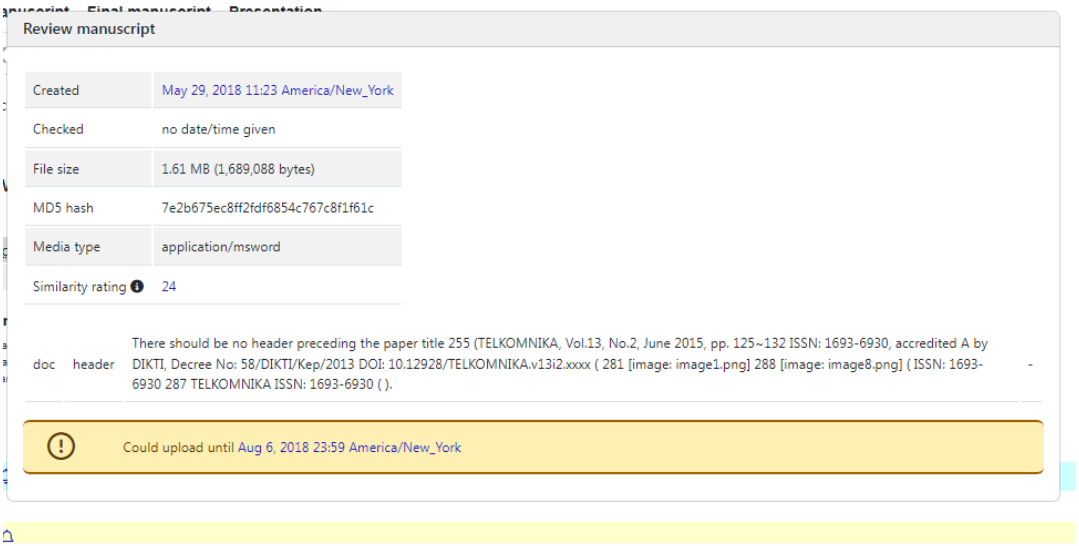
RINGKASAN BUKTI KORESPONDENSI

Judul Artikel : Live forensics of tools on android devices for email forensics
Penulis : Rusydi Umar, Imam riadi, Bashor Fauzan Muthohirin
Jurnal : Telkomnika Vol. 17 No. 4 (2019)
1 Lampiran 1 : Penulis melakukan submission artikel pada 29 May 2018 pada 1st International Conference and Workshop on Telecommunication, Computing, Electronics and Control 2018
2 Lampiran 2 : Pada tanggal 15 Juli 2018, penulis mendapatkan pemberitahuan bahwa penulis diminta untuk merevisi artikel (revisions required)
3 Lampiran 3 : Pada tanggal 04 Agustus 2018, penulis mengirimkan hasil revisi artikel
4 Lampiran 4 : Pada tanggal 4 Agustus 2018, penulis mendapatkan pemberitahuan bahwa artikel diterima (accept submission)
5 Lampiran 5 : Pada bulan Agustus 2019, artikel dinyatakan terbit (published)

1 Lampiran 1



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TELKOMNIKA, Vol.13, No.2, June 2015, pp. 125~132
ISSN: 1693-6930, accredited **A** by DIKTI, Decree No: 58/DIKTI/Kep/2013
DOI: 10.12928/TELKOMNIKA.v13i2.xxxx

A Comparison of Tools on Android Devices for Email Forensics

Rusydi Umar[1], Imam Riadi[2], Bashor Fauzan Muthohirin[3]
[1,3]Department of Informatics Engineering, Universitas Ahmad Dahlan, Yogyakarta Indonesia
[2]Department of Information System, Universitas Ahmad Dahlan, Yogyakarta Indonesia
Jln. Prof. Dr. Soepomo, S.H., Janturan, Yogyakarta, 563515 Indonesia
*Corresponding author, e-mail: bashor1707048017@webmail.uad.ac.id

Abstract

The development of information and communication technology are growing rapidly, such as email. Email is one of the communication tools that are used to send and received the information in a matter of minutes and even seconds. Speed in communication causes weaknesses that cybercrime can exploit. Cybercrime is any criminal activity that involves a network, cybercrime must be leaving digital evidence. Digital evidence can be done live forensics using wireshark and networkminer, that are software capable of capturing data packets across the internet network. This study will conduct a comparison of wireshark and networkminer forensic tools, these research subjects focus on e-mail services based android to obtain digital evidence as much as possible on both of these tools. In this process using mobile forensic methods the national institute of standards and technology (NIST). The result of this research is that networkminer get more digital evidence than wireshark.

Keywords*: Email, Networkminer, NIST, Wireshark*

1. Introduction

The development of technology can facilitate human work so that more effective, one of the development of technology is electronic mail (email). Email is one of the medium of communication, information dissemination and the number of email provider services makes it all to be concise and easy. Users can send information in minutes and even seconds to the world. Likewise the recipient of the information can easily and quickly reply with the information [1].

The more people who connect to the internet, making electronic mail (email) as one form of communication the most rapid and economical. The amount of digital information in email as a result of the development of information technology requires a way of organizing and grouping information in an email inbox for the convenience of its users. This unstructured grouping of information is known by the classification of documents [2].

Smartphones have many applications that can be used to help access email. Smartphones are working phones that use the full potential of operating system software that provides user-friendly connections and powerful hardware. Smartphones have different operating systems, just like with the operating system for desktop computers [3]. Currently smartphone devices have the same functionality as computers. Although the function is the same as the computer, but there are some differences in the process of handling digital forensics between computer devices and smartphones because the smartphone has unique characteristics that cannot be equated with ordinary computer handling [4]. The familiar smartphone used by the community is an Android based smartphone.

Indonesian society is no stranger to the name of smartphones, Indonesia is one of the market is quite promising for companies makers of smartphones, especially android. Every year android users continue to leave because the user interface friendly and open source makes it easy for users to use it and develop it. Based on statistics of mobile operating system market share in Indonesia from January 2012 to December 2017 users android smartphone continue to increase, can be seen in Figure 1 [5].

