

PoC Cyber Range Platform 22/09/2020

About us



We are a **consulting** company specialised in **Cybersecurity**, on the market **since 2012**

We provide innovative and highly-qualified **professional services**

We implement next-generation information technology infrastructures, we focus on IT/OT security, system integration and automation. We are ISO 9001:2015 certified for the quality of our Services







Vision, Mission and Values



Make technologies an enabling factor for Digital Transformation and a driver for business

Be the Partner of reference for our Customers on information security and innovation issues

We believe in Innovation and the Value of People, putting the Customer at the centre of our activity.





We work together with our customers in a transparent and responsible manner

We provide significant design, configuration and service **expertise** with highly qualified and certified personnel

We implement **bespoke information technology infrastructures** according to Customer needs

We integrate the most innovative **technologies**

Focussed



- Professional and managed services
- IT/OT security
- Systems integration
- Automation

The method:



- Holistic approach to security
- Customer training







About Cyberbit

Who is Cyberbit?

Leading Global Provider of Cyber Range Platforms to:

Upskill Cybersecurity Employees

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Assess Cybersecurity Skillset

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Optimize Incident Response Playbooks

- Live Since 2009
- 150 Employees Across US, Europe, & Asia
- Raised \$100 Million+ Since 2016
 Charlesbank





Cybersecurity Skills Shortage Having a Major Impact



of cybersecurity professionals feel that their organization has been impacted by a shortage of skilled analysts.

Source: ESG/ISSA: The Life and Times of Cybersecurity Professionals, April 2019



nection >> transfer ----- complete // command RR00267B

...system overload // dlc 330000x // stabledone // code Ulloxx00xx

We believe in Experiential Learning



The Most Widely Used Cybersecurity Training Platform



Cyberbit Range: Hyper-Realistic Training Simulating a Real-World SOC Under Attack





Cyber Range Hyper Realistic Environment



Training Exercises for Any Use

BLOCK OT



Diverse Use Cases





Telecom Italia Sparkle Spa

Federico Italiano **Pasquale Raia**



THE WORLD'S COMMUNICATION PLATFORM

Sparkle Sicily Hub: il punto d'incontro della connettività di Sparkle in Italia





Cyber Range

Detect, respond and recover from a Security Incident





Andrea Dainese (CSO @ NGS) andrea.dainese@nextgensolutions.it

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- Senior Network & Security Architect with 15+ years' experience in management of complex IT infrastructures
- Focused on cyber security strategies, GDPR/ISO27001 compliance and automation
- Member of Cyber Incident Response Team
- Cisco (CCIE), VMware, Red Hat... certified
- Privacy and digital security evangelist expert counselor-mediator in Cyberbullying







Rosario Bonanno (SE @ Cyberbit) rosario.bonanno@cyberbit.com

Rosario is a Cybersecurity professional with around 20 years of experience. Rosario is the South Europe Cyberbit **Sales Engineer** and **Cyber Range Instructor**. Prior to Cyberbit Sales Engineer Rosario was part of Symantec System Engineer Team Responsible for the end-to-end technical engagement with Symantec large customers and partners.











- Understand how Cyber Range can help your SOC
- Learn how to approach a security incident
- Understand how to optimize incident analysis
- Learn from any security incident





Typical SOC Operation

















• Daily activity of SOC operators starts from the SIEM:

7	ld	Description	Offense Type	Offense Source	Magnitude

No results were returned.

• Regular check should verify the effectiveness of the in place rules:

Event Count	Time 💌	Low Level Category	Low Level Category Source IP		Destination IP
71	Sep 11, 2020, 1:19:02 PM	Firewall Session Closed	172.16.100.35	47246	192.168.214.13
1	Sep 11, 2020, 1:19:02 PM	Firewall Session Closed	172.16.100.35	47182	192.168.214.13
1	Sep 11, 2020, 1:18:58 PM	Firewall Session Closed	172.16.100.35	47174	192.168.214.13
1	Sep 11, 2020, 1:18:57 PM	Firewall Session Closed	172.16.100.35	47174	192.168.214.13

Anomaly connection from Wordpress server to MySQL server (with payment data)





Confirm the anomaly



• Anomaly detected: Wordpress website is connecting to the credit card database:

