RESEARCH OF THE SPAMASSASSIN ANTI-SPAM SYSTEM

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Abstract: *This paper presents the results of a research on the use of the anti-spam system SpamAssassin to prevent the receipt of spam messages on a Linux e-mail server at the College of Applied Sciences, department Uzice, SERBIA. One of the most significant problems of today's use of the Internet is that a significant percentage of e-mails are spam messages. An efficient system for filtering spam messages is a necessary package on every e-mail server, and these papers present the results of research conducted on a real system and analyze its efficiency.*

Keywords: *SpamAssassin, spam messages, research*

1. INTRODUCTION

Spammers or people who produce unsolicited commercial e-mail, create a huge problem on the Internet, generating messages for drugs, time attachments, fast money and the like. These people consume large resources of the Internet, which we often have to pay for. After receiving such messages, we have to waste time inspecting our mailboxes and deleting spam mail. While we can't stop spam, there are some tools that make it easier to deal with spam. One such tool is SpamAssassin, which scans every incoming email on the server and assesses the likelihood that the email is spam [1].
SpamAssassinsistem is software for analyzing incoming emails, determining how likely they are to be spam and reporting its findings. It is a rule-based system, which compares different parts of an email with a large set of rules. Each rule adds or removes points from the spam rating in the message. A message with a high enough rating is marked as spam [2].
At the moment, there is a large number of software systems for checking spam, which arrives every day to almost all e-mail users, including the e-mail addresses of employees at the College of Applied Sciences, department Uzice, Serbia (CAS-UE). SpamAssassin software, which was chosen as an anti-spam tool, became popular for several reasons:

- Uses a large number of different types of rules, which are constantly changing according to results and diagnostics. Rules that have been shown to be more effective at recognizing spam are more important,
- It is easy to recognize the results associated with each rule or new rules can be added,
- SpamAssassin can adapt to the email environment of each system, as well as identify new types of spam,
- Can report spam to several different "houses" to remove spam and can be configured to create spam traps - an email address used only to forward spam to a "cleaning house",
- It is free software, distributed under the GNU Public License or Artistic License. Any license held by users allows them to freely modify the software and redistribute their modifications under the same conditions.

Anti-spam filtering is a serious business, as opposed to the perspective of a software product. Human effort to set up, customize, maintain, and adjust spam detection filters is emphasized. Because choosing the right rules (relevance) for spam filters is crucial for accuracy in the fight against spam, and this is one of the biggest challenges for the ApacheSpamAssassin project, which is the most commonly accepted open source anti-spam software [3].
With all anti-spam software, the way in which messages are classified is very important, ie on the basis of which the system decides whether to declare a message as spam or not. This is very important, because it can happen that a large number of messages that are important to users in this way are placed in spam and declared spam.
An open source spam filter, SpamAssassin is an example of a classifier hybrid because it combines a rule-based classifier created using genetic programming with an Näive-Bayes (NB) classifier trained on user examples. Classification rules may include: 1) checking the suspicion of words or expressions; 2) content and layout checks, such as hidden HTML code; 3) black list of senders and 4) statistical classification performed by NB classifier trained on examples provided by the user [4].
Some of the ways in which SpamAssassin decides whether a message is spam or not [5]:

- Message headers can be checked for consistency and compliance with Internet standards (eg: is the date properly formatted?),
- Headers and body can be checked for phrases or message elements that are usually found in spam, e.g. "MakeMoneyFast" or similar, only translated into Serbian "Napravi novac brzo",
- Headers and body can be viewed in several online databases that monitor the verified spam check numbers,
- The IP address of the sending system can be searched on several network lists of WEB sites that have used spam or are otherwise suspicious,
- Specific addresses, hosts or domains may be blacklisted or allowed. The "whitelist" can be automatically constructed based on the previous history of the sender's messages,
- SpamAssassin can be "trained" to recognize the types of spam you receive by learning from a set of messages that you consider to be spam and a set that you consider to be spam,
- The IP address of the sending system can be compared to the sender's domain name using the Sender Policy Framework (SPF) protocol (http://spf.pobox.com) to determine if a particular mail system is allowed to send messages. This feature requires version SpamAssassin 3.0 [2]. The Sender Policy Framework (SPF) protocol is used to check email senders and help detect and block spoofed email. With the help of TXT records in their DNS zone, each organization can publish a series of hosts authorized to send e-mail in their domain, as well as SPF policies. Mail servers will check the host for incoming messages and send a DNS request to determine if it belongs to the organization or not [5].
- SpamAssassin can privilege senders who are willing to spend additional computing power in the form of Hashcash (http://www.hashcash.org). Spammers can't do those calculations and still send huge amounts of mail quickly. This feature requires at least version Spamassassin 3.0.

The software works by checking the message format, filtering the content and giving the ability to check on blacklists. With SpamAssassin, as with some other anti-spam software, filtering requires little user intervention and thus delays the process of sending and receiving emails. There are other spam prevention systems, each of which has its advantages and disadvantages (and many of them can be used in addition to, as well as instead of SpamAssassin).

