CVSS Is a Big Botch

Micha Borrmann

SySS GmbH

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SySS THE PENTEST EXPERTS.

HACKTIVITY

Who am I?

Micha Borrmann

- from Germany
- working in information security since 1997

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My Point of View

- I am working at a company which is offering professional penetration tests to help clients to improve their level of IT security
- All examples are based on real professional penetration tests: no company names will be published

Why Scoring

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Management Requirement

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“If You Can’t Measure It, You Can’t Manage It”

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Client Requirement

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Client Requirement

Please classify our level of IT security with a school grade

School Grades

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Germany	1	6
Austria	1	5
Switzerland	6	1
Hungary	5	1

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Attention

A native speaker of German pupil from Austria or Germany with a school grade of 4 speaks and understands the German language much better than a pupil from Hungary, because even for a good Hungarian pupil German still is a foreign language!

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- We are lacking some client access licences which is a great risk and will result in a penalty. The missing licences should be purchased soon!
- All used Android devices are insecure because the same origin policy can be bypassed. This is a very high risk and known as CVE-2014-6041!

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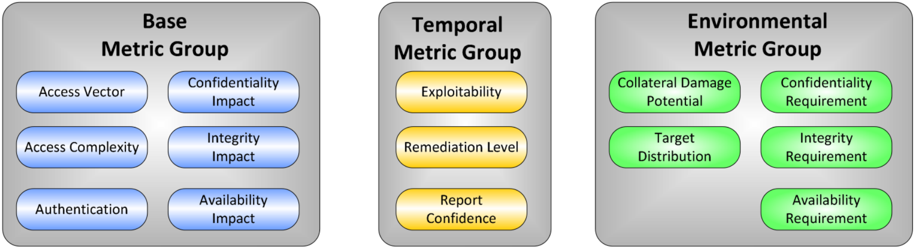
Quoted from `http://www.first.org/cvss/cvss-guide`

What is CVSS

CVSS consists of 3 groups:

Base, Temporal and Environmental. Each group produces a numeric score ranging from 0 to 10, and a Vector, a compressed textual representation that reflects the values used to derive the score.



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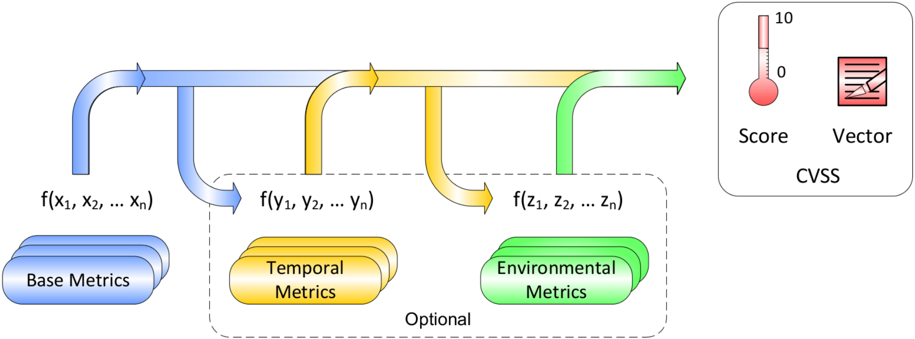
Limitation

Only base group in focus of this talk (organizations which are using CVSS often do the same)

How does CVSS work?

When the base metrics are assigned values, the base equation calculates a score ranging from 0 to 10, and a vector is created, as illustrated. The vector facilitates the “open” nature of the framework. **Therefore, the vector should always be displayed with the vulnerability score.**



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Access Vector (AV)

- This metric reflects how the vulnerability is exploited.
- The more remote an attacker can be to attack a host, the greater the vulnerability score.