09/11 13:19:02	end	CNT-DMZ	CNT-DMZ	172.16.100.35	192.168.214.13	3306	mysql	allow
09/11 13:19:02	end	CNT-DMZ	CNT-DMZ	172.16.100.35	192,168,214,13	3306	mysql	allow
09/11 13:19:01	end	CNT-DMZ	CNT-DMZ	172.16.100.35	192.168.214.13	3306	mysql	allow
09/11 13:19:01	end	CNT-DMZ	CNT-DMZ	172.16.100.35	192,168,214,13	3306	mysql	allow
09/11 13:19:01	end	CNT-DMZ	CNT-DMZ	172.16.100.35	192.168.214.13	3306	mysql	allow
09/11 13:19:01	end	CNT-DMZ	CNT-DMZ	172.16.100.35	192,168,214,13	3306	mysql	allow

• What is going on? (attack, administrative activity, misconfiguration)



Analysis



What is going on in the database server?



• MySQL server analysis: /var/log/mysql/error.log

2020-	09-11T13:18:47.3105722	25	[Note]	Access	denied	for	user	'root']'microbit-pr
ess'	(using password: YES)								
2020-	09-11T13:18:47.314561z	26	[Note]	Access	denied	for	user	'root']'microbit-pr
ess'	(using password: YES)								28
2020-	09-11T13:18:47.318313z	27	[Note]	Access	denied	for	user	'root']'microbit-pr
ess'	(using password: YES)								
2020-	09-11T13:18:47.322056z	28	[Note]	Access	denied	for	user	'root']'microbit-pr
ess'	(using password: YES)								
2020-	09-11T13:18:47.326067z	29	[Note]	Access	denied	for	user	'root']'microbit-pr
ess'	(using password: YES)								
2020-	09-11T13:18:47.329825z	30	[Note]	Access	denied	for	user	'root']'microbit-pr
ess'	(using password: YES)								

- Brute force attack detected
- Does the attacker gained access to the database?





Data has been leaked?



• MySQL server analysis: /var/log/mysql/mysql.log

2020-09-11T13:18:47.351779z	36	Connect	root@microbit-press on using TC
P/1P			
2020-09-11T13:18:47.356424z	36	Query	SHOW DATABASES
2020-09-11T13:18:47.368160z	36	Quit	
2020-09-11T13:18:52.633412z	37	Connect	root@microbit-press on using TC
P/IP			
2020-09-11T13:18:52.642958z	37	Query	select @@version_comment limit 1
2020-09-11T13:18:52.645388z	37	Query	show tables in bookshop
2020-09-11T13:18:52.646579z	37	Quit	
2020-09-11T13:18:52.675627z	38	Connect	root@microbit-press on using TC
P/IP			
2020-09-11T13:18:52.676344z	38	Query	select @@version comment limit 1
2020-09-11T13:18:52.677077z	38	Query	select * from bookshop.payments

- Access granted
- Data leaked (payment table with credit card information)









- 13:18:02 Wordpress server to MySQL connections detected (brute force)
- 13:18:47 MySQL access granted (root user from Wordpress server)
- 13:18:52 MySQL data leak (payments table)



Wordpress server has been compromised?



• Wordpress server analysis:

root@CNT-DMZ-	WP1:~# find	/var/ww	w/html/	-mtime -1	-type f ·	-ls			
1183571	4 -rw-r	r 1	www-data	a www-data	114	Sep	11	13:18	/var/www
/html/wp-cont	ent/uploads,	image.p	ohp						
1183572	4 -rw-r	1	www-data	a www-data	637	Sep	11	13:18	/var/www
/html/wp-cont	ent/uploads,	test.pl	ıp						
1183573	4 -rw-r	1	www-data	a www-data	387	Sep	11	13:18	/var/www
/html/wp-cont	ent/uploads,	passwoi	ds.txt						

• Recent files found:

- image.php: web shell
- test.php: brute force attack script
- passwords.txt: password dictionary
- Files are malicious



How have been the files uploaded? (1)



• Wordpress application analysis:

WordPress Updates	
Last checked on September 11, 2020 at 1:42 pm.	Check Again
You have the latest version of WordPre	ess. Future security updates will be applied automatically.
Learn more about WordPress 5.0.	
Plugins	
Your plugins are all up to date.	
Themes	
Your themes are all up to date.	

• No updates available: has been used a zero day vulnerability?



