help; remove such info!
- Linux compresses older log files. Search with with:
  - zgrep KEYWORD FILENAME
  - zcat FILENAME | grep KEYWORD

Be on the Look Out

- Always survey the internet for any signs of exposure or attacks against your systems.
- Set up Google Alerts for your organization's keywords.
- Set up Pastebin alerts for any leak on your organization.
- Search Twitter for any targeted links.
- Keep an eye on what Google indexes on you!

Reading Room

- Visit www.owasp.org for detailed & thorough security guidelines, projects, tools, articles and more!
  - OWASP Top Ten
  - OWASP ModSecurity Core Rule Set
  - OWASP Cheat Sheets
  - OWASP Zed Attack Proxy (ZAP)

- Center for Internet Security (CIS):
  - https://benchmarks.cisecurity.org
  - A vast collection of security benchmarks and guidelines for a wide array of systems and software.

References

- www.owasp.org
- https://benchmarks.cisecurity.org/
- https://modsecurity.org
- SANS Intrusion Detection Cheat Sheets:
  - http://pen-testing.sans.org/resources/downloads
- http://www.aqtronix.com/
- www.ossec.net