In a challenge / response system, the system holds all messages from unknown senders and sends them a response with a unique code or set of instructions (challenge). Senders must respond to a challenge in some way that confirms their email addresses and generally proves that they are people, not an automated bulk mail program (response). After a successful response, the system allows you to accept the sender's messages [2].

In a temporary greylisting system, the e-mail server returns SMTP on the first attempt to send. If the sending system tries to resend the message after a reasonable period of time, the server accepts the message, as well as subsequent messages from the sending host. Because spammers are likely to either treat a temporary failure as a permanent failure, or try to deliver messages continuously during the time period in which the gray list is checked and created, their messages will not be received in the future.

In time-limited address systems, users generate unique variations of email addresses to include in various web forms, emails, newsgroup posts, and more. Addresses may be valid for a limited time only or may be valid until revoked by the user. In these systems, if a user receives spam at one of their addresses, they can usually identify the company that sent the spam and can immediately blacklist that address, or simply delete their variation of the email address that received the spam [2].

Most SpamAssassin behavior is controlled by configuration files located throughout the system itself, as well as a set of configuration files per user. The configuration per user can also be saved in a SQL (Structured Query Language) database [2].

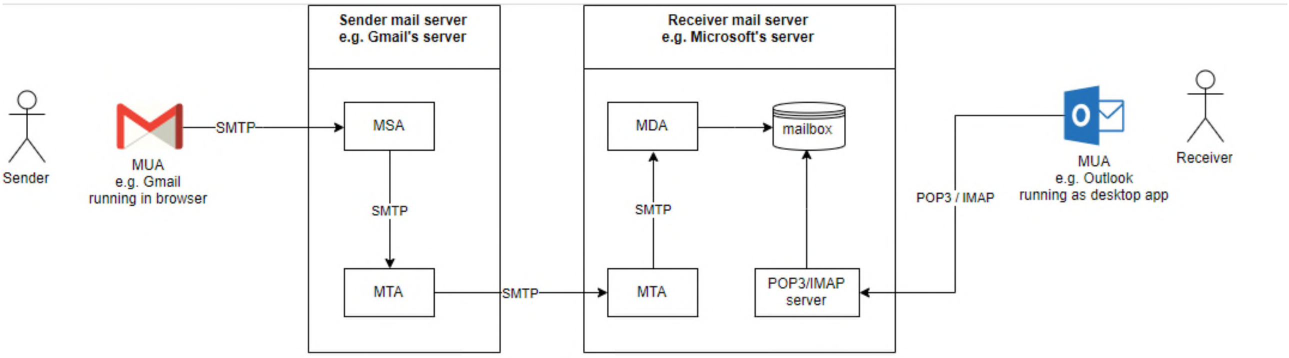


Figure 1: The process of sending emails from sender to recipient [6]

2. SPAMASSASSIN ANTI-SPAM SYSTEM - RESEARCH ON THE LOCAL NETWORK CAS-UE

SpamAssassin is a well-known and widely used OpenSorce spam filter. It consists of about nine hundred binary evaluated "tests", each of which is intended to detect certain characteristics of spam [7]. Each "test" is associated with a result: the result is zero if the corresponding characteristic is not present or is non-zero if such a characteristic is present.

For each email, the result of all tests is summarized. If their sum is higher than the predefined threshold, e-mail is marked as spam, otherwise it is marked as spam [7]. By default the threshold is 5.0.

At the local network level, it was first analyzed to systematically check for spam on the local server, as well as to carefully identify the needs of all users and their habits and needs related to email. All users of the computer network are informed about the spam check that is constantly performed on their e-mail. It is possible to mark spam to all users and store it in the appropriate folders. Because SpamAssassin is running on a local server, individual network users on their workstations are unable to configure their own settings and spam detection threshold..

An analysis was then performed as to which email address was most at risk as a potential target for spam. All CAS-UE employees have an open official e-mail address consisting of the full name and surname separated by a period, as well as the domain name of CAS-UE: vpts.edu.rs (for example: predrag.popovic@vpts.edu.rs, milisav.suljagic@vpts.edu.rs). In addition to these personal e-mail addresses of employees, additional addresses have been created for individual services or workplaces, such as studentskasluzba@vpts.edu.rs, sekretar@vpts.edu.rs, studentskiparlament@vpts.edu.rs and others. Also, the e-mail addresses info@vpts.edu.rs, skola@vpts.edu.rs are used, which are used at the level of practically the entire institution, ie these are the addresses that are most often used when communicating with third parties and which are featured on the CAS-UE website. Based on the analysis and experience from the previous period, the view is that these two email addresses are the most vulnerable and that the largest influx of spam can be expected from these email addresses.

In order to optimize SpamAssasin to work on a local server, it is necessary to define a threshold with spam e-mail. It depends on the "tests", ie the rules that are defined and initiated. The rules are constantly changing and improving. If the test is positive, ie if it is not zero, the indicator with the usual threshold of 5.0 starts to grow. When the sum exceeds this number, SpamAssassin places the message in spam. Table 1 gives some examples of how tests work in SpamAssassin.