How have been the files uploaded? (2)



• Wordpress application analysis:

ReFlex Gallery	Wordpress Plugin for creating responsive image galleries. By: HahnCreativeGroup
Deactivate	Version 3.1.3 By HahnCreativeGroup Visit plugin site

- Vulnerability assessment: https://www.exploit-db.com/
 - 2015-03-08 🔮 🗸 WordPress Plugin Reflex Gallery 3.1.3 Arbitrary File Upload
- Vulnerable application (arbitrary file upload)



How the malicious files have been used?



• Webserver log analysis: /var/log/nginx/access.log

199	<u>203 100 66 [11/Sep/</u> 2020:13:18:31 +0000] "GET /wp-content/uploads/image.p
hpi	cmd=netstat%20-tun HTTP/ <mark>1.1" 200 305 "-" "Mozilla/5.0 (X11; Linux x86_64) App</mark>
leī	ebKit/537.36 (KHTML, lik <mark>e Gecko) Chrome/51.0.2704.103 Safari/537.36"</mark>
199	.203.100.66 [11/Sep/ <mark>2020:13:18:31 +0000] "GET /wp-content/uploads/image.p</mark>
hpi	cmd=ping%20-c%201%20192. <mark>168.214.13 HTTP/1.1" 200 294 "-" "Mozilla/5.0 (X11; L</mark>
inı	x x86_64) AppleWebKit/53 <mark>7.36 (KHTML, like Gecko) Chrome/51.0.2704.103 Safari/</mark>
531	.36"
199	.203.100.66 [11/Sep/ <mark>2020:13:18:41 +0000] "GET /wp-content/uploads/image.p</mark>
hpi	cmd=nc%20192.168.214.13%203306%20%3C%20%2Fdev%2Fnull HTTP/1.1" 200 121 "-" "M
ozi	.lla/5.0 (X11; Linux x86_64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/51.
0.2	2704.103 Safari/537.36"

- Command executed: ls, arp, netstat, ping, nc, mysql
- Data leak confirmed





Data leak confirmation



 Executing mysql command using the malicious web shell: /wp-content/uploads/image.php?cmd=mysql -u root -ppassword123 -h 192.168.214.13 -e "select * from bookshop.payments"

← → C 🛈 microbit-press.com/wp-content/uploads/image.php?cmd=mysql%20-u%20root%20-ppassword123%20-h%20192.168.214.13%20-e%20"SELECT%20*%20FROM%2

🗱 Apps – For quick access, place your bookmarks here on the bookmarks bar. Import bookmarks now...

id	type	number	name	expire	cvv cre	ated_at	order	id	client	t_id					
1	Visa	4716461	05971168	0	Maximo Berg	naum 04/20	661	2015-09	-15 02	:09:31	75193	23889	8132307	390	
2	Visa	4916708	22746764	7	Cleve Schum	m 06/20	953	2015-04	-20 05	:04:42	93337	46069	6609268	196	
3	Visa	4556284	82478753	5	Enos Hoppe	03/21	517	2016-06	-02 19	:06:34	28800	58510	8816949	798	
4	Visa	4024007	16478624	5	Prof. Olga	Gleichner P	hD	11/21	384	2015-	03-20 16	:03:42	1360825	241	2997091315
5	MasterCa	ard	5449353	521787045	Emm	et Fisher	12/19	460	2017-0	01-22 13	:01:48	926760	62439	4848647	087
6	Visa	4539700	22510460	0	Dr. Benjami	n Kub I	07/19	191	2018-0	02-05 06	:02:43	937770	03018	70855317	770
7	MasterCa	ard	5387342	722758891	Ern	estina McGl	ynn	12/20	457	2016-	09-20 06	:09:12	5378392	080	4116180705
8	Visa	4556494	38730880	7	Consuelo Le	mke 03/19	429	2017-02	-15 05	:02:05	68495	93979	9436775	906	
9	MasterCa	ard	5584609	517952520	Pro	f. Paris Ra	th	07/20	488	2015-	07-10 18	:07:55	2258205	261	4321834872
10	Discover	c Card	6011496	650198462	Arm	ani Hayes	12/20	415	2013-	12-25 14	:12:00	804053	33703	4435950	233
11	MasterCa	ard	5360904	817036896	Bra	ndt Grimes	03/21	625	2018-0	06-11 02	:06:15	301295	50585	3235106	553
12	Visa	4619989	84607180	0	Gabrielle H	ills 10/20	404	2015-01	-01 00	:01:51	53515	00808	3798003	287	
13	Discover	c Card	6011569	623288139	Ms.	Zaria O'Co	nner	09/21	912	2015-	04-24 18	:04:50	4289723	345	2351066805

• Data leak confirmed



SPARKLE When the malicious files have been uploaded?