Received February 23, 2014; Revised May 29, 2014; Accepted June 12, 2014

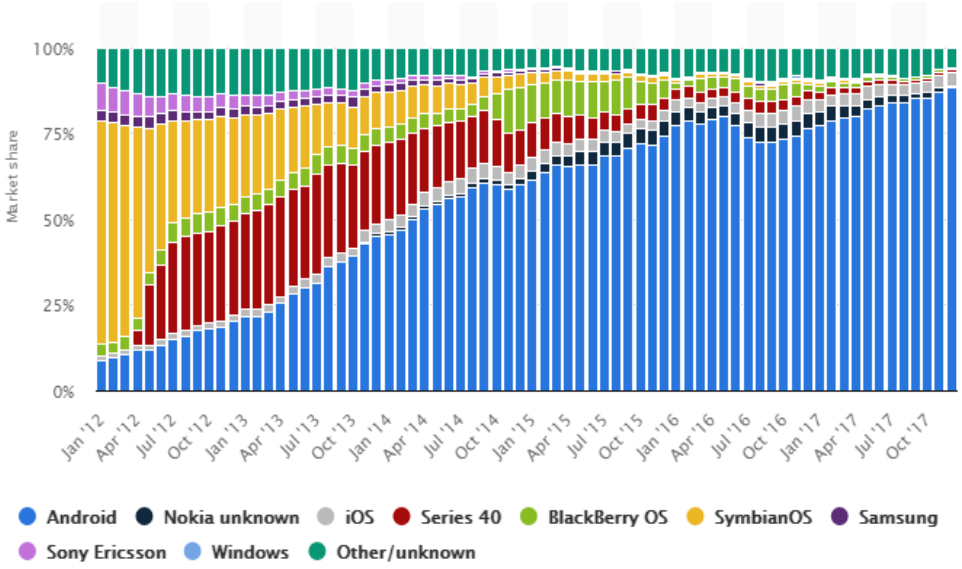

Figure 1. Smartphone User in Indonesia

In any cybercrime must leave evidence, in the form of digital and electronic evidence [6]. Digital evidence can be seen when the criminal process is direct and can be stored, digital evidence can be handled exclusively by digital forensics science using tools to solve and draw conclusions from criminal cases on digital evidence obtained. In real or fake emails it can be detected using several ways, such as viewing email headers [7]–[9], *digital signature*, and reading logs [10]–[13] . Digital forensics is the study of how to deal with crimes involving technology such as computers. There are several techniques in digital forensics, one of which is live forensics that is used to handle digital crimes using approaches to systems operating that are working and connected to the network [14].

Packages run on the network can be used as digital evidence by way of live forensics [15]–[17], Software that can be used is wireshark and networkminer. Wireshark is a Network Protocol Analyzer software used for packet sniffing and tries to capture network packets and attempts to display all the information in the package as much detail as possible [18]. networkminer is a network analysis software for windows, networkminer has the same functionality as Wireshark is network analyzer protocol [19].

The law on cybercrime crimes is set in the laws on ITE in Indonesia [20]. The crimes of ITE can be criminalized by civil or civil law in accordance with the level of the crime committed, the process of arrest of the cybercrime by the authorities based on the evidence of crimes that are stored on the smartphone or on other hardware that can be used as evidence in the law court. No criminal cases have escaped evidentiary evidence. Almost all criminal prosecution, always leaning on examination of evidence. At least in addition to proof with other evidence, there is always a need for verification with at least two evidences [21].

in [22] Identification and Analysis of Email and Contacts Artefacts on iOS and OSX Kenneth, The tool used for sniffing emails is wireshark. The research is limited to Apple's iOS and OSX Kenneth devices, the results of which are getting artifacts from the Mail and Contacts app.

From the above background, the authors will conduct research on the comparison of forensic tools on the email service based android to get the digital evidance using mobile forensic method based on the guidelines that have been available and prepared by the National Institute of Standards and Technology (NIST) as the process of getting the digital evidence.

2. Research Method

In this study the method used is the mobile forensic method based on the guidelines available and prepared by the National Institute of Standards and Technology (NIST). The NIST method is used to perform analysis of digital evidence in emails and as a stage for obtaining information from digital evidence, consisting of 4 stages such as Figure 2 [23].

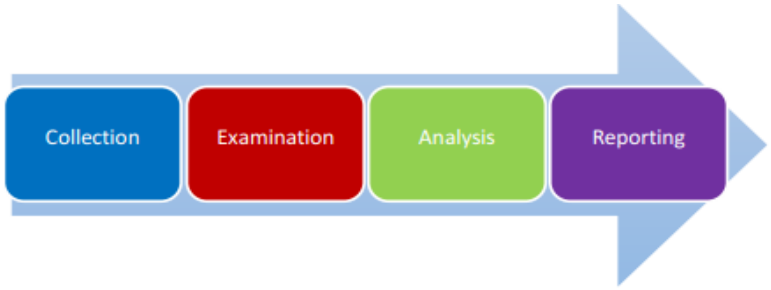

Figure 2. Stages of the NIST Method

1. Collection
   Colection is a collection process, identifying, labeling, recording and retrieving evidence in the form of software to be retrieved for use as digital evidence of a digital crime case.
2. Examination
   Testing includes an appraisal process and selects appropriate information from all the data collected, as well as bypassing prosses or minimizes various features in the operating system and applications that can eliminate data such as encryption, data compression, access control mechanisms, specify file locations, checks metadata, extract files and more.
3. Analysis
   The analysis is done by various method approaches, the task of this analysis includes many activities, such as identifying the users involved indirectly, the location, the occurrence, the device and considering how to get all the components connected to the final conclusion.
4. Re*port*ing
   Report the results of the analysis including the description of the actions performed, what tools are used and the procedures used. After that researchers write the results of the test as well as the results of testing evaluation of Android**.**

3. Results and Analysis

The results of this study conducted a comparison of forensic tools in finding digital evidence on email received. Tools used are wireshark and networkminer for sniffing on received email packets. The email used is webmail. Here is a comparison process of forensic tools on android based email services using the National Institute of Standarts and Technology (NIST) forensic mobile method.

3.1. Collection

At this stage of collecting goods on smartphone owners, the smartphone used is google nexus 6 and android version ando 8.0. Smartphone used in this research is smartphone emulator genymotion version 2.12. The following is a collection stage concept.

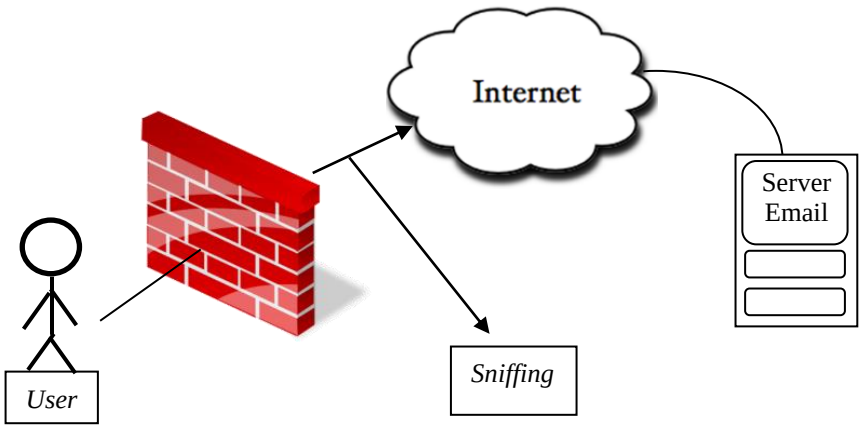

Figure 3. Conceptual Stages in Collection Process.

In Figure 3 is a conceptual stage in the collection process, the user receives an email from someone then opens the email, together the investigator sniffing. This collection process of digital evidence is done live forensics.