Table 1: Examples of tests in SpamAssassin [8]

Subject of testing	Testing condition	Test name	Test value
header	The subject of the message contains only capital letters	SUBJ_ALL_CAPS	1
header	The sender of the message corresponds to the SPF record	SPF_PASS	-0.001
email body	The text part of the message consists of 80-90% of blank lines	BLANK_LINES_80_90	1

There are a number of rules, and some of the most commonly chosen are [9]:

- Antidrug, have the task of detecting unwanted "pill spams",
- Backhair, a set of rules designed to capture incorrect HTML tags,
- Evilnumbers, a collection of phone numbers, mailboxes and street addresses collected from spam,
- Bogus-virus-warnings, a list of false virus warnings,
- Malware Block List, a list of blocked software, free, automated and updated by users,
- sa-blacklist, a large set of domains and IP addresses added to the blacklist,
- blacklists, unwanted URIs
- sa-random, random spam errors such as% RANDOM_WORD,
- Sought, an automatically generated set of rules that searches for good rules directly from SpamAssassin spam,
- Tripwire, looks for 3 characters that should not be together,
- French Rules, searches for spam written in French. This rule also exists for other languages,
- Airmax, other rules that may seem useful to individual users.

In order to add a rule or test, it is necessary to place it in the configuration folder SpamAssassin: /etc/mail/spamassassin/. Configuration files have the extension cf. Therefore, if more rules, filters are added, it is more likely that some e-mails will be declared spam. As a result, the spam threshold has been raised from the usual 5.0 to 6.0.

Setting or configuring SpamAssassin parameters on the local server is done in the file local.cf located in the path: /etc/mail/spamassassin/. It was necessary to set the required_score n.nn (default: 5.0) parameter to 6.0 (required_score 6.0).

The features of one of the received spam messages are given:

```
Return-Path: <outmail@countservice.us>
X-Original-To: direktor@vpts.edu.rs
Delivered-To: spam@vpts.edu.rs
Received: by mail.vpts.edu.rs (Postfix, from userid 5001)
        id 9BED54A04A3; Mon, 10 Feb 2020 11:57:59 +0100 (CET)
X-Spam-Checker-Version: SpamAssassin 3.4.2 (2018-09-13) on server.vpts.edu.rs
X-Spam-Level: ******
X-Spam-Flag: Yes
X-Spam-Status: Yes, score=6.1 required=6.0 tests=_TESTS autolearn=no
        autolearn_force=no version=3.4.2
X-Spam-Report:
        *  0.2 FREEMAIL_REPLYTO_END_DIGIT Reply-To freemail username ends
        in
```

```
                * digit (resultsbox500[at]gmail.com)
                *  0.0 SPF_HELO_NONE SPF: HELO does not publish an SPF Record
                *  0.0 HTML_MESSAGE BODY: HTML included in message
                *  0.1 MISSING_MID Missing Message-Id: header
                *  1.3 RDNS_NONE Delivered to internal network by a host with no rDNS
                *  2.5 FREEMAIL_FORGED_REPLYTO Freemail in Reply-To, but not From
                *  0.4 SUBJ_OBFU_PUNCT_FEW Possible punctuation-obfuscated Subject:
                *      header
                *  1.6 SUBJ_OBFU_PUNCT_MANY Punctuation-obfuscated Subject: header
        Received: from rdns0.countservice.us (unknown [31.220.1.110])
                by mail.vpts.edu.rs (Postfix) with ESMTPS id 32DCC4A0360
                for <direktor@vpts.edu.rs>; Mon, 10 Feb 2020 11:57:58 +0100 (CET)
        Content-Type: multipart/alternative; boundary="===============1078994761=="
        MIME-Version: 1.0
        Subject: **SPAM** Please I need your help. direktor@vpts.edu.rs
        To: direktor@vpts.edu.rs
        From: "Sgt Patrick Dunford" <outmail@vpts.edu.rs>
        Date: Mon, 10 Feb 2020 03:02:43 -0800
        Reply-To: resultsbox500@gmail.com
        X-Spam-Prev-Subject: Please I need your help. direktor@vpts.edu.rs
Message-Id: 20200210105759.9BED54A04A3@mail.vpts.edu.rs
```

Based on the spam message that SpamAssassin declared to be spam, the following can be concluded:

