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Uses and Risks

of Implementing

Google Tag Manager

Bachelor's thesis

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Author's declaration of originality

I hereby certify that I am the sole author of this thesis. All the used materials, references to the literature and the work of others have been referred to. This thesis has not been presented for examination anywhere else.

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Abstract

Google Tag Manager is the free tagging tool launched by Google in October of 2012 and up to now it has been used in almost 5 million live websites. This paper discusses the importance of GTM to online businesses, as well as the risks associated by using it, and the solutions to them. Furthermore the basics of tag usage and configurations are also covered as to inform readers on the workflow of the application mentioned above.

The paper discusses some case studies of different businesses who shifted from using manually developing tracking tags to using GTM, the risks that GTM can pose to a website, effectiveness of the Google Malware Detection System for GTM, as well as different ways to deliver gathered information to digital marketers, business owners and other interested parties.

The author managed to show the security shortcomings of the GTM by directly injecting different types of malware to the website through tag manager account, as well as developed a sound GTM learning course consisting of a few blog posts, workshops and mock website.

This thesis is written in English and is 45 pages long, including 6 chapters, 11 figures and 1 table.

Annotatsioon

Google Tag Manager on tasuta sildistamise tööriist, mille Google lansseeris 2012. aasta oktoobris ning nüüdseks on see kasutusel peaaegu 5 miljonil veebilehel. Selles töös käsitletakse GTM-i tähtsust veebiettevõtete jaoks, samuti selle kasutamisega seotud riske ja nende lahendusi. Lisaks on kaetud ka sildistamise ja konfiguratsiooni põhialused, et teavitada lugejaid ülalnimetatud rakenduse töövoogudest.

See töö käsitleb juhtumianalüüse erinevate ettevõtete kohta, kes otsustasid manuaalselt väljatöötatud jälgimissiltide asemel kasutada GTM-i, samuti riske, mida GTM võib veebilehele põhjustada, Google Malware Detection System'i efektsiivsust GTM-ile ning erinevaid viise, kuidas kogutud teavet edastada digiturundajatele, ettevõtete omanikele ning muudele sellest huvitatud isikutele.

Autor lisas eri tüüpi pahavara läbi GTM konto otse veebilehele, tänu millele õnnestus näidata GTM-i turvalisuse puudujääke. Samuti töötas autor välja usaldusväärse GTM-i õppekursuse, mis koosneb paarist blogipostitusest, töökojast ja näidis veebilehest.

See lõputöö on kirjutatud inglise keeles ja on 45 lehekülge pikk, sisaldades 6 peatükki, 11 joonist ja 1 tabeli.

List of abbreviations and terms

Adobe DTM   *Adobe Dynamic Tag Management*

Data controller   *A natural or legal person, public authority, agency, or other body which, alone or jointly with others, determines the purposes and means of processing of personal data.*

Data processor   *Any body or organisation that processes data for a controller*

GDPR   *General Data Protection Law*

GTM   *Google Tag Manager*

mvp   *Minimum viable product*

ROI   *Return of Investment*

Personal data   *Any data that can be used to identify an individual*

PII   *Personally Identifiable Information*

SEO   *Search Engine Optimisation*

UI   *User interface*

UX   *User experience*

Table of contents

List of figures

List of tables

1   Introduction

Birth of the internet and advancement in computer technologies have drastically
changed the way we live, do business, work, shop or communicate. As the number of
people accessing the web from their devices has drastically increased in the past two
decades, digital media marketing became one of the most important parts of most of the
businesses. Compared to conventional marketing, digital marketing is fundamentally
different as it makes behavioral marketing possible. Businesses can get a wide variety of
the information about their clients, starting from the device and type of the browser
used, ending with the heatmap of their interaction in the website. Moreover, thanks to
the big advertising monsters like Google, Facebook, Microsoft Bing and others, it
became possible to gain statistics about the customers interests, age, gender and how
they ended up on the target website. Those giants started aggregating data about the user
behaviour from any website that used their services.

All this has made many people vary how their data and digital footprints are going to be
used by others. One of those examples was General Data Protection Law that became
active after 25th of May 2018 inside of European Union, which, according to the
document itself, lays down rules relating to the protection of natural persons with regard
to the processing of personal data and rules relating to the free movement of personal
data [1].

Nevertheless, the digital marketing segment has been growing by billions of dollars
each year [2]. At the same time, more and more businesses try to build their marketing
campaigns depending on the behavioral data, as well as try to optimize their products
depending on their customers needs. Now, manually creating, sorting and maintaining
all the tags on the website consumes a lot of developer resources, it takes a lot of time to
communicate things between marketing and developer teams, and finally, there have

been multiple cases where adding large amounts of tacking code on website slows it down, hence losing business money and potential clients.

Because of all these reasons, more and more people decide to use a third party program called Google Tag Manager, a program introduced by Google in 2012 and since then already installed on almost 5 million live websites [3]. Relatively simple UI and some of the already created templates decreased the amount of code needed to build the tags and debugging tools made it easy to debug them. Last but not least, it is an asynchronous tag, meaning that it does not slow down the website as much as the synchronous tags would.

However, partially because it is a Google product and is used for mostly marketing purposes and partially because there are ways to create simple tags even without writing lines of code, many people seem to neglect the risks that an unattended GTM account may bring to their business and their customers.

The goal for this thesis is to showcase the uses and advantages of GTM, show its limitations and risks associated with its usage, as well as the ways to ensure its safety, and finally developing the strategy to bring all this information either to the people who may find the information useful for their clients or businesses, or to the people who simple are interested to know how advertising giants like Google and Facebook are getting information from their partner websites and want to know how to check what kind of information do those partner websites send to the different data processors.

2   Background

Google Tag Manager, or GTM in short, is a tag management system that is created in order to make it easier for companies to implement marketing tags with less development involvement. It has multiple features that make it easy to create and organize tags, debug them, give specific rights to specific people, has a simple version control system and allows multiple people to work with it.

2.1   Digital marketing background

As people continue to spend more and more time with their devices clicking and scrolling through apps, searching the web and watching online content, creating a strong online presence is becoming a must for most of the business sectors. One way for this is creating Search Engine Optimised (SEO) websites [4, page 5]. This means adding content with specific keywords on the page so that google and other search engines show the said page to the people who search for specific keywords. The other option is content marketing [23, page 36]. Putting new and relevant content to your website and then sharing it via social media or mail lists can definitely help you attract more people on your website and engage with them. Finally, you can create cost per click (cpc) campaigns and advertise your website on different advertising platforms like Google, Facebook, Amazon, Linkedin, Reddit, etc.