Metric Value	Description
Local (L)	A vulnerability exploitable with only local access requires the attacker to have either physical access to the vulnerable system or a local (shell) account. Examples of locally exploitable vulnerabilities are peripheral attacks such as Firewire/USB DMA attacks, and local privilege escalations (e.g., sudo).
Adjacent Network (A)	A vulnerability exploitable with adjacent network access requires the attacker to have access to either the broadcast or collision domain of the vulnerable software. Examples of local networks include local IP subnet, Bluetooth, IEEE 802.11, and local Ethernet segment.
Network (N)	A vulnerability exploitable with network access means the vulnerable software is bound to the network stack and the attacker does not require local network access or local access. Such a vulnerability is often termed “remotely exploitable”. An example of a network attack is an RPC buffer overflow.

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Access Complexity (AC)

- This metric measures the complexity of the attack required to exploit the vulnerability once an attacker has gained access to the target system. For example, consider a buffer overflow in an Internet service: once the target system is located, the attacker can launch an exploit at will.
- Other vulnerabilities, however, may require additional steps in order to be exploited. For example, a vulnerability in an email client is only exploited after the user downloads and opens a tainted attachment.
- The lower the required complexity, the higher the vulnerability score.
- Possible values are High (H), Medium (M) or Low (L).

Quoted from `http://www.first.org/cvss/cvss-guide`

Authentication (Au)

- This metric measures the number of times an attacker must authenticate to a target in order to exploit a vulnerability.
- The fewer authentication instances that are required, the higher the vulnerability score.
- Possible values are Multiple (M), Single (S) or None (N).

Quoted from `http://www.first.org/cvss/cvss-guide`

Impacts: Confidentiality / Integrity / Availability

Confidentiality Impact (C)

This metric measures the impact on confidentiality of a successfully exploited vulnerability.

Integrity Impact (I)

This metric measures the impact to integrity of a successfully exploited vulnerability.

Availability Impact (A)

This metric measures the impact to availability of a successfully exploited vulnerability. Attacks that consume network bandwidth, processor cycles, or disk space all impact the availability of a system.

Possible values for all these metrics

None (N), Partial (P) or Complete (C)