3.2. Examination

At this stage, performing a comparison on wireshark and networkminer forensic tools. In the process of getting the proof of email must be opened through the original browser from smarphone. Smartphone Here is the comparison stage of forensic tools in the process of obtaining digital evidence.

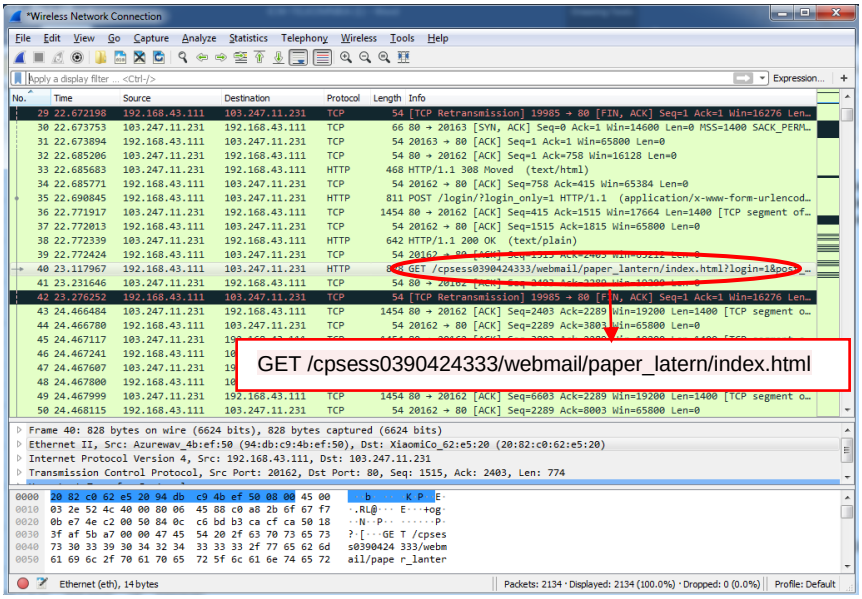

Figure 4. Process examination tools Wireshark

In Figure 4 is a sniffing process using wireshark tools. Tools wireshark successfully do sniffing data packets on email service that opened using android browser, can see there is a red circle in picture 4.

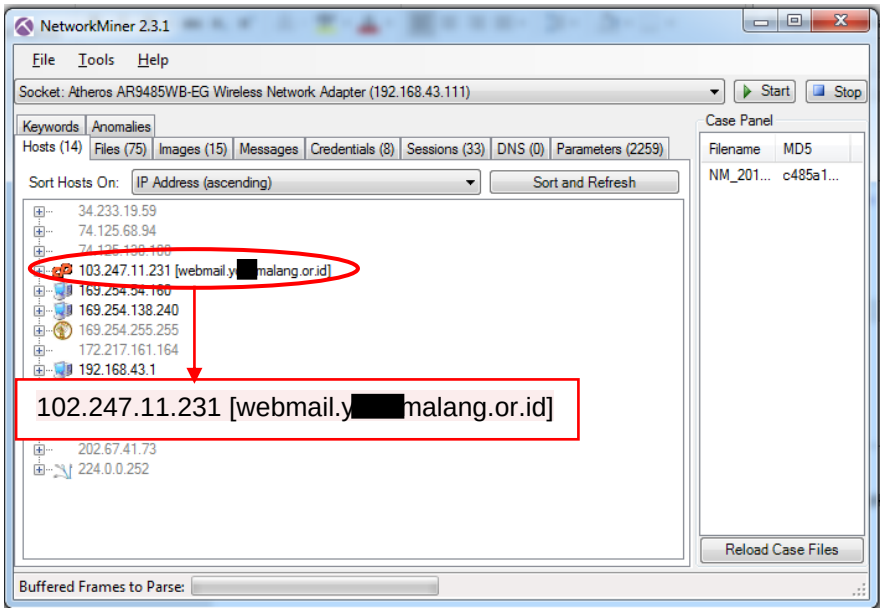

Figure 5. Process examination tools Networkminer

In Figure 5 is a Networkminer sniffing tool. Networkminer succeeded in sniffing and capturing on email packets marked with found IP Address and webmail, can see there is a red circle in figure 5.

3.3. Analysis

At this stage is the result obtained by wireshark and networkminer forensic tools on android-based email is complete. Here are the results obtained.

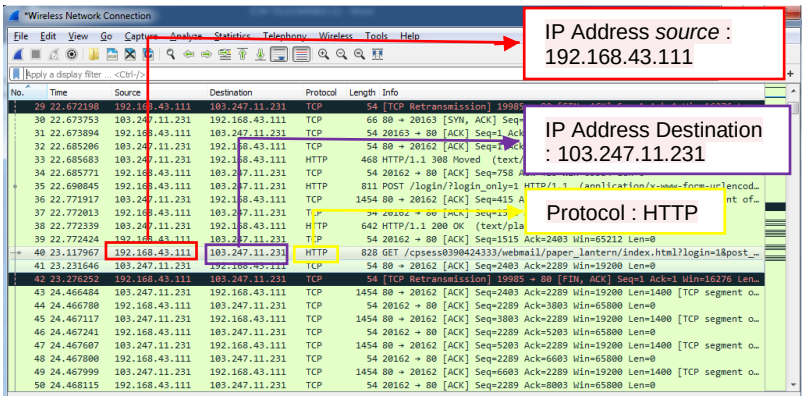

Figure 6. Results of Wireshark Sniffing.

In Figure 6 is the result of sniffing on the email service accessed using android smartphone. Found IP Address source: 192.168.43.111, IP Address destination: 103.247.11.231, and the email protocol: HTTP.

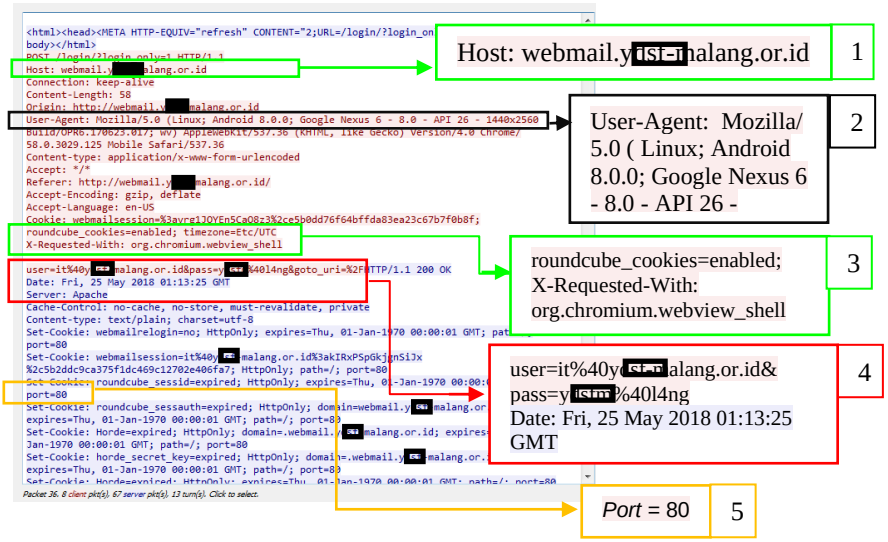

Figure 7. TCP-Stream *Wireshark*.