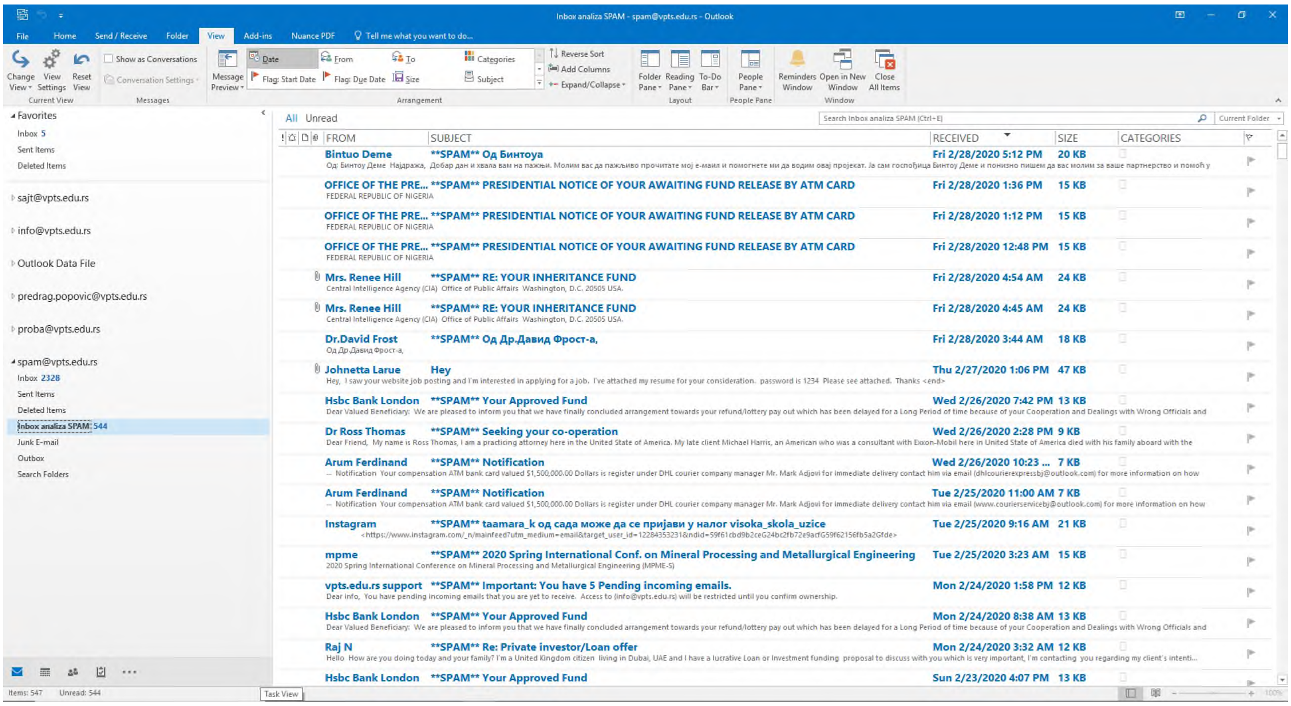
- the message was originally intended for the e-mail address: direktor@vpts.edu.rs, ie this address is intended as a "victim" of spam,
- the message was delivered to the address: spam@vpts.edu.rs, because according to the given criteria of SpamAssassin, it was declared spam,
- the name of the e-mail server is specified (mail.vpts.edu.rs),
- day of the week, day, month, year, time, as well as the time zone when the message was received (Mon, 10 Feb 2020 11:57:59 +0100 (CET)),
- the current version of SpamAssassin and the name of the server on which it is located (SpamAssassin 3.4.2 (2018-09-13) on server.vpts.edu.rs),
- spam status, ie whether a message has met the set threshold, in our case 6.0, to be declared spam. This message is about to be declared spam because its score is 6.1, which is still greater than 6.0, which automatically means that it is classified as spam (X-Spam-Status: Yes, score = 6.1 required = 6.0 tests = _TESTS autolearn = noautolearn_force = no version = 3.4.2),
- X-Spam-Report where it is clearly seen on the basis of which rules, filters the message is declared spam. When all the results in front of the above rules are added up, the test result is 6.1, the subject or subject of the message, the e-mail address from which it was sent and the identification number of the message.

3. EFFICIENCY RESEARCH OF THE SPAMASSASSIN ANTI-SPAM SYSTEM

In the period before the installation of the anti-spam system SpamAssassin, there was no protection against spam. Spams in daily arrived without any records by the persons in charge of the CAS-UE information system. An even bigger problem was that spam arrived at individual addresses of e-mail users who did not inform the IT service. Another step towards greater security of the school computer network, after the installation of SpamAssassin, was that all employees were obliged in case a message "passes" through spam filters, and that they believe that there is unwanted content about it. notify the local network administrator system.

After installing and configuring the anti-spam system SpamAssassin on the local server, its work was monitored for a period of three months. The system is configured so that all messages that its filters consider spam or that are "suspicious" are redirected to the newly opened e-mail address: spam@vpts.edu.rs.