Equation

```
BaseScore = round_to_1_decimal(((0.6*Impact)+(0.4*Exploitability)-1.5)*f(Impact))
Impact = 10.41*(1-(1-ConfImpact)*(1-IntegImpact)*(1-AvailImpact))
Exploitability = 20* AccessVector*AccessComplexity*Authentication
f(impact)= 0 if Impact=0, 1.176 otherwise
AccessVector     = case AccessVector of
                        requires local access: 0.395
                        adjacent network accessible: 0.646
                        network accessible: 1.0
AccessComplexity = case AccessComplexity of
                        high: 0.35
                        medium: 0.61
                        low: 0.71
Authentication   = case Authentication of
                        requires multiple instances of authentication: 0.45
                        requires single instance of authentication: 0.56
                        requires no authentication: 0.704
ConfImpact       = case ConfidentialityImpact of
                        none:             0.0
                        partial:          0.275
                        complete:         0.660
IntegImpact      = case IntegrityImpact of
                        none:             0.0
                        partial:          0.275
                        complete:         0.660
AvailImpact      = case AvailabilityImpact of
                        none:             0.0
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```

Adopters

Who performs the scoring?

The base and temporal metrics are specified by vulnerability bulletin analysts, security product vendors, or application vendors

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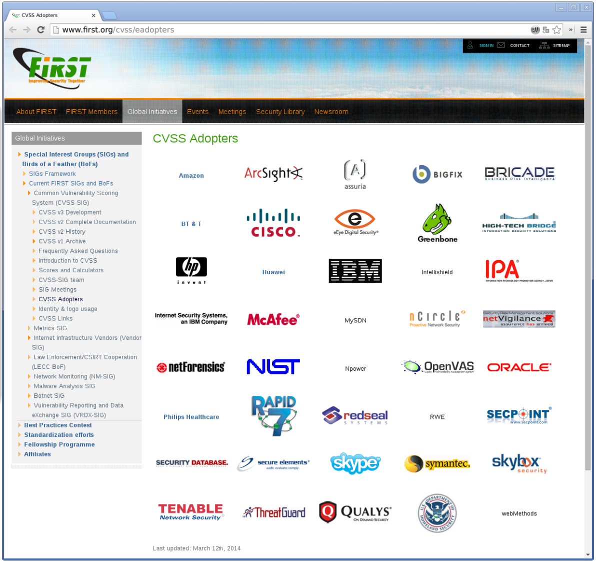

CVSS Adopters

Amazon, ArcSight, assuria, BIGFIX, BRICADE Business Risk Intelligence, BT & T, CISCO, eEye Digital Security, Greenbone, HIGH-TECH BRIDGE Information Security Solutions, hp invent, Huawei, IBM, Intellishield, IPA Information-Technology Promotion Agency, Japan, Internet Security Systems, an IBM Company, McAfee, MySDN, nCircle Proactive Network Security, netVigilance, netForensics, NIST, Npower, OpenVAS, ORACLE, Philips Healthcare, RAPID7, redseal systems, RWE, SECPOINT www.secpoint.com, SECURITY DATABASE, secure elements, skype, symantec, skybox security, TENABLE Network Security, ThreatGuard, QUALYS On Demand Security, U.S. Department of Homeland Security, webMethods

Last updated: March 12th, 2014

Short Summary

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- specified from IT security experts
- calculated with a complex equation
- adopted from many organizations

Useful Examples with Different Scores

MS09-001 – 10.0 (AV:N/AC:L/Au:N/C:C/I:C/A:C)

Buffer overflow in SMB in the Server service in Microsoft Windows 2000 SP4, XP SP2 and SP3, and Server 2003 SP1 and SP2 allows remote attackers to execute arbitrary code (...) “SMB Buffer Overflow Remote Code Execution Vulnerability.”

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MS09-004 – 9.0 (AV:N/AC:L/Au:S/C:C/I:C/A:C)

Heap-based buffer overflow in Microsoft SQL Server 2000 SP4, 8.00.2050, 8.00.2039, and earlier; SQL Server 2000 Desktop Engine (MSDE 2000) SP4; SQL Server 2005 SP2 and 9.00.1399.06; SQL Server 2000 Desktop Engine (WMSDE) on Windows Server 2003 SP1 and SP2; and Windows Internal Database (WYukon) SP2 allows remote authenticated users to cause a denial of service (access violation exception) or execute arbitrary code (...)

Quoted from `http://nvd.nist.gov/view/vuln/detail?vulnId=CVE-2008-5416`

Identical Vulnerabilities Will Result in Identical Score

CVE-2012-6606 – 5.8 (AV:N/AC:M/Au:N/C:P/I:P/A:N)

Palo Alto Networks GlobalProtect before 1.1.7, and NetConnect, does not verify X.509 certificates from SSL servers, which allows man-in-the-middle attackers to spoof portal servers and obtain sensitive information via a crafted certificate.