In Figure 7 is the contents of the TCP stream, in the TCP Stream gives a lot of information. The following information can be found:

- Number 1. Is the webmail host.
- Number 2. Is the smartphone information used.
- Number 3. Is the browser used to open the email.
- Number 4. Is Username and password of the user, timestamp email delivery, and email server.
- Number 5. Is the sending port used.
- Number 6. It is an email recipient timestamp.

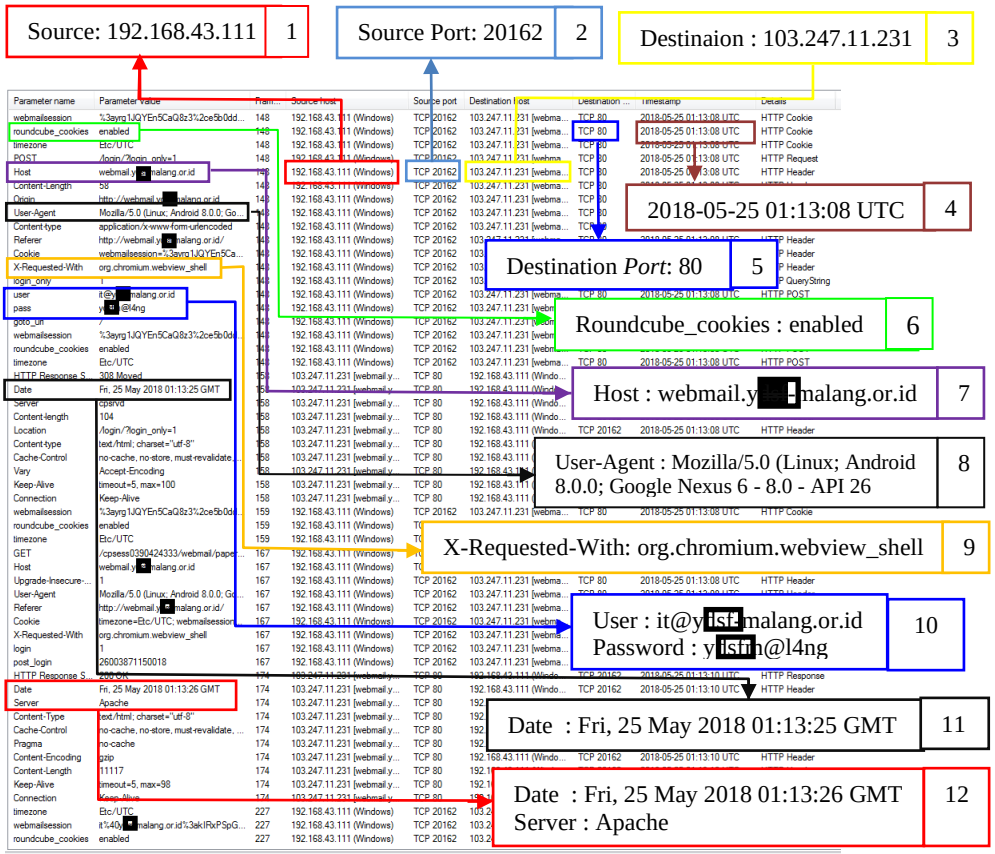

Figure 8. Netwokminer Sniffing Resutl.

In Figure 8 is a result that is captured by networkminer tools. Networkminer can be a lot of information. The following information can be found:

- Number 1. Is the IP Address source.
- Number 2. Is port source.
- Number 3. Is the IP Address destination.
- Number 4. It is the timestamp information on the server.
- Number 5. Is the destination port.
- Number 6. Is the interface used is roudcube.
- Number 7. Is the webmail host used.
- Number 8. Is the browser used to open the email.
- Number 9. Is the user's username and password.
- Number 10. It is an email delivery timestamp.
- Number 11. Represents an email recipient timestamp.

3.4. Re*port*ing

At this stage it is the result of comparison comparison of wireshark and networkminer forensic tools. In Table 1. It is the result found by wireshark and networkminer.

Table 1. Comparison of Forensic Tools

No	Ditemukan	*Wireshark*	*Networkminer*
1.	Host	✓	✓
2.	Username and password	✓	✓
3.	Browser for open email	✓	✓
4.	Server mail	✓	✓

5.	Timestamp email delivery	✓	✓
6.	Timestamp recipient of email	✓	✓
7.	Port delivery	✓	✓
8.	Port recipient	-	✓
9.	IP Address source	✓	✓
10.	IP Address destination	✓	✓
11.	Layout mail	✓	✓
12.	Used smartphone	✓	✓
13.	Interface webmail	✓	✓

Table 1 is sniffing done with wireshark and networkminer forensic tools get different results. The wireshark forensic tool can not find the receiving port, while the networkminer succeeded in sniffing the receiving port. So from the results of the research networkminer get more digital evidence.

4. Conclusion

Based on the results of research that has been done, this study comparing wireshark and networkminer forensic tools to obtain digital evidence on email service based android. The process of comparison of forensic tools to obtain digital evidence using mobile forensic methods is the National Institute of Standards and Technology (NIST). In the early stages of this research is to collect goods on android smartphone. The android smartphone used is android that runs on genymotion emulator. In the second stage of testing, testing is done to compare wireshark and networkminer forensic tools. Forensic tools are running on windows 7 operating system, wireshark and networkminer managed to get evidence such as IP Address pengrim, timestamp, port and others. Networkminer forensic tools successfully get more digital evidence than network minner.

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2 Lampiran 2

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BASHOR FAUZAN MUTHOHIRIN <bashor1707048017@webmail.uad.ac.id>

[ICW-TELKOMNIKA 2018] Decision for paper 'A Comparison of Tools on Android Devices for Email Forensics'

2 pesan

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Kepada: Bashor Fauzan Muthohirin <bashor1707048017@webmail.uad.ac.id>, Rusydi Umar <rusydi_umar@rocketmail.com>, Imam Riadi <imam.riadi@is.uad.ac.id>

Dear Mr. Bashor Muthohirin:

After careful review, the decision for your paper #1570463800 "A Comparison of Tools on Android Devices for Email Forensics" for ICW-TELKOMNIKA 2018 is REVISIONS REQUIRED. You are asked to submit a revised full manuscript for re-review, according to the comment from reviewers. The due date for revision is Aug 1, 2018.

We would like your cooperation with the double check of your REVISED paper:
(1) TEMPLATE for preparing final camera ready paper: http://goo.gl/FiPFbF
(2) Checklist for preparing your paper for publication: http://www.journal.uad.ac.id/index.php/TELKOMNIKA/about/editorialPolicies#custom-1
(3) Please ensure the maximum page of your final paper is 8-page, but still allowed up to 12 pages (required to pay an extra fee).
(4) Most importantly, please ensure the similarity score is less than 30%. If the similarity score of revised version is more than 30%, the paper will be rejected from consideration for ICW-TELKOMNIKA 2018.