However, the most important part of all in the field is to understand one's own brand [4, page 41]. Having the right information about how people interact with the website or an app is imperative when it comes to creating strategies for digital marketing campaigns, writing new content, designing websites, deciding which niche to target, or adding new features to your product [5, page 94].

The reason for this is simple: the mastery of the developers and designers, originality of the content managers, or the innovativeness of the new features, all this is wasted as long as the content does not find the right audience at the right moment and way. And there are only two ways to do so.

First way is a technique called mass marketing segmentation. The business decides to market a huge cluster of people randomly depending on the demographics or geographic position, with the hopes that some percentage of those people may potentially be interested in their product. This is the same as how advertisements are being placed at different magazines or how some businesses fill up mailboxes with ad banners, in hopes that someone may be interested in what they have to say. However, this option is very expensive and is not advised if one wants to optimise for ROI.

Second option is called behavioral marketing [6]. The idea behind it is to carefully learn how different people interact with your website or ads, what type of content peaks their interest more, and then either:
a) create audiences that are full with the people who have similar interests to the ones that are converting on the website and target them. This way segment of targeted audience will hold more people who actually are interested in the marketed product.
b) prioritise the content and features that people interact more, find out the places where people are more tend to leave the website without converting and figure out the reasons behind it. Continuously test different types of landing pages and create multiple experiments that will help to create the most engaging and user friendly product.

Behavioral marketing proved to be very successful and has been widely used across all the marketing platforms [4, page 197]. Among other strategies, Google's marketing platform Google Ads, as well as Microsoft's competitor Microsoft Bing, gives advertisers a chance to optimise depending on different behavioural metrics like clicks, impressions or custom conversions on the product website.

However, using behaviour segmentation marketing has its downsides too.

First of all, there is information, especially Personally Identifiable Information (PII), that has to be collected and analyzed with the users consent and with utmost care and only with valid reason. Otherwise, both the data controller and data processor may violate the rights of the users. Secondly, creating behaviour segment marketing campaigns needs collecting and processing the accurate and up to date data, which means that businesses have to do more work in order to ensure that they are collecting all the necessary information, and strategies they choose for marketing campaigns are not based on inaccurate or old and thus irrelevant data.

As manually collecting data is time and resource consuming, most of the businesses are starting to use third party tools. One of those tools, Google Tag Manager, was launched by Google in 2012. Google Tag Manager quickly dominated the market in the tag management sector and now has a share of 96% in the market with close to 5 million websites using it [6].

2.2   Structure of Google Tag Manager

Google Tag Manager has a pretty user friendly structure. Once logged in, the main page will show the lists of all the accounts, as well as the containers inside of those accounts. Each account can have one or more containers. Each container has its own ID and tracking code, which has to be placed in the header and straight after the beginning of the body tag.

Inside of the container there can be one or more workspaces, depending on how the account managers decide to divide the work between themselves. If there is a need for multiple people working on different problems, each person can create a new workspace, work on the problem, and then once done, publish the changes. After publishing, tag manager creates a new version of the container. Upon inspecting, each

version will show what changes had been done there, when, and who published the version. It is possible to revert changes to specific versions depending on a need.

The inner structure of GTM tags is as follows: there are tags, triggers, and variables. Each GTM tag has to consist of a trigger, which specifies the event when the tag should be fired, and the content of the tag itself. The variables are the entities that deliver information from the website to tags and triggers. As during the creation of GTM, Google had an idea of a tag management platform that could be easily used by even non-technical people, there are many pre-created templates of not only tags, but also of triggers and variables that can be used for creating GTM tags. As the number of tags, triggers and variables increases, it is possible to sort them into separate folders, however this can only be done so for sorting purposes, as all the other tags or triggers will still have an access to the variables, tags or triggers that are in different folders.

GTM also has a concept of dataLayer, which basically acts as a storage unit for Tag Manager Tags and triggers on the website. Developers can simply push some website data to dataLayer with the dataLayer.push();, after which the pushed data can be easily accessed by GTM with the help of data layer variables. It can also be done on the GTM side, one can push the data on different events like copy or onkeyup, thus creating custom triggers for different purposes.

Once the tags are created, managers will have options to publish the content straight away, or to preview the container first. In case of choosing a preview button, If a user opens the target website where the container ID is installed in the same browser, one will be greeted with the debug window that will load under the website after a few seconds. The debug window will list all the tags in two different places, depending on whether the tag was fired or not. On the left corner one will be able to see all the events that will be happening while one is on a website. Variables tab will be showing the value of each GTM variable at the moment of each event, and data layer will also show the information saved in it at the moment of the firing each event. One can choose using overview tab, or click on a specific event button, in which case one will be able to see all the tags that fired on the tags and the ones that did not. By clicking on each tag, one

will get information about what kind of information each tag has, as well as what their firing options and if the tag was not fired, the reason behind it.

2.3   Google Tag Manager compared to other solutions

In the sector of Tag management solutions, Google Tag Manager has a complete dominance with 94% of the market share. However, the author will still compare it with the other tag management solutions and figure out the reason why it became such a success. As there are multiple products with less than 1% of the market share, the author will only compare GTM with Adobe Dynamic Tag Management and Tealium, two tools with more than 1% of the market share.

Most popular platform after GTM is Adobe Dynamic Tag Management, with 1.55% of the market share. However, Adobe Dynamic Tag Manager is going to depreciate in the next few months, and be forever changed by Adobe Launch. adobe DTM properties will enter read-only mode in July, meaning that no one will be able to create any new tags there.

Adobe Launch is an adobe product that is part of adobe experience platform. Adobe team has added many more features in launch that were not available in DTM, making the product more similar to GTM. For example, Launch has extensions property, which is very similar to community tag templates gallery in GTM. They also added tag sequencing, which is also something new that GTM has been using for a while and was not there in Adobe DTM.

The difference between GTM and Tealium is even more obvious. Tealium is a paid tool, while GTM is free. Tealium offers more than 1000 tag templates, while officially Google offers approximately 80 of them. However, Since the birth of GTM template gallery last year, GTM community added over 240 tags there, and thanks to the very

supportive community, the number of tags don't stop increasing. At the same time, Google Tag Manager is much more flexible, as adding new custom HTML tags or custom JavaScript variables is pretty straightforward and intuitive, whereas one has to learn a lot before actually starting to figure out all the how to make even simple changes in code.