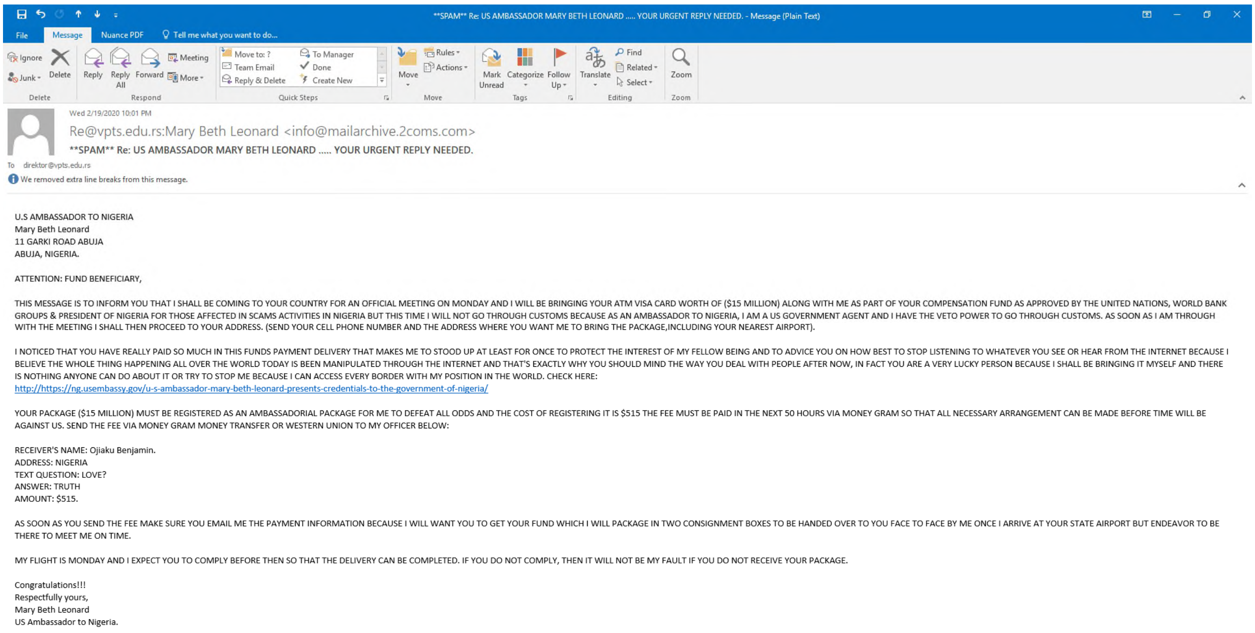
In the stated period of three months, a total of 544 messages (Figure 2) were redirected to the address spam@vpts.edu.rs by SpamAssassin, which met the set filtering criteria. The total number of "caught" spams by the system on an annual basis was 2328.



FROM	SUBJECT	RECEIVED	SIZE	CATEGORIES
Bintuo Deme	**SPAM** Од Бинтоуа Од: Бинтоу Деме Најдража, Добар дан и хвала вам на пажњи. Молим вас да пажљиво прочитате мој е-маил и помогнете ми да водим овај пројекат. Ја сам госпођица Бинтоу Деме и понизно пишем да вас молим за ваше партнерство и помоћ у	Fri 2/28/2020 5:12 PM	20 KB	
OFFICE OF THE PRE...	**SPAM** PRESIDENTIAL NOTICE OF YOUR AWAITING FUND RELEASE BY ATM CARD FEDERAL REPUBLIC OF NIGERIA	Fri 2/28/2020 1:36 PM	15 KB	
OFFICE OF THE PRE...	**SPAM** PRESIDENTIAL NOTICE OF YOUR AWAITING FUND RELEASE BY ATM CARD FEDERAL REPUBLIC OF NIGERIA	Fri 2/28/2020 1:12 PM	15 KB	
OFFICE OF THE PRE...	**SPAM** PRESIDENTIAL NOTICE OF YOUR AWAITING FUND RELEASE BY ATM CARD FEDERAL REPUBLIC OF NIGERIA	Fri 2/28/2020 12:48 PM	15 KB	
Mrs. Renee Hill	**SPAM** RE: YOUR INHERITANCE FUND Central Intelligence Agency (CIA) Office of Public Affairs Washington, D.C. 20505 USA.	Fri 2/28/2020 4:54 AM	24 KB	
Mrs. Renee Hill	**SPAM** RE: YOUR INHERITANCE FUND Central Intelligence Agency (CIA) Office of Public Affairs Washington, D.C. 20505 USA.	Fri 2/28/2020 4:45 AM	24 KB	
Dr.David Frost	**SPAM** Од Др.Давид Фрост-а, Од Др.Давид Фрост-а,	Fri 2/28/2020 3:44 AM	18 KB	
Johnetta Larue	Hey Hey, I saw your website job posting and I'm interested in applying for a job. I've attached my resume for your consideration. password is 1234 Please see attached. Thanks <end>	Thu 2/27/2020 1:06 PM	47 KB	
Hsbc Bank London	**SPAM** Your Approved Fund Dear Valued Beneficiary: We are pleased to inform you that we have finally concluded arrangement towards your refund/lottery pay out which has been delayed for a Long Period of time because of your Cooperation and Dealings with Wrong Officials and	Wed 2/26/2020 7:42 PM	13 KB	
Dr Ross Thomas	**SPAM** Seeking your co-operation Dear Friend, My name is Ross Thomas, I am a practicing attorney here in the United State of America. My late client Michael Harris, an American who was a consultant with Exxon-Mobil here in United State of America died with his family aboard with the	Wed 2/26/2020 2:28 PM	9 KB	
Arum Ferdinand	**SPAM** Notification — Notification Your compensation ATM bank card valued $1,500,000.00 Dollars is register under DHL courier company manager Mr. Mark Adjovi for immediate delivery contact him via email (dhlcourierexpressbj@outlook.com) for more information on how	Wed 2/26/2020 10:23 ...	7 KB	
Arum Ferdinand	**SPAM** Notification — Notification Your compensation ATM bank card valued $1,500,000.00 Dollars is register under DHL courier company manager Mr. Mark Adjovi for immediate delivery contact him via email (www.courierservicebj@outlook.com) for more information on how	Tue 2/25/2020 11:00 AM	7 KB	
Instagram	**SPAM** taamara_k од сада може да се пријави у налог visoka_skola_uzice <https://www.instagram.com/_n/mainfeed?utm_medium=email&target_user_id=12284353231&ndid=59f61cbd9b2ceG24bc2fb72e9acfG59f62156fb5a2Gfde>	Tue 2/25/2020 9:16 AM	21 KB	
mpme	**SPAM** 2020 Spring International Conf. on Mineral Processing and Metallurgical Engineering 2020 Spring International Conference on Mineral Processing and Metallurgical Engineering (MPME-S)	Tue 2/25/2020 3:23 AM	15 KB	
vpts.edu.rs support	**SPAM** Important: You have 5 Pending incoming emails. Dear info, You have pending incoming emails that you are yet to receive. Access to (info@vpts.edu.rs) will be restricted until you confirm ownership.	Mon 2/24/2020 1:58 PM	12 KB	
Hsbc Bank London	**SPAM** Your Approved Fund Dear Valued Beneficiary: We are pleased to inform you that we have finally concluded arrangement towards your refund/lottery pay out which has been delayed for a Long Period of time because of your Cooperation and Dealings with Wrong Officials and	Mon 2/24/2020 8:38 AM	13 KB	
Raj N	**SPAM** Re: Private investor/Loan offer Hello How are you doing today and your family? I'm a United Kingdom citizen living in Dubai, UAE and I have a lucrative Loan or Investment funding proposal to discuss with you which is very important, I'm contacting you regarding my client's intenti...	Mon 2/24/2020 3:32 AM	12 KB	
Hsbc Bank London	**SPAM** Your Approved Fund	Sun 2/23/2020 4:07 PM	13 KB	