The reviews are below or can be found at http://edas.info/showPaper.php?m=1570463800, using your EDAS login name bashor1707048017@webmail.uad.ac.id.

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Scopus indexed journal, SJR: 0.265, CiteScore: 0.63, SNIP: 0.580
Q3 on Electrical & Electronics Engineering

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======= Review 1 =======

> *** Novelty and Contribution: Rate the degree of scientific contribution provided by this paper. Do the authors offer new findings? Do they give proper explanation and detailed analysis?
Average (2)

> *** Paper Presentation: What is your evaluation on the quality of presentation from this paper (e.g. figures, tables, formats, etc.)?
Acceptable (3)

> *** Detailed Comments: Please provide detailed comments that will be helpful to the TPC for assessing the paper. Also provide feedback to the authors.

* The proposed approach could be explained with extra details.
* The challenge and contribution of the paper are not clear.
* The main aim and contribution of the paper are not understandable.

> *** Recommendation: Your overall rating.
Borderline (3)

BASHOR FAUZAN MUTHOHIRIN <bashor1707048017@webmail.uad.ac.id> 26 Juli 2018 pukul 10.22
Kepada: lppi@uad.ac.id

Good morning

sorry, I want to upload a revision, I can upload through what?
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thanks
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TELKOMNIKA, Vol.17, No.1, February 2019, pp. 101~10x
ISSN: 1693-6930, accredited **A** by DIKTI, Decree No: 58/DIKTI/Kep/2013
DOI: 10.12928/TELKOMNIKA.v17i1.xxxx

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Rusydi Umar[1], Imam Riadi[2], Bashor Fauzan Muthohirin*[3]
[1,3]Department of Informatics Engineering, Universitas Ahmad Dahlan, Yogyakarta Indonesia
[2]Department of Information System, Universitas Ahmad Dahlan, Yogyakarta Indonesia
Jln. Prof. Dr. Soepomo, S.H., Janturan, Yogyakarta, 563515 Indonesia
*Corresponding author, e-mail: bashor1707048017@webmail.uad.ac.id

Abstract

Email is one communication technology that can be used to exchange information, data, and etc. The development of email technology not only can be opened using a computer but can be opened using an smartphone. The most widely used smartphone in Indonesian society is Android. Within a row the development technology of higher cybercrime such as email fraud catching cybercrime offenders need evidence to be submitted to a court, for obtain evidence can use tools like Wireshark and Networkminer to analyzing network traffic on live networks. Opportunity, we will do a comparison of the forensic tools it to acquire digital evidence. The subject of this research focused on Android-based email service to get as much digital evidence as possible on both tools. This process using National Institute of Standards and Technology method. The results of this research that networkminer managed to get the receiving port, while in Wireshark not found.

Keywords*: Android, Email, Networkminer, NIST, Wireshark*

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Received September 5, 2017; Revised December 28, 2018; Accepted January 12, 2019

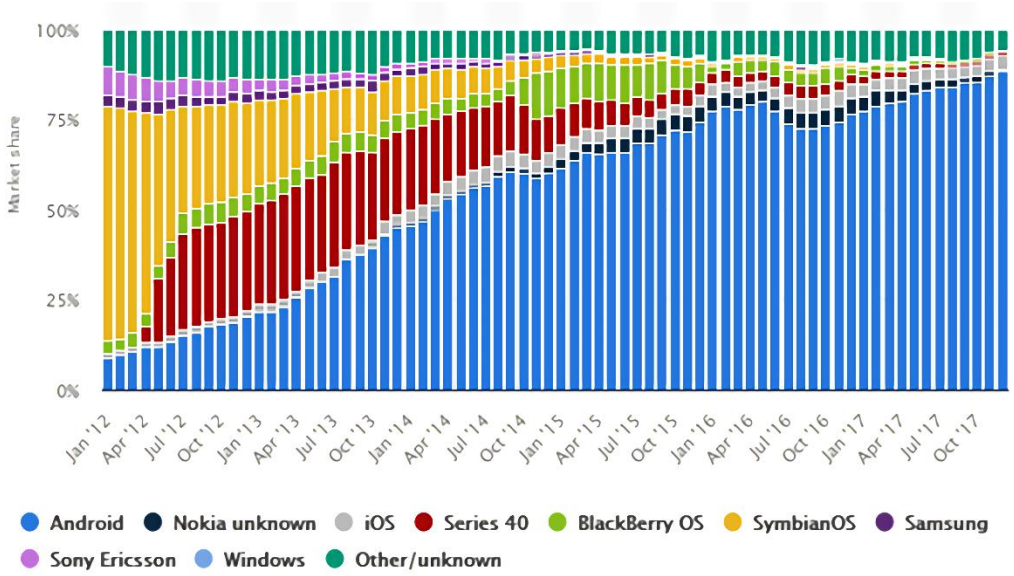

Figure 1. Smartphone User in Indonesia

In any cybercrime must leave evidence, in the form of digital and electronic evidence[6]. Digital evidence can be seen when the criminal process is direct and can be stored, digital evidence can be handled exclusively by digital forensics science using tools to solve and draw conclusions from criminal cases on digital evidence obtained. In real or fake emails it can be detected using several ways, such as viewing email headers [7], [8], *digital signature*, and reading logs [9]–[11] . Digital forensics is the study of how to deal with crimes involving technology such as computers[12]. There are several techniques in digital forensics, one of which is live forensics that is used to handle digital crimes using approaches to systems operating that are working and connected to the network [13].

The law on cybercrime crimes is set in the laws on ITE in Indonesia. The crimes of ITE can be criminalized by civil or civil law in accordance with the level of the crime committed, the process of arrest of the cybercrime by the authorities based on the evidence of crimes that are stored on the smartphone or on other hardware that can be used as evidence in the law court such as username, ip address and timestamp [14]. No criminal cases have escaped evidentiary evidence. Almost all criminal prosecution, always leaning on examination of evidence. At least in addition to proof with other evidence, there is always a need for verification with at least two evidences. Tools that can be used to obtain digital evidence such as Wireshark and Networkminer. Wireshark and Networkminer are open source packet analytical tools that can be used for troubleshooting networks and network analysis. Digital evidence can be found in a way that is by traditional or dead means such as looking for evidence of artifacts, history, and etc. Meanwhile, to obtain the evidence directly or the forensic analysis process when the system is running is called live forensics[15].

In [16] the title of A Comparative Study of Email Forensic Tools. The study conducted a comparison of traditional email forensic tools. Tools used to obtain digital evidence are Mailxaminer, Add4Mail, Digital Forensic Framework, Emailtrackerpro, and Paraben E-Mail Examiner. The study successfully compared between forensic tools.

In [17] the title of Network and device forensic analysis of Android social-messaging applications. The study focused on detecting the presence of unclear artifacts associated with email accounts, retrieving data from service providers, and representatives email in a well-structured format based on existing standards.