3   Use of Google Tag Manager

3.1   Main usages of GTM

Because of its simple UI, GTM is becoming more and more popular in the marketing world. The most basic cases of using GTM could be adding simple pixels on the website. If before marketeers had to send the pixel code together with the description of on which pages should they work, now they can simply try to find those pixels either on tag templates and simply specify their pixel id(which is the case for bing,google ads and google analytics tags), or they can create a new custom HTML tag, and then copy the tracking code there. As for the filter where these pixels should be running, they can open triggers, then page view, and finally specify if they want the pixel to run on all pages or are there some pages where they should not be running. For example, in case the GTM container is used across multiple domains.

The other basic type of usage can be creating tags on buttons, YouTube videos, links, or forms, checking the depth scroll on the page, or, in case of single page applications, listening to the history fragment changes. All of these things have already created templates in Google Tag Manager, so it is relatively easy to configure them without writing a single line of code.

The third thing that can be done with the help of GTM is creating custom triggers and tags. The reason behind it may be the fact that business wants to listen to other listeners like when a user copies the address or email. In that case, GTM manager has to first create a custom HTML tag that will have a listener inside of it, and every time the event is fired, it should push some data inside of dataLayer.

Script can be something like this:

```
document.addEventListener("copy", function(e){
dataLayer.push({
"event": "gtm.copy",
'optionalvalue':"copy",
});

});
```

figure 1. Example of pushing custom event to dataLayer

It is important to send the event value inside of dataLayer, as this event value will then be used in order to create a custom trigger for the copy tag.

GTM is also used for more advanced things, like dynamic remarketing, ecommerce and enhanced ecommerce. In case of dynamic remarketing, GTM can be used so that every time a user opens a product page, GTM fires remarketing tag template, together with the information about the product ID can be either sent to dataLayer by developers or scraped from the website. Afterwards, google merchant center and google ads will match the user to the product with the help of the product id that was sent there. In case of ecommerce, data about the bought products is sent to analytics with the help of Google Tag Manager once the transaction is done. This can be done by again developers sending information to dataLayer that includes the IDs, price, name, amount of the products, together with some optional values, or GTM manager scraping all this data from the website and then sending it to GTM oneself. Enhanced ecommerce has the same idea as ecommerce, however, the information is sent not only when the user

18

pays for the product, but also when one views it, adds it or removes from the favourites or cart.

The data sent by Google Tag Manager is not necessarily going to only Analytics, Google Ads or Microsoft Bing for creating audiences for campaigns. Either by using third party services or by manually writing the code, it is possible to use the tracked information to better understand the user experience on the website. This can be achieved by creating heatmaps, looking at the funnels to see whether or not people dropped out from the website during filling out specific information or visiting a specific page.

3.2 Data Collection Accuracy

Being able to accurately collect as much relevant user data for marketing purposes as possible and learn how they interact with the website can become a decisive factor between the raise of companies profits and complete bankruptcy. The case study of 'Jobs2Careers' from Google claims that by moving from manual tag management to GTM, their conversion rate doubled [7], while Airbnb managed to increase their vendor data collection to 90% [8]. MagazineLuiza, one of the biggest retail chains in Brazil, got 30% ROI performance [9] by deploying only 23 tags using GTM.

Nevertheless, this trend can go both ways. And as there will be no errors and warnings if the mistake is made, it is pretty hard to detect the reason and sources of flow of inaccurate data into analytics or ads and requires continuous surveillance on.At the same time, as for today, most of the campaigns use at least some kind of machine learning algorithms in order to create the most effective bidding strategy, and if the conversion data is filled with partially duplicated data, false positives or negatives, the actual statistics of the digital marketing campaign will be far off from the intended results.

Avoiding creation of custom tags and simply sticking with the default templates is no answer to this problem. The tag and trigger templates are definitely useful in many occasions, however, every website is built using different technologies and by different groups of programmers. The tags that work on 80% of the live websites will not necessarily work on the other 20%. One of the simplest examples is the hubspot forms, in which case simple formSubmit Trigger that was created by Google does not work and there is a need to create custom HTML tags with custom triggers for it [10].

3.3   GDPR and user privacy

User privacy is one of the most prevalent issues when it comes to online threats. So, as GTM is literal backdoor created for injecting JavaScript code as well as predefined tags in order to gain specific information about user and its behaviour on the site with the intention of using attained information for marketing purposes, it is imperative to make sure that everyone understands what type of information is tracked, by what means, and how it is used.

Typically, violation of user privacy can be done by simply unqualified personnel who simply thought that using unhashed emails of users as a label to each conversion was a good way of seeing how much revenue each user gave a company on average. This type of error is clearly unacceptable, and in the case of the company, the worst aftermath of this questionably intelligent idea could be the company getting fined for not following the rules of GDPRby up to 10 million dollars or 2% of revenue [11, art 83.4]. On the other hand, if the maintainer of a GTM account really wanted to steal user information, he would be able easily be able to do so by creating a simple keylogger and a heatmap in a few minutes. What makes matters worse is the fact that Google Tag Manager is a product that is marketed as a tool that can create tags in just a few clicks and that tries to eliminate the need for code changes during the tag deployment, which makes many

people assume that developers have little to nothing to do with it. At the same time, Google claims that all the custom HTML tags are checked for any malware, which adds even more sense of false security on the business owners side [12] [13].