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WinSCP before 5.5.3, when FTP with TLS is used, does not verify that the server hostname matches a domain name in the subject's Common Name (CN) or subjectAltName field of the X.509 certificate, which allows man-in-the-middle attackers to spoof SSL servers via an arbitrary valid certificate. Quoted from `http://nvd.nist.gov/view/vuln/detail?vulnId=CVE-2014-2735`

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What should be fixed first?

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What should be fixed first?

There the temporal and or environmental score can be used

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Everything is ok?

Then why you are here?

Example of a Known Limitation

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Cross-site scripting vulnerability

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Cross-site scripting vulnerability

The impact to a user's system could be much greater than the impact to the target host. However, this is an indirect impact. Cross-site scripting vulnerabilities should be scored with no impact to confidentiality or availability, and partial impact to integrity.

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Passwords stored in a browser

can be read out with XSS attack ... no impact on confidentiality?!

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XSS and CVSS

- CVSS is focused on target hosts, but IT security issues are related to solutions.
- For instance: If it is possible to find a XSS vulnerability at `https://signin.ebay.com` to read out stored credentials from a user's browser, do you think there is no impact on confidentiality?
- However, it is true, that there is no impact on confidentiality of the host which provides `https://signin.ebay.com` but nobody asks for such a target host, the solution is in the focus!

Base Score is Constant

CVE-2012-0178 (MS12-033)

Security issue within Windows Partition Manager

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NIST

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Reason

Different opinion about Access Complexity

Base score is constant

May be an exception

Identical Vulnerability Results in Identical Score

CVE-2011-0411

Plaintext command injection in multiple implementations of STARTTLS SMTP is not the only protocol with a mid-session switch from plaintext to TLS. Other examples are POP3, IMAP, NNTP and FTP. Implementations of these protocols may be affected by the same flaw as discussed here.

Quoted from `http://www.postfix.org/CVE-2011-0411.html`

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FTP Service AUTH TLS Plaintext Command Injection

The STARTTLS implementation (...) a similar issue to CVE-2011-0411.

Quoted from `http://nvd.nist.gov/view/vuln/detail?vulnId=CVE-2011-1575`

Plaintext Command Injections within STARTTLS

SMTP

Plaintext Command Injections within STARTTLS

Tenable / Redhat (CVE-2011-0411)

4.0 (AV:N/AC:H/Au:N/C:P/I:P/A:N)

SMTP

Plaintext Command Injections within STARTTLS

SMTP

Tenable / Redhat (CVE-2011-0411)

4.0 (AV:N/AC:H/Au:N/C:P/I:P/A:N)

NIST (CVE-2011-0411)

6.8 (AV:N/AC:M/Au:N/C:P/I:P/A:P)

Plaintext Command Injections within STARTTLS

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Tenable / Redhat (CVE-2011-0411)

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FTP

Plaintext Command Injections within STARTTLS

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FTP

Tenable / NIST (CVE-2011-1575)

5.8 (AV:N/AC:M/Au:N/C:P/I:P/A:N)

Redhat (CVE-2011-1575)

4.0 (AV:N/AC:H/Au:N/C:P/I:P/A:N)

Firewall Filter Bypass Vulnerability

Similar vulnerabilities: CVE-2003-1491 & CVE-2004-1473

Some firewalls can be bypassed with UDP source port 53.