Figure 2: Display of folders with incoming spam messages

Most of the received spam messages in the observed three-month period referred to spam messages such as various financial frauds, such as "you got an inheritance", "we need financial help", "pay here and there" and the like (Figure 3).



Wed 2/19/2020 10:01 PM

Re@vpts.edu.rs:Mary Beth Leonard <info@mailarchive.2coms.com>

SPAM Re: US AMBASSADOR MARY BETH LEONARD ..... YOUR URGENT REPLY NEEDED.

To direktor@vpts.edu.rs

We removed extra line breaks from this message.

U.S AMBASSADOR TO NIGERIA
Mary Beth Leonard
11 GARKI ROAD ABUJA
ABUJA, NIGERIA.

ATTENTION: FUND BENEFICIARY,

THIS MESSAGE IS TO INFORM YOU THAT I SHALL BE COMING TO YOUR COUNTRY FOR AN OFFICIAL MEETING ON MONDAY AND I WILL BE BRINGING YOUR ATM VISA CARD WORTH OF ($15 MILLION) ALONG WITH ME AS PART OF YOUR COMPENSATION FUND AS APPROVED BY THE UNITED NATIONS, WORLD BANK GROUPS & PRESIDENT OF NIGERIA FOR THOSE AFFECTED IN SCAMS ACTIVITIES IN NIGERIA BUT THIS TIME I WILL NOT GO THROUGH CUSTOMS BECAUSE AS AN AMBASSADOR TO NIGERIA, I AM A US GOVERNMENT AGENT AND I HAVE THE VETO POWER TO GO THROUGH CUSTOMS. AS SOON AS I AM THROUGH WITH THE MEETING I SHALL THEN PROCEED TO YOUR ADDRESS. (SEND YOUR CELL PHONE NUMBER AND THE ADDRESS WHERE YOU WANT ME TO BRING THE PACKAGE,INCLUDING YOUR NEAREST AIRPORT).

I NOTICED THAT YOU HAVE REALLY PAID SO MUCH IN THIS FUNDS PAYMENT DELIVERY THAT MAKES ME TO STOOD UP AT LEAST FOR ONCE TO PROTECT THE INTEREST OF MY FELLOW BEING AND TO ADVICE YOU ON HOW BEST TO STOP LISTENING TO WHATEVER YOU SEE OR HEAR FROM THE INTERNET BECAUSE I BELIEVE THE WHOLE THING HAPPENING ALL OVER THE WORLD TODAY IS BEEN MANIPULATED THROUGH THE INTERNET AND THAT'S EXACTLY WHY YOU SHOULD MIND THE WAY YOU DEAL WITH PEOPLE AFTER NOW, IN FACT YOU ARE A VERY LUCKY PERSON BECAUSE I SHALL BE BRINGING IT MYSELF AND THERE IS NOTHING ANYONE CAN DO ABOUT IT OR TRY TO STOP ME BECAUSE I CAN ACCESS EVERY BORDER WITH MY POSITION IN THE WORLD. CHECK HERE:
http://https://ng.usembassy.gov/u-s-ambassador-mary-beth-leonard-presents-credentials-to-the-government-of-nigeria/