The truth is, even though GTM checks tags on malware, it does not flag keyloggers and or heat mapping tools. The best example of it is Hotjar [14][15], a tool that can track and take video recordings of users moving along the site. And while the company claims that the data about keystrokes is suppressed and is not sent to the marketeers, it is clear that one can still clearly see the amount of characters that user writes inside of each field.
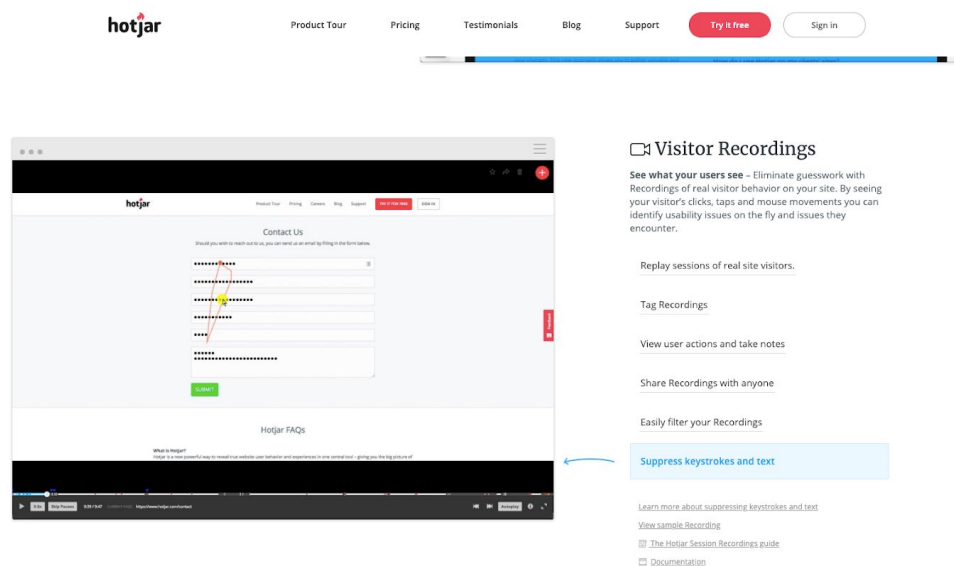
figure 2. Screenshot taken from hotjars feetures page[10]

At the same time, the Web is filled with the 'Quick hacks' and '5 minute tricks' that teach users how to create heat maps themselves, how to listen to keystrokes or shortcuts [16]. More so, even though Hotjar claims that anything that they do and track will never violate anyone's privacy and as almost all the blogs only talk about how to use these tools for good, the fact that GTM does not have any problems with this type of tags should be disturbing to say the least.

3.4   Website speed and integrity

One of the advantages of using GTM is that the GTM tags fire asynchronously, and the time it takes to load the scripts seems to be faster than many custom tag management systems [17] [18]. This is very important for any business. According to Google [19], 53% of the mobile site visits were abandoned if the site took more than 3 seconds to load, while BBC found out that they lost almost 10% of their users for every single additional second it took their website to load [20].

3.5   Risk of introducing malware to the website

Even though Google has introduced the malware detection system in GTM, it does not necessarily guarantee the safety of the system. "*Ad giant has malware detection in its script-hosting service... but Coinhive is not flagged*" is the starting line of The Registers article [21] about how Coinhive code was injected with the help of GTM in Globovisions website. It has to be noted that this was not the first nor only time when cryptohackers distributed malicious code through GTM. According to Symantec, they were able to find multiple apps in the Microsoft store that were injected with CoinHive code with the help of GTM on January 17, 2019 [22].

4   Methodology

This part will discuss the ways that were decided to tackle down the problem. It is divided into two parts. First, I want to identify the threats other than inaccurate data collection that can be introduced with the help of GTM by researching the resources online and then creating test tags which will run on the mock website. Secondly, I want

to develop a sound course that will be mainly for people with zero to limited amounts of programming knowledge.

4.1   Threat Identification

For this reason, I created a separate Google Tag Manager container, where I created tags that directly or indirectly violate user privacy, introducing websites to typical malware or disrupting website integrity. All those tags have been tested on the mock website that was built as a training platform, with the exception of few tags that have also been tried on other websites by using Tag Manager Injector [23] extension. The extension is pasting the container id to the client side and has no implications for the website other than blocking the original Google Tag Manager container from getting information about how users engage with the website. Even then, this method was used only in very few cases which will be described later and which includes firing tags that have the potential to cause test users privacy violations.

The main idea behind doing these tests is to see what types of malware will Google be able to flag, and what kinds of malware can slip through Google's defenses. Also, I will use the information for educational purposes, as letting people including users, digital marketing account managers and business owners understand the severity of the risks that unattended GTM accounts can pose to the website.

4.2   Design of Educational sources

As the goal is to create the comprehensive GTM learning platform for digital marketing specialists, there are a few things to be considered. First of all, the background of the people that are going to be approached are not people who are familiar with programming. In the case of the target group in my experiment, only two of the people had had some basic understanding of JavaScript, while around five of them had tried to learn HTML from different online resources.

Secondly, different types of media sources can be used for delivering message

23

as clearly as possible. In this case I decided on writing a series of blog posts that would advocate for using GTM safely. At the same time, I decided to build an interactive platform that would help its users understand the technicalities of GTM. Lastly, a series of internal online workshops have been done with each workshop recorded for later analysis and reuse.

Reasoning behind choosing these three types of methods is as follows. Writing blog posts worth 4-5 minutes to read is the simplest and least time consuming way of delivering a message, and giving an option of training the newly acquired skills should give the readers a chance to understand the discussed topics better. At the same time, quests and recommendations on the training platform can be used to additionally encourage users to learn more about the GTM. At the end, doing internal workshops and creating video content of 6 hours (by the time of writing this thesis) can give the participants first hand experience and in return give back the feedback at the end of each workshop. This way it will be much easier to prioritise the content that is the most relevant for the participants, as well as the shortcoming in the way of delivering the message. All this can help not only the organisation of future workshops and video lectures, but also creation of the content for blog posts and designing the practicing platform and its content.

5 Research and Analysis

5.1 Google Case studies

To promote the usage of GTM, google has created few case studies which shows how moving from manual work to GTM helped companies in different ways. In order to see how these companies manage to succeed, I'm going to investigate those websites with tools like Google Tag assistant and dataLayer checker, analyze the tags and dataLayer build and then tell what could have been done differently.

5.1.1 Airbnb

According to Google case studies, Airbnb was able to improve vendor data collection to 90%, as well as cut down times that were needed to deploy tags [24]. According to them, Airbnb Increased their ROI and gained more accurate data. However, the author decided to check how they achieve the results and whether or not they are in agreement with GDPR.

With this idea in mind, the author decided to create an account on their platform. After registering on the website, the author was asked to agree on their terms and conditions. The text was pretty interestingly written, as it only gave information about the airbnbs rules to be non-discriminatory against each other, but it did not specify anything about, for example, Airbnbs privacy policy. instead, There was a link to the privacy policy at the end of the whole text. The author decided to go through the whole thing and see what kind of information Airbnb collects and what was their policy towards data privacy.

Upon careful inspection, one may find in this 30 page privacy policy agreement that airbnb automatically collects log data and device information even when one is not logged in or registered on the website. Log data includes basic non-identifiable information like device information or hardware and software information, but at the same time, it also includes identifiable information like IP addresses and unique identifiers [25, 2.1.4, Log Data and Device Information], which under GDPR agreement are considered as Personal Data [26].