• Webserver log analysis: /var/log/nginx/access.log

199.203.100.66 - [11/Sep/2020:13:18:21 +0000] "POST /wp-content/plugins/reflex -gallery/admin/scripts/FileUploader/php.php HTTF/1.1" 200 56 "-" "curl/7.58.0" 199.203.100.66 - [11/Sep/2020:13:18:47 +0000] "POST /wp-content/plugins/reflex -gallery/admin/scripts/FileUploader/php.php HTTF/1.1" 200 55 "-" "curl/7.58.0" 199.203.100.66 - [11/Sep/2020:13:18:47 +0000] "POST /wp-content/plugins/reflex -gallery/admin/scripts/FileUploader/php.php HTTF/1.1" 200 60 "-" "curl/7.58.0"

• Attacker IP found (Israel)



ESPARKLE Could other servers have been compromised too?



• Firewall log analysis:

199.203.100.66	51836	172.16.100.35	80
199.203.100.66	51840	130.2.1.35	80
199.203.100.66	51844	172.16.100.35	80
199.203.100.66	51840	172.16.100.35	80
199.203.100.66	51846	172.16.100.35	80
199.203.100.66	51842	130.2.1.35	80
199.203.100.66	51838	172.16.100.35	80

• Attack targeted Wordpress server only









- 13:18:21 Malicious files upload (Reflex Gallery Wordpress plugin exploit)
- 13:18:47 Wordpress server to MySQL connections detected (brute force)
- 13:18:47 MySQL access granted (root user from Wordpress server)
- 13:18:52 MySQL data leak (payments table)



Remediation





- Delete or update Wordpress plugins: Wordpress is not considered a weak application; the misuse of plugins and themes make it vulnerable.
- Delete the webshell (Wordpress server)
- Change MySQL root password (MySQL server): a weak password leads to account compromise





Lesson Learned (Post Mortem Analysis)

Attack Flow



- 1. A Wordpress website is exposed to Internet.
- 2. A vulnerable Wordpress plugin has been used to upload a webshell.
- 3. The webshell has been used to find the database administrative password.
- 4. The administrative account has been used to leak sensitive information.

Intelligence gathering	Attacker scans the WordPress server using different tools and scripts to enumerate installed themes and plugins.
Uploading a shell	Attacker exploits a vulnerable plugin (ReFlex Gallery 3.1.3) in order to upload a PHP shell.
Database credentials brute force	Attacker uses brute force to gain access to the database.
Leaking data	Attacker runs SQL queries on the database using the PHP shell that was previously uploaded and brute force login credentials.





Attack Kill Chain (how to stop the attack) (1)

- 1. A vulnerable application can be used to compromise critical servers:
 - a. Reduce attack surface
 - b. Patch management (kill #2)
 - c. Vulnerability Assessment and Penetration test (kill #2)
 - d. Hardening (disable PHP Exec) (kill #3)
 - e. CMS generators (Wordpress WP2Static plugin) (kill #1,2)
- 2. Weak passwords can be easily discovered
 - a. Use complex passwords (kill #3)
 - b. Use password management softwares (not XLS/TXT files) (kill #3)
- 3. Zero trust networks:

- a. Enable required traffic flows only (kill #3)
- b. Review firewall policies (kill #3)
- C. Enable per database access from specific hosts (MySQL permissions) (kill #3,4)
- d. Split critical data into different servers (already implemented) (kill #3,4)





Attack Kill Chain (how to stop the attack) (2)

- 4. Install a Web Application Firewall
 - a. Filter out anomaly web requests (kill #2)
- 5. Improve incident detection:
 - a. Enable Firewall IPS (kill #3)
 - b. Assess and review SIEM rules
 - C. Implement a PDCA framework (kill #1,2,3,4)
- 6. Compliance:

a. PCI DSS (CVV cannot be stored)





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