YOUR PACKAGE ($15 MILLION) MUST BE REGISTERED AS AN AMBASSADORIAL PACKAGE FOR ME TO DEFEAT ALL ODDS AND THE COST OF REGISTERING IT IS $515 THE FEE MUST BE PAID IN THE NEXT 50 HOURS VIA MONEY GRAM SO THAT ALL NECESSARY ARRANGEMENT CAN BE MADE BEFORE TIME WILL BE AGAINST US. SEND THE FEE VIA MONEY GRAM MONEY TRANSFER OR WESTERN UNION TO MY OFFICER BELOW:

RECEIVER'S NAME: Ojiaku Benjamin.
ADDRESS: NIGERIA
TEXT QUESTION: LOVE?
ANSWER: TRUTH
AMOUNT: $515.

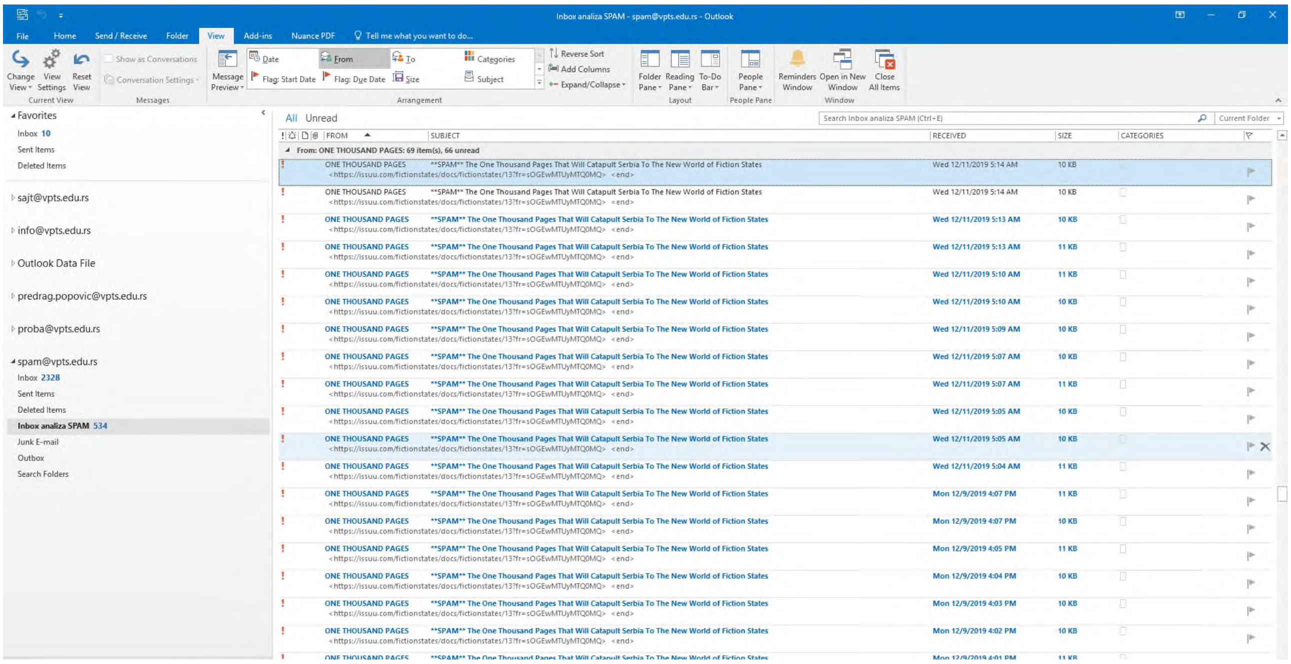
AS SOON AS YOU SEND THE FEE MAKE SURE YOU EMAIL ME THE PAYMENT INFORMATION BECAUSE I WILL WANT YOU TO GET YOUR FUND WHICH I WILL PACKAGE IN TWO CONSIGNMENT BOXES TO BE HANDED OVER TO YOU FACE TO FACE BY ME ONCE I ARRIVE AT YOUR STATE AIRPORT BUT ENDEAVOR TO BE THERE TO MEET ME ON TIME.

MY FLIGHT IS MONDAY AND I EXPECT YOU TO COMPLY BEFORE THEN SO THAT THE DELIVERY CAN BE COMPLETED. IF YOU DO NOT COMPLY, THEN IT WILL NOT BE MY FAULT IF YOU DO NOT RECEIVE YOUR PACKAGE.

Congratulations!!!
Respectfully yours,
Mary Beth Leonard
US Ambassador to Nigeria.

Figure 3: Spam messages

Most spammers, as expected, because that is the way they usually work, have sent spam messages several times during this time period. The address from which the record 69 spam messages were sent is "ONE THOUSAND PAGES 20191210@1000PAGES.INT" in a time interval of ten days (Figure 4).