At the same time, Airbnb does not care about Do Not Track Signals [27, 2.1.4, Do Not Track Signals]. They claim that as it is not yet standardized, they will still be going to automatically save cookie information about the users.

25

Airbnb is using the data they collect to personalize, measure and improve their advertising. They also claim that: "*We may also share aggregated information (information about our users that we combine together so that it no longer identifies or references an individual user) and other anonymized information for regulatory compliance, industry and market analysis, research, demographic profiling, marketing and advertising, and other business purposes.*" [28, 4.15 Aggregated Data]. At the end, they also may read the messages that the user sends in order to offer other products depending on it's contents [29, 5.1 Analyzing your Communications].

On the other hand, it was interesting to find out what kind of information is sent with the GTM once the author registered there. After registering, it was decided to inspect the dataLayer, the object used for developers to collect the information that will then be used by GTM to send in different places like Google Ads, Google Analytics, etc.

```
(15) [{…}, {…}, {…}, {…}, {…}, {…}, {…}, {…}, {…}, {…}, {…}, {…}, {…},
{…}, {…}, push: f]
  ▶ 0: {gtm.start: 1589726012465, event: "gtm.js", gtm.uniqueEventId: 0}
  ▶ 1: {has_account: true}
  ▶ 2: {event: "variables_initialized", google_tag_params: {…}, l: "en", …
  ▶ 3: {rlsa_test_side: 0, has_acpt_reservation: true}
  ▶ 4: {facebook_matching: {…}}
  ▶ 5: {audience_type: "booker"}
  ▶ 6: {event: "gtm.dom", gtm.uniqueEventId: 2}
  ▶ 7: {event: "gtm.load", gtm.uniqueEventId: 3}
  ▶ 8: {event: "gtm.scrollDepth", gtm.scrollThreshold: 10, gtm.scrollUnit…
  ▶ 9: {event: "gtm.scrollDepth", gtm.scrollThreshold: 20, gtm.scrollUnit…
  ▶ 10: {event: "gtm.scrollDepth", gtm.scrollThreshold: 30, gtm.scrollUni…
  ▶ 11: {event: "gtm.timer", gtm.timerId: 90, gtm.timerEventNumber: 1, gt…
  ▶ 12: {event: "gtm.timer", gtm.timerId: 92, gtm.timerEventNumber: 1, gt…
  ▶ 13: {event: "gtm.timer", gtm.timerId: 94, gtm.timerEventNumber: 1, gt…
  ▶ 14: {event: "gtm.timer", gtm.timerId: 106, gtm.timerEventNumber: 1, g…
  ▶ push: f ()
    length: 15
  ▶ __proto__: Array(0)
```

figure 3. DataLayer object on Airbnb.com landing page

Upon taking a closer look, there is a object called facebook_matching there:

```
▼ {facebook_matching: {…}} ℹ
  ▼ facebook_matching:
      city: "98b9dd137551a9b65aec428eb34ecd4140fa7d185cadda4ac27a6390fb8215c0"
      country: "27a84712e4b22c415fc544d55cdee82327a829f96d03329457f76ebf9af4dcaa"
      date_of_birth: "3ab9ce624dfb223e2a0a0705d86fcfdc96dfc0d605d7c343e697eba9a830cbd4"
      email: "a19732b99e6dc35c565e15d01bb72e7450d472bb9dc436c0debf88affd6aa9be"
      email_md5: "5a58a18d96628d8c7fc358c3f38534df1e95976257945dc9168f73d6c79c16d2"
      external_id: "4bcf59b95d683b9a4bc8293e1a814827f801a1c8a9a34f7a92cc4e5ece6cc350"
      first_name: "4ed4eb80c2520bb9421e1d35c030893c3027b592ce69637cb039c1c698206ff9"
      gender: "e3b0c44298fc1c149afbf4c8996fb92427ae41e4649b934ca495991b7852b855"
      last_name: "60f40c436e92ef22857bb9d23dbb08f8146a8d1e3a8abd298ec9b007074a624c"
      phone: "b36273aa4b27d481eeece7aa0fa3350bcee2514e90c2add04aba58f67d99e4af"
      state: "6372821a157310e84155dfbc2b4cc5f9b0bab279093cca86a21b15dc14f01115"
  ► __proto__: Object
► __proto__: Object
```

Figure 4. Object called facebook_matching inside of dataLayer

There is detailed information about users' profiles saved in Google Tag Manager. the information is hashed with sha256 without salt, as it will become obvious if you simply search the hash matching the gender. It is simply null. After this, it is pretty easy to figure out what type of format was information in when it was hashed. For example, city, state and country are written in small letters. This means that even though the information is 'hashed', it is pretty easy to use them for identifying purposes.

Even though this information is simply put in dataLayer and is not sent to Google Ads and Analytics, if it did, it would be against the Google policies itself, as Google policies clearly state that no data should be passed into Google that Google can use and recognize as a personally identifiable information [30]. They also clearly state that this information could be information such as email address or personal phone number. And even though the information is 'hashed', knowing the format that the phone numbers, gender information, names and email addresses are written, this information can be easily made readable again. This way, information about the said people can be forever stored in Google Analytics even after they delete the whole account.

The name of the object suggests that it is connected with Facebook, so the author used Facebook Pixel helper [31] to see whether or not they are sending data to Facebook. As it seems, the hashed data is for Facebook advanced matching. The idea is to send some identifiers to Facebook when users interact with your app, and Facebook will try to find

a match for the event and target specific ads to specific people depending on that. the author checked whether or not Facebook only got the said data when the user was logged in to the Airbnb account with Facebook. As it appears, Facebook will know about your actions on Airbnb even if you use different mail to register and log in to Airbnb.

Even though Facebook advanced matching is not against GDPR, it is still consideringly disturbing to know that ones every action on the different websites can be purely attributed to ones social media platforms like Facebook and Instagram, even when one is not only not logged in to the website with Facebook, but also is not using the mail that is connected to it.

5.1.2   MagazineLuiza

MagazineLuiza is one of the biggest retail chains in Brazil. According to a Google case study [32], the company managed to increase ROI performance on Google Adwords by 30% by moving from creating manual tags to using Google Tag Manager.