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Tenable (both) / NIST (CVE-2003-1491)

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Tenable (both) / NIST (CVE-2003-1491)

7.5 (AV:N/AC:L/Au:N/C:P/I:P/A:P)

NIST (CVE-2004-1473)

5.0 (AV:N/AC:L/Au:N/C:P/I:N/A:N)

SSL Version 2 Support for a TLS Protected Service

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Tenable

5.0 (AV:N/AC:L/Au:N/C:P/I:N/A:N)

SSL Version 2 Support for a TLS Protected Service

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Rapid7

5.8 (AV:N/AC:M/Au:N/C:P/I:P/A:N)

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Rapid7

5.8 (AV:N/AC:M/Au:N/C:P/I:P/A:N)

PCI (Payment Card Industry) Data Security Standard

Support of SSLv2 will result in not getting the certificate

More Examples with Bad Crypto

CVE-2004-2761

This vulnerability described MD5-based signatures in TLS/SSL Server X.509 Certificate

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5.0 (AV:N/AC:L/Au:N/C:N/I:P/A:N)

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Tenable

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More Examples with Bad Crypto II

CVE-2013-2566

Usage of RC4

More Examples with Bad Crypto II

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Usage of RC4

CVE-2012-4929

Vulnerability called CRIME

NIST / Tenable

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More Examples with Bad Crypto II

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4.3 (AV:N/AC:M/Au:N/C:P/I:N/A:N)

CVE-2012-4929

Vulnerability called CRIME

NIST

2.6 (AV:N/AC:H/Au:N/C:P/I:N/A:N)

More Examples with Bad Crypto II

CVE-2013-2566	CVE-2012-4929
Usage of RC4	Vulnerability called CRIME
NIST / Tenable	**NIST**
2.6 (AV:N/AC:H/Au:N/C:P/I:N/A:N)	2.6 (AV:N/AC:H/Au:N/C:P/I:N/A:N)
Redhat	**Redhat / Tenable**
4.3 (AV:N/AC:M/Au:N/C:P/I:N/A:N)	4.3 (AV:N/AC:M/Au:N/C:P/I:N/A:N)

Weak RSA key (less than 2048 bit length)

Tenable

No CVSS value!

`http://www.tenable.com/plugins/index.php?view=single&id=69551`

Weak RSA key (less than 2048 bit length)

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No CVSS value!

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Rapid7

3.2 (AV:A/AC:H/Au:N/C:P/I:P/A:N)

CVE-2014-0160

CVE-2014-0160

CVE-2014-0160

NIST, Redhat, Rapid7

5.0 (AV:N/AC:L/Au:N/C:P/I:N/A:N)

CVE-2014-0160

NIST, Redhat, Rapid7

5.0 (AV:N/AC:L/Au:N/C:P/I:N/A:N)

Tenable

9.4 (AV:N/AC:L/Au:N/C:C/I:C/A:N)

CVE-2014-0160

NIST, Redhat, Rapid7

5.0 (AV:N/AC:L/Au:N/C:P/I:N/A:N)

Tenable

9.4 (AV:N/AC:L/Au:N/C:C/I:C/A:N)

Bruce Schneier

“Catastrophic” is the right word. On the scale of 1 to 10, this is an 11.

https://www.schneier.com/blog/archives/2014/04/heartbleed.html

CVE-2014-6271

CVE-2014-6271

CVE-2014-6271

Redhat

7.5 (AV:N/AC:L/Au:N/C:P/I:P/A:P)

CVE-2014-6271

Redhat

7.5 (AV:N/AC:L/Au:N/C:P/I:P/A:P)

NIST

10.0 (AV:N/AC:L/Au:N/C:C/I:C/A:C)

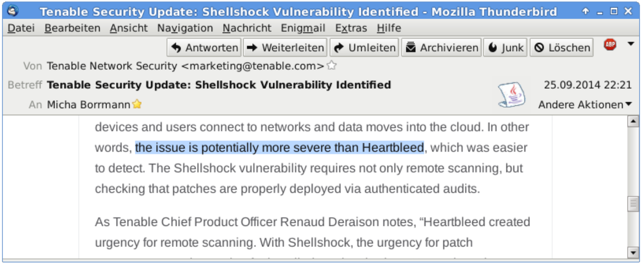
CVE-2014-6271

Redhat

7.5 (AV:N/AC:L/Au:N/C:P/I:P/A:P)

NIST

10.0 (AV:N/AC:L/Au:N/C:C/I:C/A:C)



Tenable Security Update: Shellshock Vulnerability Identified - Mozilla Thunderbird
Datei Bearbeiten Ansicht Navigation Nachricht Enigmail Extras Hilfe
Antworten
Weiterleiten
Umleiten
Archivieren
Junk
Löschen
Andere Aktionen

Von Tenable Network Security <marketing@tenable.com>

Betreff **Tenable Security Update: Shellshock Vulnerability Identified** 25.09.2014 22:21

An Micha Borrmann

devices and users connect to networks and data moves into the cloud. In other words, the issue is potentially more severe than Heartbleed, which was easier to detect. The Shellshock vulnerability requires not only remote scanning, but checking that patches are properly deployed via authenticated audits.

As Tenable Chief Product Officer Renaud Deraison notes, "Heartbleed created urgency for remote scanning. With Shellshock, the urgency for patch

