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**Title:**

Why and how apply basic security validations after each web application deployment?

**Abstract:**

Deployment of web application (website, api, etc.) is today an activity that is performed several times a day/week/month by a company. However, how to do you ensure that the content deployed only contains what is expected to be exposed? Let’s explore this question together…

**GitHub repository associated that will be publicly released along with this blog post:**

<https://github.com/ExcelliumSA/PostDeploymentSecurityCheck-Study>

**SEO rules indicated by Mathilde:**

* Paragraphs with fewer than 300 words.
* Keyword used as much as possible: *continuous* *deployment, security, validation*
* Presence of sections.

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**Note:** In the content below, all figure captions refer to the image file that Mathilde must use when she creates the blog post. So, it's normal if the caption does not describe the figure.

# Introduction

With the rising of the **Continuous Deployment** [1] activity, the frequency at which of web applications (website, api, etc.) are deployed have significantly increased. Today is common to see companies deploying a new version of a web application several time by weeks/months [2].

# Continuous deployment activity has a price to pay

With the increase of the frequency of deployment as well as the full automation of the deployment process, the risk to introduce a problem allowing to attack the web application significantly increase. To be honest, the validation steps (unit test, integration test, etc.) in a continuous deployment pipeline, are critical because they represent the “watch dog” before the exposure of the application to end users.

Common continuous deployment pipeline :

Diagram

Description automatically generated

Figure 1: Figure01.png

Often the test steps (Unit, Integration, Acceptance, etc.) are focused on the objective to ensure that the version deployed is functional from a business point of view (features does what they are expected to perform without bug).

It is technically possible to add security focused tests in these test steps to cover the security aspect. It is not the objective of this post to present possible tests, an interesting talk about this topic, by the WE45 company (<https://we45.com/>), is provided here [3].

However, when the deployment on production step is finished, doubts like the following will remain:

* Does the version deployed only expose content that is expected to be accessible by end-users?
* Does the production configuration is hardened as expected?

# Doubt removal

To try to remove these mentioned doubts, it is possible to add a final validation step to reach this continuous deployment pipeline:

Diagram

Description automatically generated

Figure 2: Figure02.png

This step, triggered automatically once the application is deployed, apply different security focused validation. The objective is to ensure that the application is in a state consistent with a production environment.

If issues are detected, then either two options are possible depending on the issues and level of automation achieved by the company in its continuous deployment activity:

* Option 1: Fix the detected issues leveraging automation on the components affected.
* Option 2: Trigger a continuous deployment pipeline to deploy the previous version.

If no issue is detected, then access to end-users (or no action) is performed depending on the deployment model of the application [4].

# Technical proposal

The table below show a list a validation that can be performed in this final post deployment step. In this table every tool leveraged were chosen to allow validation without depending on an online service to open the capability to either target an internal (Intranet) or an external (Internet) application. All chosen tools are free and open source.

|  |  |  |
| --- | --- | --- |
| Validation identifier | Validation objective | Tool used |
| VAL00 | Ensure that all HTTP security headers applicable for the application topology are present and correctly defined. | * <https://github.com/ovh/venom> * Venom test plan following the *OWASP Secure Headers Project* recommendations: https://gist.github.com/righettod/f63548ebd96bed82269dcc3dfea27056 |
| VAL01 | Ensure that only a secure protocol is used (HTTPS). | * Curl combined with some bash commands: <https://github.com/curl/curl> |
| VAL02 | Ensure that the TLS configuration is secure according to current standard. | * <https://github.com/drwetter/testssl.sh> * JQ for results handling: <https://github.com/stedolan/jq> |
| VAL03 | Ensure that no sensitive content or secrets is exposed. | * <https://github.com/ffuf/ffuf> * Custom dictionary (text file specific to the application) of items (path/file) that must not be present after the deployment * Curl commands to verify some potential information disclosure * JQ for results handling: <https://github.com/stedolan/jq> |
| VAL04 | Ensure that a security.txt [6] file is present to allow security bug reporting in a secure way. | * Curl combined with some bash commands |
| VAL05 | Ensure that a Web Application Firewall is present in front of the application. | * <https://github.com/stamparm/identYwaf> |

# Proof of concept

This script [5] demonstrate an example of “low-level” implementation of the validations presented in the previous paragraph. Usage of a script allow to strongly customize validations according to the application and its deployment context.

Below is an example of the report generated providing all the detail about the different validations as well as a final state. The final state can be used to make the pipeline to fail to trigger a rollback or other automated fixation operation:

Text

Description automatically generated

Figure 3: Figure03.png

Overview of the pipeline using GitHub action [7] and the processing time of very steps:

A screenshot of a computer

Description automatically generated with medium confidence

Figure 4: Figure04.png

Validation operations stay short in terms of delay, less than 3 minutes. It is important to keep this delay shortest as possible to [8]:

* Not impact parallel deployment of several applications by the continuous deployment platform.
* Provide quick feedback about a deployment, allowing to run a deployment several times in case of need.
* Not monopolize resources for a long-time frame.

# Increase the maintainability

In the previous section, a bash script was used to perform the collection of security validations proposed. Even if is a direct and effective way to achieve the validation steps, it can become difficult to maintain with the time and the increase to validations steps performed (in addition to be platform specific). For the steps requiring only to perform HTTP requests (no execution of local tools like *testssl* for example), it is possible to move the collection of validations to a “recipe” easier to edit, maintain, test and portable across different operating system on which a continuous deployment platform is installed.

The tool, named “venom” [9], can helps to achieve the migration to a recipe via its “tests plan” approach and its cross-platform support.

This test plan [10] demonstrate an example about how it can be achieved (execution from a Windows machine):

Graphical user interface, text

Description automatically generated

Figure 5: Figure05.png

Note that venom can execute local tools [11] and deal with generated report, therefore, it is possible to include operation needing external tools.

# References

1. <https://www.atlassian.com/continuous-delivery/continuous-deployment>
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3. <https://www.youtube.com/watch?v=i34Ihbuslgw>
4. <https://blog.christianposta.com/deploy/blue-green-deployments-a-b-testing-and-canary-releases/>
5. <https://github.com/ExcelliumSA/PostDeploymentSecurityCheck-Study/blob/main/validate.sh>
6. <https://excellium-services.com/2021/05/18/security-txt/>
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