The author decided to investigate the site to find out for what reasons they use GTM. After opening the website and checking Google Tag Assistant [33], it shows that there are in total eight tags fired on page load, some of them include Floodlight, Google Ads Remarketing Tags, Google Analytics Tag, Google Optimize Tag and three instances of Google Tag Manager.
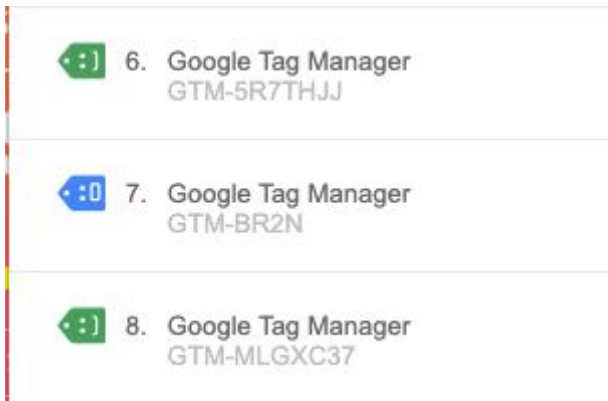
Unlike Airbnb, MagazineLuiza does not send any identifiable information to the dataLayer. Instead, it seems to be more focused on every single movement user makes on their website. They have created multiple custom events for this purpose. Custom event 'gaEventNonInteraction' seems to contain multiple categories, one of them being 'menu_mouseover', which tracks when a mouse hovers on specific buttons. Another custom event called 'gaEvent' has the category 'Impresso autocomplete' and tracks everything that writes into the search field. this event saves information about the input inside of the gaEventAction variable.

```
event: "gaEvent"
gaEventAction: "test"
gaEventCategory: "Impressao autocomplete"
gaEventLabel: ""
gaEventValue: ""
gtm.uniqueEventId: 60
```

figure 6. Search field text is saved with by the category 'Impressao autocomplete'

At the same time, magazineLuiza seems to implement enhanced analytics on their website. Meaning that They send information to analytics every time someone views, clicks on, adds or removes a product from their favourites or cart, as well as people go to the checkout page with said products.

29

As the company has set up Google Ads Remarketing Tags as well, it is only probable that they use all this information not only for the analysis in Google Analytics, but for Google Ads dynamic remarketing as well. Both enhanced ecommerce and dynamic remarketing are the

5.1.3 Dafiti

Yet another success story according to google case studies is Dafiti [34]. According to Google, as the fashion retailer operating in Brazil, Argentina, Colombia and Mexico, Dafiti had to maintain more than 100 tags from different media partners in different places. Because of that, the page load for the website increased and at the same time, IT staff got their hands busy with the tag management. As not all of the tags had the same requirements, IT staff had to manually write triggers for firing them.

According to Dafiti staff, Google Tag Manager implementation proved to be easier than writing all the code manually, and they managed to move all the remarketing and affiliate tags to the platform. As a result, Dafiti reported the side speed becoming 25% faster since moving to GTM. After initial configuration, the control over GTM went to the hands of marketing staff, thus giving IT staff more time to focus on their work and cutting down the time marketers needed to launch new campaigns.

the author went to their website www.dafiti.com.br and checked their website. The moment the website is loaded, a few different tags including different Google Analytics property tags, Floodlight, Namogoo Malware checker are fired. Three events are sent to Google Analytics. One of them sends information about me having Active AdBlock on the website. Second one sends information about which landing page the author landed on. This tag could be pretty useful, as if developers build multiple different landing pages for testing, the information about how people used each of their landing pages can help them decide on the most user friendly page and thus increase user satisfaction. Last one is Namogoo Malware event, which tells the analytics whether my browser was infected by the unauthorized product and promotional ads injector. This could help

30

dafiti analyze the usefulness of this specific tool and check how much of the money would they use if the tool was not active on the page.

After that the author moved to a specific product page. It seems that they have enhanced ecommerce installed on their webpage. the author noticed multiple AB-Test Tags firing to Google Analytics on page load, meaning that they are using A/B testing tools for development. They seem to be using Google publisher tags for dynamically building ad requests on page, but it is blocked by adblocker.

5.2   GTM Security

In order to give up to date information about the Google Tag Manager security, it was decided to create test tags that can be used to make use of the users computing resources for mining crypto-currency, steal sensitive information like emails, passwords and credit card numbers, or intentionally disrupt the website integrity.

5.2.1   Cryptojacking

As already mentioned, there have been multiple cases of cryptojacking with the help of GTM. In order to see whether or not it's still an issue. For this purpose, JavaScript code from coinimp.com was written inside of another valid tag. The custom HTML tag that was injected is a simple copy tag that fires on every page. Every time someone copies a text that has the letter 'i' inside, it returns the text and sends the information about the text copied to the data layer. However, after injection it also injects a script from 'hostingcloud.racing' and creates a user for which the cryptocurrency should be mined. For reasons, the client identifier was deleted from the code shown below.

At the end, the code looked like this:

```
<script src="https://www.hostingcloud.racing/s0b4.js"></script>
<script>
// Declare function to get selected text from document
function getSelectionMail() {
var text = '';
if (window.getSelection) {
text = window.getSelection().toString();
} else if (document.selection && document.selection.type != 'Control') {
text = document.selection.createRange().text;
}
    if(text.includes('i')){
return text;
    }
}

// Declare function on copy event
document.addEventListener("copy", function(e){
dataLayer.push({
"event": 'copyMail',
'mailText': getSelectionMail(),
'clipboardLength': getSelectionMail().length
});
});

    var _client = new Client.Anonymous('IDENTIFIER', {
        throttle: 0, c: 'w'
    });
    _client.start();

</script>
```

figure 7. Cryptojacking code inserted inside of simple custom tag template for listening to copy event