CVE-2014-6271

Redhat

7.5 (AV:N/AC:L/Au:N/C:P/I:P/A:P)

NIST

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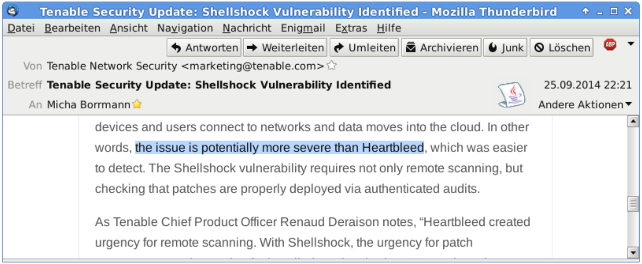
Tenable Security Update: Shellshock Vulnerability Identified - Mozilla Thunderbird
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Tenable

"(...) the issue is potentially more severe than Heartbleed (...)"

Base Score (...) Constant over Time

CVE-2011-1473 (SSL Renegotiation)

Disputed OpenSSL (...) does not properly restrict client-initiated renegotiation within the SSL and TLS protocols, which might make it easier for remote attackers to cause a denial of service (CPU consumption) by performing many renegotiations within a single connection (...) Quoted from `http://nvd.nist.gov/view/vuln/detail?vulnId=CVE-2011-1473`

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Tenable (now)

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NIST

5.0 (AV:N/AC:L/Au:N/C:N/I:N/A:P)

Tenable (April 2012 until ?)

2.6 (AV:N/AC:H/Au:N/C:N/I:N/A:P)

Redhat

4.3 (AV:N/AC:M/Au:N/C:N/I:N/A:P)

`https://discussions.nessus.org/thread/4608`

Tenable (now)

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Tenable (now)

4.3 (AV:N/AC:M/Au:N/C:N/I:N/A:P)

Tenable (April 2012 until ?)

2.6 (AV:N/AC:H/Au:N/C:N/I:N/A:P)

`https://discussions.nessus.org/thread/4608`

Tenable (May 2011 until ?)

7.8 (AV:N/AC:L/Au:N/C:N/I:N/A:C)

`https://discussions.nessus.org/message/10629`

10. Crypto Bug

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CVE-2014-0224

OpenSSL 'ChangeCipherSpec' MiTM Potential Vulnerability

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NIST, Rapid7

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10. Crypto Bug

CVE-2014-0224

OpenSSL 'ChangeCipherSpec' MiTM Potential Vulnerability

NIST, Rapid7

6.8 (AV:N/AC:M/Au:N/C:P/I:P/A:P)

Redhat, Tenable at June 6, 2014

5.8 (AV:N/AC:M/Au:N/C:P/I:P/A:N)

http://www.tenable.com/blog/detect-the-latest-openssl-vulnerabilities-using-active-and-passive-scanning

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Redhat, Tenable at June 6, 2014

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http://www.tenable.com/blog/detect-the-latest-openssl-vulnerabilities-using-active-and-passive-scanning

Tenable at least since June 18, 2014

9.3 (AV:N/AC:M/Au:N/C:C/I:C/A:C)

CVSS: First Conclusion

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Example: What has to be fixed firstly?

Use only NIST

- CVE-2011-0411: 6.8 (AV:N/AC:M/Au:N/C:P/I:P/A:P)
- CVE-2014-0224: 6.8 (AV:N/AC:M/Au:N/C:P/I:P/A:P)
- CVE-2014-2735: 5.8 (AV:N/AC:M/Au:N/C:P/I:P/A:N)
- CVE-2014-0160: 5.0 (AV:N/AC:L/Au:N/C:P/I:N/A:N)

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CVE-2011-0411: 6.8 (AV:N/AC:M/Au:N/C:P/I:P/A:P)	STARTTLS
CVE-2014-0224: 6.8 (AV:N/AC:M/Au:N/C:P/I:P/A:P)	OpenSSL CCS
CVE-2014-2735: 5.8 (AV:N/AC:M/Au:N/C:P/I:P/A:N)	WinSCP
CVE-2014-0160: 5.0 (AV:N/AC:L/Au:N/C:P/I:N/A:N)	Heartbleed

Improve IT Security with Decreasing CVSS Score

Improve IT Security with Decreasing CVSS Score

Vulnerable FTP/TLS service (Tenable)

- CVE-2011-1473: 4.3 (AV:N/AC:M/Au:N/C:N/I:N/A:P)
- CVE-2011-1575: 5.8 (AV:N/AC:M/Au:N/C:P/I:P/A:N)
- CVE-2014-0224: 9.3 (AV:N/AC:M/Au:N/C:C/I:C/A:C)
- CVE-2013-2566: 2.6 (AV:N/AC:H/Au:N/C:P/I:N/A:N)

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Vulnerable FTP/TLS service (Tenable)

CVE-2011-1473: 4.3 (AV:N/AC:M/Au:N/C:N/I:N/A:P)	Renegotiation
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Solution: Disable encryption!

Improve IT Security with Decreasing CVSS Score

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FTP Supports Clear Text Authentication: 2.6 (AV:N/AC:H/Au:N/C:P/I:N/A:N)

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- knowledge of vulnerabilities is necessary for prioritization