From the above background then we will conduct research on the comparison of Wireshark and networkminner forensics, forensic tools to get as much digital evidence as possible for use in trials such as IP address, ports, and timestamps. The comparison process, forensic tools use Android-based webmail services. The method used in this study is the National Institute of Standards and Technology (NIST) to obtain digital evidence.

2. Research Method

In this research, we use mobile forensics methods based on the guidelines available and prepared by the National Institute of Standards and Technology (NIST). The NIST method is used to perform analysis of digital evidence in emails and as a stage for obtaining information from digital evidence, consisting of 4 stages such as Figure 2 [18].

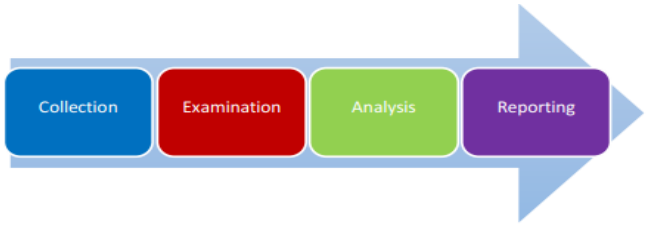

Figure 2. Stages of NIST Method

1. Collection
   Colection is a collection process, identifying, labeling, recording and retrieving evidence in the form of software to be retrieved for use as digital evidence of a digital crime case.
2. Examination
   Testing includes an appraisal process and selects appropriate information from all the data collected, as well as bypassing prosses or minimizes various features in the operating system and applications that can eliminate data such as encryption, data compression, access control mechanisms, specify file locations, checks metadata, extract files and more.
3. Analysis
   The analysis is done by various method approaches, the task of this analysis includes many activities, such as identifying the users involved indirectly, the location, the occurrence, the device and considering how to get all the components connected to the final conclusion.
4. Reporting
   Report the results of the analysis including the description of the actions performed, what tools are used and the procedures used.

3. Results and Analysis

The results of this research conducted a comparison of forensic tools in finding digital evidence in the email received live forensics. Tools used are Wireshark and Networkminer for sniffing on received email packets. The email used is webmail. Here is a comparison process of forensics tools on Android based email services using the National Institute of Standarts and Technology (NIST) forensics mobile method.

3.1. Collection

At this stage of collecting goods on smartphone owners, the smartphone used is google nexus 6 and Android version oreo 8.0. Smartphone used in this research is smartphone emulator genymotion version 2.12. The following is a collection stage concept.

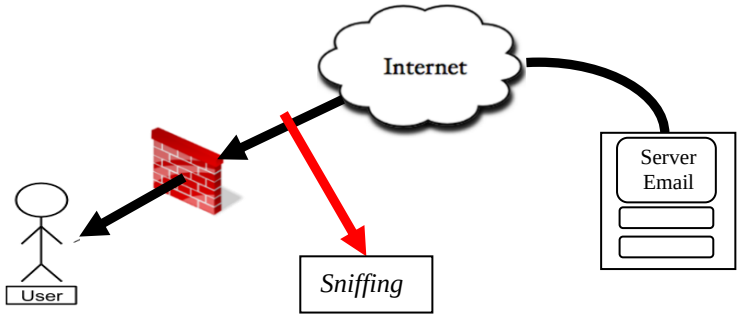

Figure 3. Conceptual Stages in Collection Process

In Figure 3 is a conceptual stage in the collection process, the user receives an email from someone then opens the email, together the investigator sniffing. This collection process of digital evidence is done live forensics.

3.2. Examination

In Examination, we performed a comparison on Wireshark and Networkminer forensic tools. The email recipient opens using the Android smartphone browser version of oreo 8.0. The smartphone runs on a 2.12.1 Geanymotion emulator. Here are the comparison stage forensic tools in the process of getting the digital evidence on Android smartphone.

Figure 4. Android Oreo Smartphone

Figure 4 is an Android smartphone that is used to open the email received from someone to us. At the same time, Wireshark and Networkminer are running to capture packets of passing data. Here is the process of capturing packages using Wireshark and Networkminer.

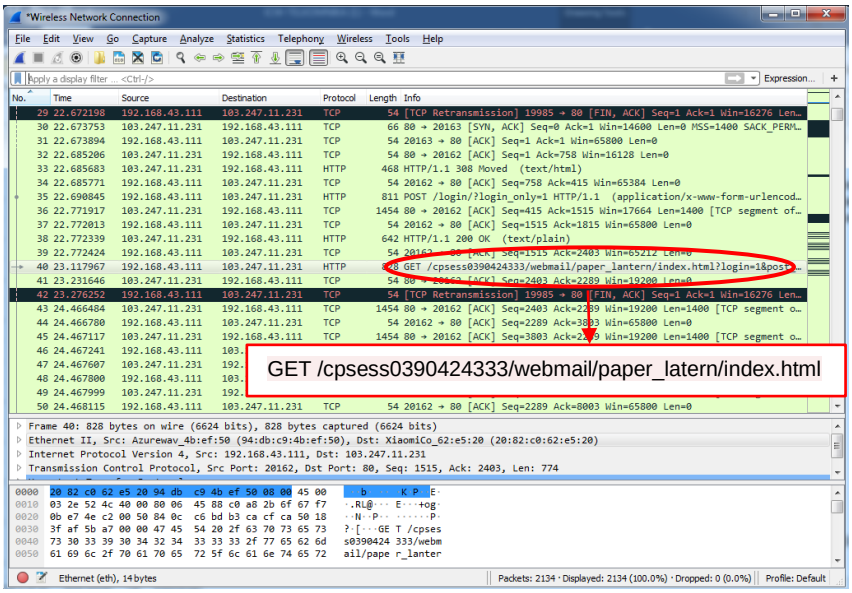

Figure 5. Process Examination Tools Wireshark

Figure 5 is a sniffing process using Wireshark tools. Tools Wireshark successfully for sniffing data packets on email service that opened using Android browser, can see there is a red circle in Figure 5.