From: ONE THOUSAND PAGES: 69 item(s), 66 unread

FROM	SUBJECT	RECEIVED	SIZE	CATEGORIES
ONE THOUSAND PAGES	**SPAM** The One Thousand Pages That Will Catapult Serbia To The New World of Fiction States <https://issuu.com/fictionstates/docs/fictionstates/13?fr=sOGEwMTUyMTQ0MQ> <end>	Wed 12/11/2019 5:14 AM	10 KB	
ONE THOUSAND PAGES	**SPAM** The One Thousand Pages That Will Catapult Serbia To The New World of Fiction States <https://issuu.com/fictionstates/docs/fictionstates/13?fr=sOGEwMTUyMTQ0MQ> <end>	Wed 12/11/2019 5:14 AM	10 KB	
ONE THOUSAND PAGES	**SPAM** The One Thousand Pages That Will Catapult Serbia To The New World of Fiction States <https://issuu.com/fictionstates/docs/fictionstates/13?fr=sOGEwMTUyMTQ0MQ> <end>	Wed 12/11/2019 5:13 AM	10 KB	
ONE THOUSAND PAGES	**SPAM** The One Thousand Pages That Will Catapult Serbia To The New World of Fiction States <https://issuu.com/fictionstates/docs/fictionstates/13?fr=sOGEwMTUyMTQ0MQ> <end>	Wed 12/11/2019 5:13 AM	11 KB	
ONE THOUSAND PAGES	**SPAM** The One Thousand Pages That Will Catapult Serbia To The New World of Fiction States <https://issuu.com/fictionstates/docs/fictionstates/13?fr=sOGEwMTUyMTQ0MQ> <end>	Wed 12/11/2019 5:10 AM	11 KB	
ONE THOUSAND PAGES	**SPAM** The One Thousand Pages That Will Catapult Serbia To The New World of Fiction States <https://issuu.com/fictionstates/docs/fictionstates/13?fr=sOGEwMTUyMTQ0MQ> <end>	Wed 12/11/2019 5:10 AM	10 KB	
ONE THOUSAND PAGES	**SPAM** The One Thousand Pages That Will Catapult Serbia To The New World of Fiction States <https://issuu.com/fictionstates/docs/fictionstates/13?fr=sOGEwMTUyMTQ0MQ> <end>	Wed 12/11/2019 5:09 AM	10 KB	
ONE THOUSAND PAGES	**SPAM** The One Thousand Pages That Will Catapult Serbia To The New World of Fiction States <https://issuu.com/fictionstates/docs/fictionstates/13?fr=sOGEwMTUyMTQ0MQ> <end>	Wed 12/11/2019 5:07 AM	10 KB	
ONE THOUSAND PAGES	**SPAM** The One Thousand Pages That Will Catapult Serbia To The New World of Fiction States <https://issuu.com/fictionstates/docs/fictionstates/13?fr=sOGEwMTUyMTQ0MQ> <end>	Wed 12/11/2019 5:07 AM	11 KB	
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Figure 4: Display of the "recorder" by the number of sent spam

In the analyzed period in which SpamAssassin identified 544 messages as spam, an omission was made only in a total of 4 messages sent from the same e-mail address. These messages were placed in spam and sent to the address spam@vpts.edu.rs and therefore were not available to the sent user or recipient. All four messages had adequate content, title, and attachments. An error occurred while entering the unwanted email addresses. An incorrect e-mail address name was entered incorrectly, thus preventing the receipt of messages from that address, so that the messages ended up in spam.

As it is already known, it is difficult to precisely define what spam is. If we analyze all the messages that SpamAssassin categorized as spam, it can be concluded with certainty that out of 544 messages, only the already mentioned 4 were not spam. But the question is what about the other messages that arrive every day at e-mail addresses within the school computer network, which can also be defined as spam. These are practically all messages that were not sent from a known address, ie were not "contracted". They mainly relate to the advertising of certain products or services. In the analyzed period of three months, there were more than three hundred such messages to the two most frequent e-mail addresses in CAS-UE: skola@vpts.edu.rs and info@vpts.edu.rs.

The problem with this type of spam or legitimate e-mail is that they have a clearly and precisely defined structure, ie they do not differ in any way from "valid and valid" messages. The only way to prevent them from being received is to enter the e-mail addresses from which these advertising messages and tips are received on our internal blacklist. This solution requires a lot of additional work and engagement of persons in charge of the CAS-UE information system, which can lead to problems of expediency in the case of a large number of such messages.

3. CONCLUSION

The presented research provides useful information, especially for all Linux administrator servers, on how to set up and improve your anti-spam system. SpamAssassin is an efficient free tool, which has one very important function of the Linux server, receiving and sending e-mails, efficiently and qualitatively filtered, fully automated. Numerous filters built into SpamAssissin, at first glance, make it difficult and use the configuration of the system itself. However, they allow the administrator to fine-tune their email server to filter as efficiently as possible, with as few misidentified messages as spam, and the higher the percentage of correctly identified messages as spam — the target is 100%.

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