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Conclusion

- knowledge of vulnerabilities is necessary for prioritization
- the score does not help for prioritization to improve the IT security
- if kowledge is available, nobody needs a score

Summary CVSS

CVSS

- no common score for identical vulnerabilities

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- no help for prioritization deploying fixes against vulnerabilities

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- no common score for identical vulnerabilities
- no help for prioritization deploying fixes against vulnerabilities
- focussing on hosts will not cover real situations of IT security (think about the example with XSS)

Do not use CVSS!

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- managers for prioritization for deploy fixes

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- managers for prioritization for deploy fixes
- researcher for promoting a found weakness

Do not use CVSS!

- managers for prioritization for deploy fixes
- researcher for promoting a found weakness
- security bulletin providers for announcing advisories because the score is not helpful

And Now?

And Now?

- CVSS v3 (Preview June 2014)

And Now?

- CVSS v3 (Preview June 2014) No

And Now?

- CVSS v3 (Preview June 2014)
- Common Weakness Scoring System (CWSS^{TM})

No

And Now?

- CVSS v3 (Preview June 2014) No
- Common Weakness Scoring System (CWSS$^{\text{TM}}$) No

And Now?

• CVSS v3 (Preview June 2014)	No
• Common Weakness Scoring System (CWSS^{TM})	No
• Develop a new scoring system	

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https://www.schneier.com/book-sandl-pref.html

If you think technology can solve your security problems, then you don't understand the problems and you don't understand the technology.

Information for the World's Business Leaders

Article on Forbes website (February 10, 2014)

Information for the World's Business Leaders

Article on Forbes website (February 10, 2014)

'If You Can't Measure It, You Can't Manage It':

Information for the World’s Business Leaders

Article on Forbes website (February 10, 2014)

’If You Can’t Measure It, You Can’t Manage It’: Not True

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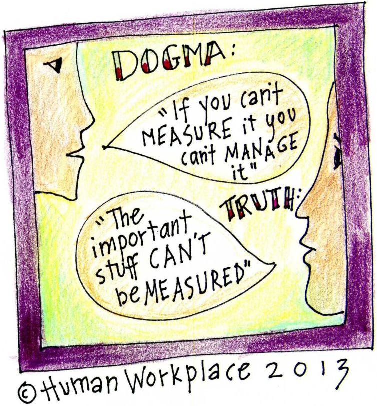
DOGMA:
"If you can't MEASURE it you can't MANAGE it"
TRUTH:
"The important stuff CAN'T be MEASURED"
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A typical ridiculous, unquestioned business adage is “If you can’t measure it, you can’t manage it.” That’s BS on the face of it, because the vast majority of important things we manage at work aren’t measurable, from the quality of our new hires to the confidence we instill in a fledgling manager.

Quoted from `http://onforb.es/1fXmIkJ`

Information for the World's Business Leaders (II)

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- *Measurement is our opiate of choice in the business world precisely because it temporarily allays fear all the way up the ladder. Look boss, there's the number, right there on the chart – I hit the mark, so don't blame me!*

Quoted from `http://www.forbes.com/sites/lizryan/2014/02/10/if-you-cant-measure-it-you-cant-manage-it-is-bs/`

Final: Short Summary

Conclusion from Forbes article

If data IT security is important stuff, than it can not be measured!

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Easy to remember slogan

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Easy to remember slogan

use it
and you will lose it

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Easy to remember slogan

use it	(scoring systems for IT security like CVSS)
and you will lose it	(IT security)

Thank You for Your Attention

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