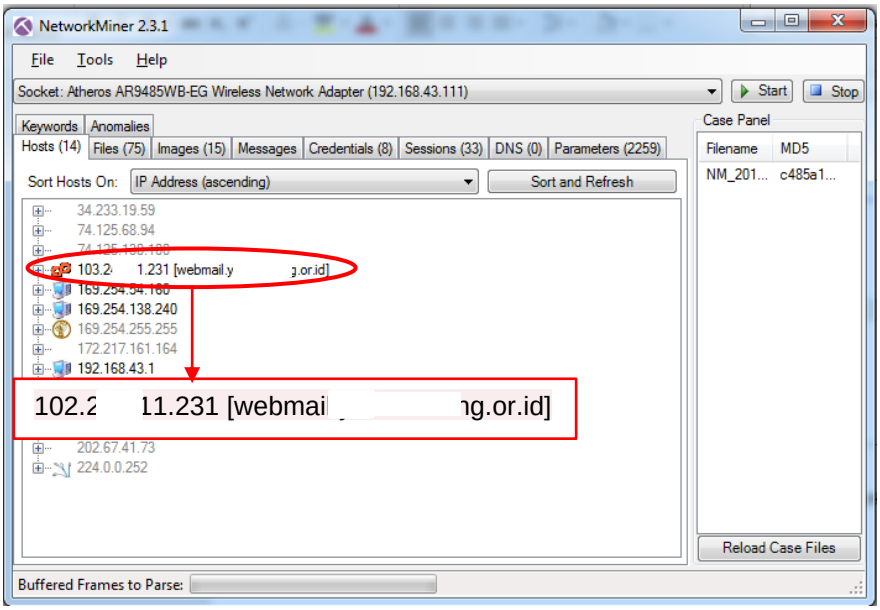

Figure 6. Process Examination Tools Networkminer

Figure 6 is a Networkminer sniffing tool. Networkminer succeeded in sniffing on email packets marked with finding IP Address and webmail, can see there is a red circle in Figure 6.

3.3. Analysis

At this stage is the result obtained by Wireshark and Networkminer forensics tools on Android-based email is complete. Here are the results obtained.

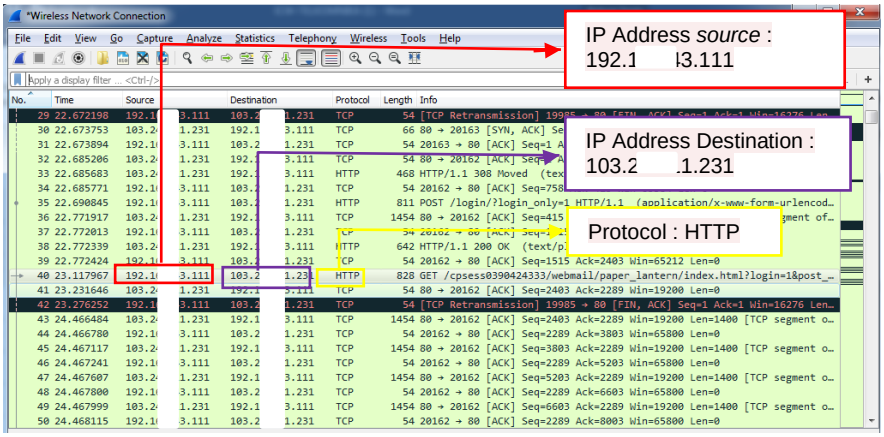

Figure 7. Results of Wireshark Sniffing

Figure 7 is the result of sniffing on the email service accessed using Android smartphone. Found IP Address source: 192.168.43.111, IP Address destination: 103.247.11.231, and the email protocol: HTTP.

Packages that are sniffing by Wireshark can be viewed in detail in the Transmission Control Protocol/ TCP Stream stream contained in the Wireshark menu. In TCP stream there is complete information about sniffing data. following is the result of capturing Wireshark.

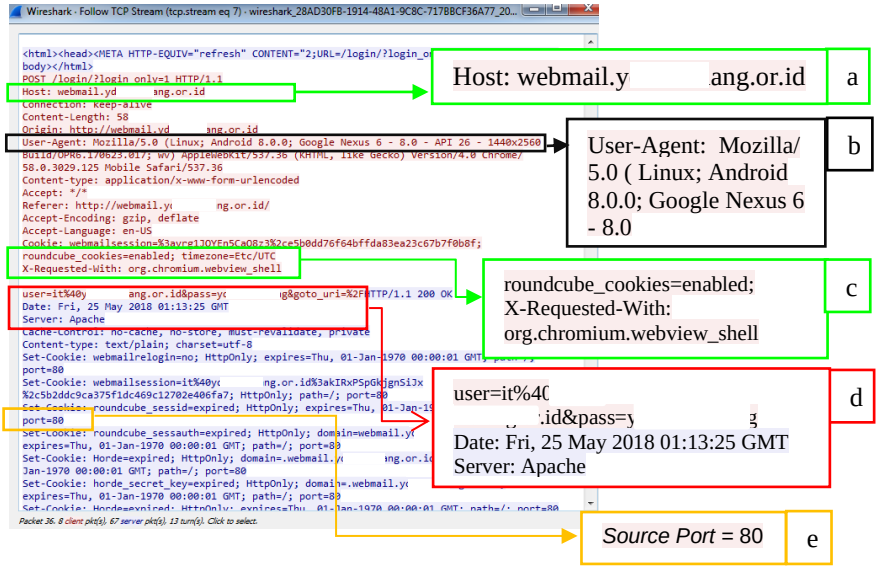

Figure 8. TCP-Stream Wireshark

Figure 8 is the contents of the TCP stream, in the TCP Stream gives a lot of information. The following information can be found : a) Is the webmail host. b) Is the smartphone information used. c) Is the browser used to open the email and layout webmail. d) Is username and password of the user, timestamp email delivery, and email server. e) Is the sending port used.