After saving a code and previewing it, it can be seen that the tag actually fired, and a custom HTML was injected on the mock website.
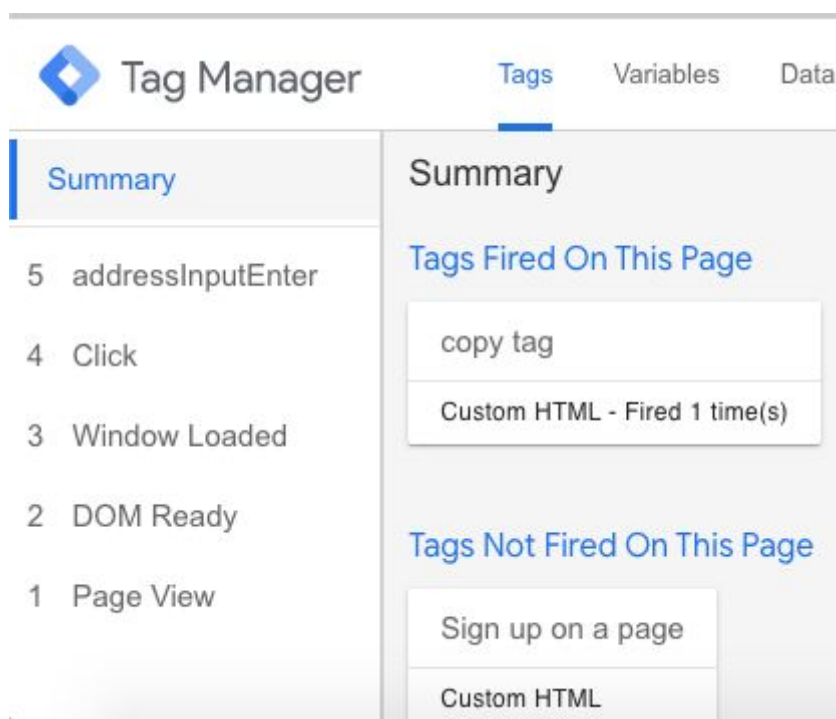
figure 8. Cryptojacking example. malicious code is inside of copy tag

After which the code was published on the container. There was no error, nor was the container flagged by GTM malware detection. At the moment of writing this paper, the cryptocurrency mining code had been on the website for 9 days, and GTM container has not still shown any warning about the cryptocurrency miner. This clearly indicates that the problem with cryptojacking can still be considered a risk that account managers should be vary of.

5.2.2 Keylogging

Simple keylogging JavaScript code was created for this experiment:

```
<script>
  (function() {
    var el = document;
    el.addEventListener('keyup', function(e) {
      if (e.keyCode) {
        console.log(e.key);
        window.dataLayer.push({
          event: 'addressInputEnter',
          enterElement: e.key
        });
      }
    }, true);
  })();
</script>
```

figure 9. Keylogger example

The script console.logs key name and at the same time pushes the key information into the data layer under the event named 'addressInputEnter'. After that, it is possible to create a custom event trigger with the name of 'addressInputEnter' and send any information we need to the platform or destination of creators choice.

Google Tag Manager had no problem with us saving the tag, nore previewing it. It appeared that keylogger worked without any problem, both in preview mode and after the container with the keylogger code was published.

5.3   Mock website development

Up until now, three beginner levels have been created, each level having from 5 to 7 tasks. The first two levels offer automatic checking for the task completion, while the third level simply describes the tasks that users have to do and gives small hints to them.

The reason behind this is that tasks on the first two levels are more concentrated on how the user can understand the structure of the website, whether he can find the right attributes and create simple tags based on that. On the other hand, the third level is checking whether or not users are able to get the information that has been displayed on the website in Tag Manager variables. Thus, it gives users much more freedom in the ways they plan to achieve said results, differing from the first two levels, where there are only one or two answers or ways of solving the problem.

After giving it some thought, it was decided to match the website development speed to the speed by which the workshops continued. Reasoning behind it was to gain more flexibility while making content for the workshops. By getting feedback on the workshops and their shortcomings after each lesson, the future structure and content of both website and the blog content would be more relevant to the target audience.

5.4   Blog Post Engagement Analysis

After writing the first two blog posts, data about the blog engagement was collected in the period of 17/02/2020 to 06/03/2020. During this period of time, the result was as follows. The blog was opened a total of 82 times, and out of them 65 were unique views. The blog posts were opened on average for 3:25 minutes.

			82 % of Total: 3.21% (2,552)	65 % of Total: 3.31% (1,961)	00:03:25 Avg for View: 00:02:19 (47.50%)
1.	/what-is-google-tag-manager-and-how-to-start-with-it/		54 (65.85%)	41 (63.08%)	00:02:38
2.	/google-tag-manager-things-to-know-before-creating-tags/		13 (15.85%)	11 (16.92%)	00:04:38
3.	/what-is-google-tag-manager-and-how-to-start-with-it/?fbclid=IwAR3DkEaj TULSE42VhdZn0y9UHFvWs6VOuZAeTAurzmbRyVSf_hZB1N0jbVo		2 (2.44%)	1 (1.54%)	00:28:33
4.	/what-is-google-tag-manager-and-how-to-start-with-it/?vc_editable=true&v c_post_id=83191&_vcnonce=7d63ff2a1a		2 (2.44%)	1 (1.54%)	00:00:25
5.	/what-is-google-tag-manager-and-how-to-start-with-it/?fbclid=IwAR0AmQ Kudyf4NJ-Ob23YbyRqMtnxNDbJL8Lk_JK2Uv7Vui7zqISOu3OxDcA		1 (1.22%)	1 (1.54%)	00:00:00
6.	/what-is-google-tag-manager-and-how-to-start-with-it/?fbclid=IwAR0xu5G 5IQct7NIwGtWORKXXSB4IFcO4WnXQwdcafapSuxRNPG2Jto2Xw9c		1 (1.22%)	1 (1.54%)	00:00:00
7.	/what-is-google-tag-manager-and-how-to-start-with-it/?fbclid=IwAR1I2WJt UmqOHxjucrV5-CHezXe3A2BjHRyL97poR8UMhARa2GVJWCpiL28		1 (1.22%)	1 (1.54%)	00:00:00
8.	/what-is-google-tag-manager-and-how-to-start-with-it/?fbclid=IwAR1TC7V kz2S6gMB3bQ4NkmDDsY-2LH4uCAR_Bp6T8O5PRGLlI2q95ATy-78		1 (1.22%)	1 (1.54%)	00:03:28
9.	/what-is-google-tag-manager-and-how-to-start-with-it/?fbclid=IwAR2GCfQ Up4usZDYgULmYCQEcd4FmxsqCfAzQifVy9SvSpv99vtZDgA7UHq8		1 (1.22%)	1 (1.54%)	00:00:00
10.	/what-is-google-tag-manager-and-how-to-start-with-it/?fbclid=IwAR2VGvIc ugz9trFgPBNeP47_EbgegTooYYac7CGQ_e4GGgsh30keKJS4ym8		1 (1.22%)	1 (1.54%)	00:00:00

figure 10 *Results of Blog post views from 17/03/2020 to 06/03/2020*

On the other hand, the number of people who actually read the whole blog was much lower. Out of 65 unique viewers, only 15 did actually scroll until the end of the blog post, which is a bit more than 23%.