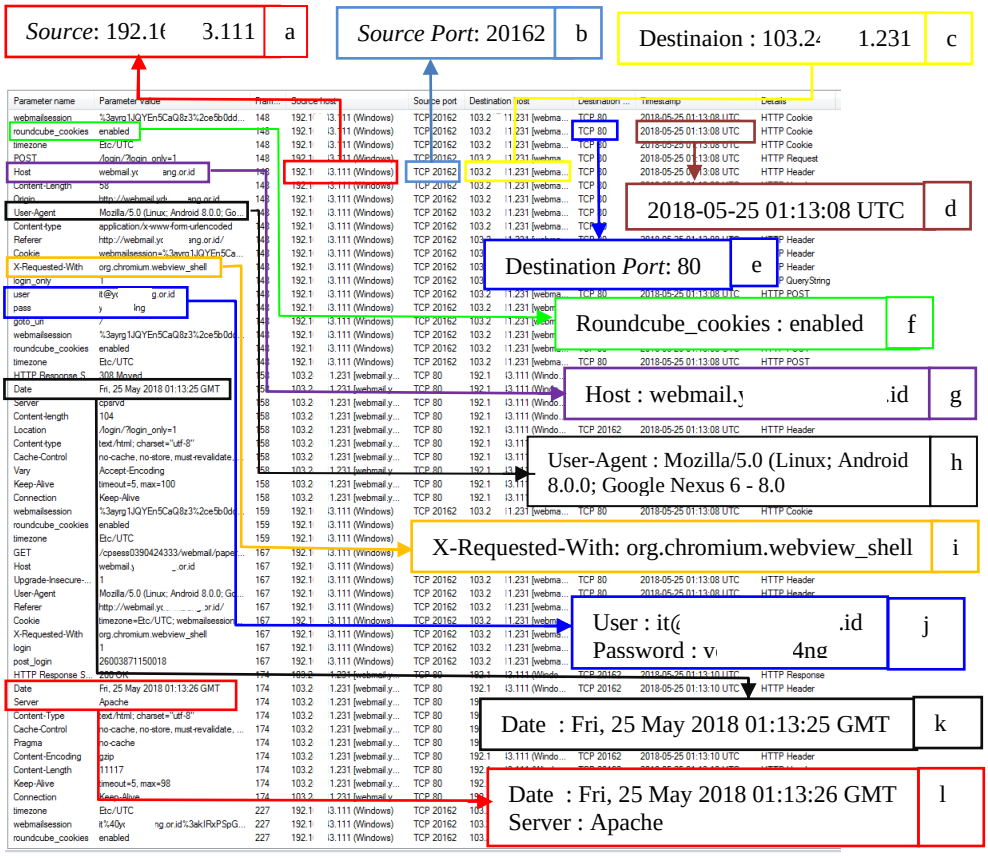

Figure 9. Netwokminer Sniffing Result

Figure 9 is a result that is captured by Networkminer tools. Networkminer can be a lot of information. The following information can be found : a) is the ip address source. b) is port source. c) is the ip address destination. d). it is the timestamp information on the server. e) is the destination port. f) is the interface used is roudcube. g) is the webmail host used. h) is a smartphone used to open email. i) is the browser used to open the email. j) is the user's username and password, k) it is an email delivery timestamp. l) represents an email recipient timestamp.

3.4. Reporting

Reporting the results of research on a comparison of Wireshark and Networkminer forensic tools. In Table 1, It is the result found.

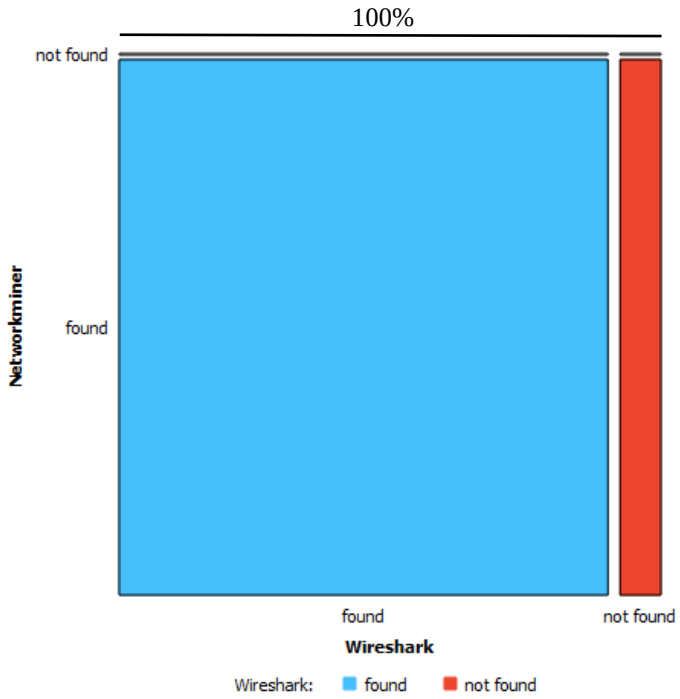

Figure 10. Comparison of Forensics Tools

Figure 10 is the result of a comparison of Wireshark and networkminer forensic tools, it is known that 92.3% of the evidence obtained from Wireshark tools and 100% of evidence can be found with the Network Miner tools. Extraction in Figure 10 uses Orange software.

4. Conclusion

Based on the results of our research we conducted a comparison of Wireshark and Networkminer forensic tools to obtain digital evidence on Android-based live email service in live forensics. In the process of a comparison of forensic tools, the method we use is mobile forensic methods based on the guidelines available and prepared by the National Institute of Standards and Technology (NIST). The results of comparative analysis of Wireshark and networkminner forensic tools obtained evidence, such as e-mail delivery timestamp, e-mail recipient timestamp, sender protocol port, recipient protocol port, source address IP and destination IP address. Networkminer forensic tools have succeeded in getting more digital evidence than Wireshark. Wireshark cannot capture the receiving port and networkminner successfully captures the receiving port. Networkminer has the ability to get digital evidence in emails so that the evidence can be used in court. In the next study, we gave advice to compare more forensic tools in email and on networks that run live forensics.

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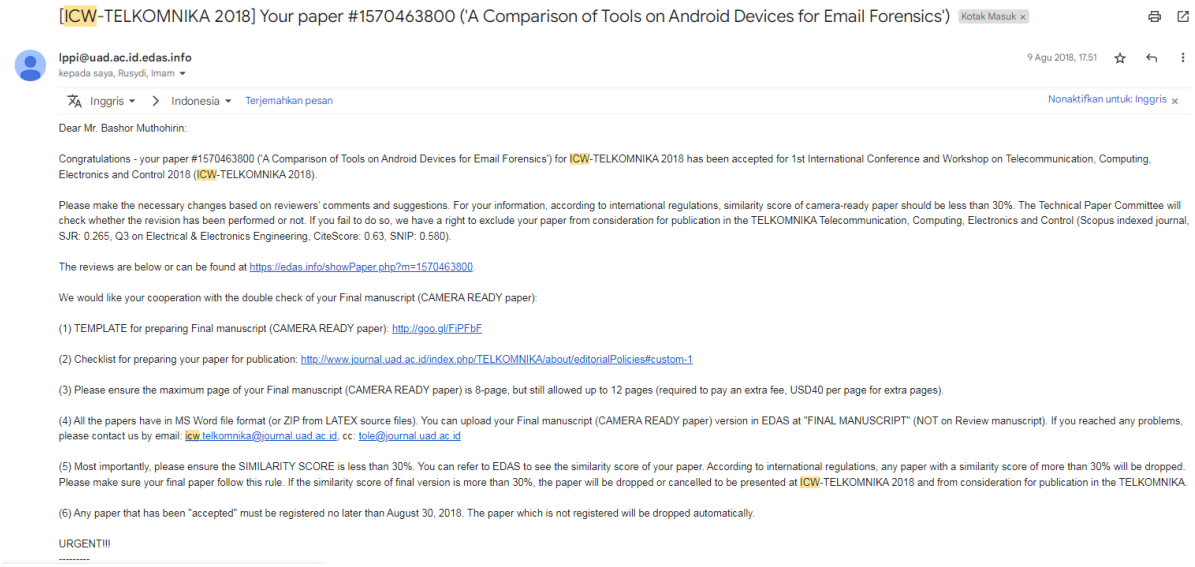
4 Lampiran 4



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5 Lampiran 5

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(2) the proposed solution(s); and
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There are four types of technical results:
1. An algorithm;
2. A system construct: such as hardware design, software system, protocol, etc.; The main goal of your revised paper is to ensure that the next person who designs a system like yours doesn't make the same mistakes and takes advantage of some of your best solutions. So make sure that the hard problems (and their solutions) are discussed and the non-obvious mistakes (and how to avoid them) are discussed.
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2. Identifying the novel aspects of the results, i.e., what new knowledge is reported and what makes it non-obvious;
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