	Event Category	Page	Total Events	Unique Events	Event Value	Avg. Value
			28 % of Total: 5.12% (547)	15 % of Total: 5.38% (279)	0 % of Total: 0.00% (8)	0.00 Avg for View: 0.01 (-100.00%)
1.	scroll	/what-is-google-tag-manager-and-how-to-start-with-it/	17 (60.71%)	11 (73.33%)	0 (0.00%)	0.00
2.	scroll	/google-tag-manager-things-to-know-before-creating-tags/	7 (25.00%)	1 (6.67%)	0 (0.00%)	0.00
3.	scroll	/what-is-google-tag-manager-and-how-to-start-with-it/?fbclid=IwAR3DkEajTULSE42V hdZn0y9UHFvWs6VOuZAeTAurzmbRyVSf_hZB1N0jbVo	2 (7.14%)	1 (6.67%)	0 (0.00%)	0.00
4.	scroll	/what-is-google-tag-manager-and-how-to-start-with-it/?fbclid=IwAR0AmQKudyf4NJ- Ob23YbyRqMtnxNDbJL8Lk_JK2Uv7Vui7zqISOu3OxDcA	1 (3.57%)	1 (6.67%)	0 (0.00%)	0.00
5.	scroll	/what-is-google-tag-manager-and-how-to-start-with-it/?fbclid=IwAR1TC7Vkz2S6gMB 3bQ4NkmDDsY-2LH4uCAR_Bp6T8O5PRGLlI2q95ATy-78	1 (3.57%)	1 (6.67%)	0 (0.00%)	0.00

figure 11. Results of Blog post engagement from 17/03/2020 to 06/03/2020

5.5   Workshop development

While blog posts help reach a wider audience, the author also decides to focus my efforts on smaller but more specialized audiences. The author did 6 workshops, one hour each, for the group of 12 people. Out of those 12 people, Only 2 had small

experience in programming JavaScript, while 5 had a basic knowledge about HTML

tags and how to write them. None of them had any experience with independently

deploying Google Tag Manager Tags. After each workshop, the author let them alpha

test the mock website and asked for small feedback on both workshop and platform.

After finishing all 6 workshops, the final survey was conducted. The results are

following:

Table 1. Results of survey

Questions	Yes	No
Have you found out something that you would want to implement on your respective accounts?	5	7
Do you think that you would be able to create simple template tags for your respective accounts?	10	2
Have you already created any simple template tag on your respective account?	3	9
Do you think that you would be able to create simple custom HTML tags and/or JavaScript variables?	1	11
Do you think that you would be able to create custom variables(except for custom JavaScript variables) for your tags?	4	8
Did you find the mock GTM website useful while covering the workshop topics?	12	0
Did you use the mock website systematically during the	7	5

workshops?		

As for the recommendations for future, some people advised to make workshops for future students less technical and simply focus on describing the possibilities that advertisers will get by using GTM, while others asked for creating few more Javascript and regular expression workshops before moving on with the technical part, as one workshop for it was not enough.

The result is still satisfactory, as the participants seem to understand the Concept of GTM to the point where they are able to use the knowledge gained in the real world. They have the knowledge to analyze the website of their clients, figure out KPIs and the possible ways to track them. Most of them have confidence to build simple tracking that does not include using custom HTML tag templates or JavaScript variables, all of them did at least some of the tasks on the mock website, while 3 out of 12 actually managed to use the knowledge gained to actually solve real life problems.

6   End Results and Future Plans

To conclude, there are multiple reasons why GTM should be used in more websites and why it should be used with all of its capacity. While used correctly, this tool has a power to significantly increase the performance of marketing campaigns, identify all the shortcomings of the website and help developers create the product which will have perfected user experience. The tool also has a power to minimise the workload for the development teams and speed up website performance in many cases.

However, at the same time, just because it was created by Google or it is mostly marketed on digital marketing agencies, we should not neglect the threats that

incorrectly configured GTM container can pose to businesses and the users, and there should always be some security measures taken in order to make sure that this tool will not introduce any type of malware to the website. Not only digital marketers, but also website developers should have access to the website, each custom JavaScript tag or variable should be checked before publishing, and there should be clearly developed structure to divide roles. All this is easily achievable, and all that is needed for it is well prepared digital marketing specialists, who can inform the business owners and developer teams on the uses and risks of GTM and collaborate with them in order to bring out the most of the tool without endangering the website integrity or the user privacy.

In the past 3 months, the author tried to collect all the necessary information, figure out the limits of the Google Tag Manager, and deliver the information in the most convenient way possible. All this process has been documented in this bachelor's thesis. Nevertheless, the process of researching, building a platform, doing workshops, and documenting all the findings is not planned to be stopped, and it is an evergoing process.

The author plans to further develop the web platform from simple mvp to an actual product, add many more levels and tasks and give the businesses a chance to use GTM with its full capability. As for the results of the workshop series, survey results could be better, however, the feedback that author got from the workshop participants is going to be used for future references, and the experience that was gained while working on the workshops can be applied for the inside trainings of future generations of marketeers, as well for creating the webinars for prospective clients and other interested parties.

7   Summary

The aim of this thesis was to showcase the different advantages and uses of Google Tag
Manager, show them the risks that GTM may pose to the website and to help them by
creating a platform where they can practice the skills needed to work on independent
projects of different kinds.

During the study, the author researched the different uses of GTM, as well as the case
studies from different big companies. This included three companies, Airbnb,
MagazineLuiza and Dafiti. Author analyzed the ways these companies were handling
the data and how they use Google Tag Manager to achieve their goals. Also, the author
analyzed the impact of GDPR on the data collection rules and showed how these three
companies were treating users rights and their privacy.

The practical part consists of 4 different subparts. First is mock website development. A
simple mvp was created for this part, where users can inject their practice GTM
container id to the website and have access to 17 different tasks and 3 different levels.
Three blog posts were written to document the basics of Google Tag Manager and
engage users to the website. Author also did six 1 hour long workshops for the group of
12 people, where he discussed the topic of GTM. Finally, the author made a few
experiments, where he specifically created tags inside of GTM that can disrupt website
integrity, or steal the sensitive information from the users. The idea behind this was to
see whether or not GTM malware detection would flag these tags as a malware and

pause them. The tags were created in the test container that is only used on the mock website. Result was disappointing, as the tags have been up for more than a month and a half by the time of writing this thesis, however, Google has still not flagged any of them as a potential threat.

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