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OPEN SOURCE INTELLIGENCE AND OSINT APPLICATIONS

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ABSTRACT

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Emerge of the Internet as a global platform for sharing and exchanging information world-wide has increased exponentially the amount of publicly available data. Open source intelligence [OSINT] aims at addressing specific intelligence requirements utilising this data. Open source intelligence is traditionally associated with military intelligence, yet users of OSINT today are ranging from governments to businesses and regular citizens. The objective of this thesis was to study what open source intelligence is and demonstrate the use of selected OSINT tools.

In the theory sections, this thesis considered the current state of OSINT and evaluated its future. The popularity of OSINT is increasing, and the usage of OSINT is expanding into new arenas. The main challenge with OSINT is the trouble of finding the meaningful bits from massive data amounts. Hence, this thesis introduced and demonstrated three OSINT solutions displaying the nature and the differing attributes of the selected OSINT solutions. The study of the solutions was conducted as a demonstration assessment, where the use and the results of selected OSINT solutions were recorded and observed.

The thesis findings show that the range of OSINT solutions is wide and scattered. The method of providing the results from OSINT data searches vary significantly between solutions. Combining data from different OSINT solutions for a comprehensive overview and analysis requires effort and use of multiple disjointed solutions while lacking automation.

The visualization of the findings is predicted as a future trend for the development of the OSINT solutions. Individuals' skills for data searches and processing is another trend to put focus on, whether it is for the ability to utilise the available OSINT solutions more efficiently or for an ability to develop more sophisticated OSINT solutions in the future.

Keywords: Intelligence, reconnaissance, open data, open source intelligence

PREFACE

This thesis was done in Oulu during spring 2019. The topic for the study was chosen based on the interest of the thesis worker. This thesis was written in English as that was the primary language for the terminology around the subject matter. Instructing teacher for the work was Eino Niemi, but support was also received from Susanna Kujanpää, in initiating the thesis work, and Kaija Posio for completing the thesis in English. I wish to thank all of you for your support, and instructor Eino Niemi particularly for the trust and “free-hands” with the thesis.

This work is my last assignment to complete Degree Programme in Information Technology, option of Intelligent Systems, at Oulu University of Applied Sciences. This study-journey has been truly memorable right from the start, partly because the first tutor lecture ended in hurrying to hospital where my (third) baby was born healthy and beautiful few hours later. As such, I wish also to thank Oulu University of Applied Sciences for such design and implementation of the program that it enabled combining family-life and later full-time work still completing the degree. That shows the power of good teachers, e-platforms, and self-motivation. Never underestimate the power in determined women, but rather endorse it.

That said, it must be noted that none of this would have been possible without the support from my family. The support, understanding, patience, and encouragement I have received from my magnificent husband has been invaluable throughout the study. Toni, you rock! Thank you.

Oulu, 6.5.2019
Sanna Tuominen

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VOCABULARY

API: Application Programming Interface

CRM: Customer Relationship Management system

CSV: Comma Separated Values

ERP: Enterprise Resource Planning system

HUMINT: Human intelligence

HTML: HyperText Markup Language

OSD: Open source data

OSINF: Open source information

OSINT: Open Source Intelligence

OSINT-V: Validated Open Source Intelligence

SIGINT: Signal intelligence

UI: User Interface

URL: Uniform Resource Locator, the resource address on the internet

XML: Extensible Markup Language

1 INTRODUCTION

Billions of users world-wide sharing, communicating and exchanging digital data to the extent of today, is something our world has not seen before. The amount of data publicly and often freely available is enormous. Consequently, our time is now described as the 'information age'. While the information age has aided in transforming into the digital age, it comes with its own challenges. The developments of the information age have brought new kinds of risks into societies. The digital means are utilized not only for good, but also for crime, terrorism, and various malicious acts. Organizations fighting against such threats, such as military, security and law enforcement agencies, have been forced to develop new techniques to counter act. (1)

It is a common misinterpretation that intelligence utilized to fight against crime is classified and must originate from secret sources (2, p.135). The truth is that these organizations have increasingly been investing in open source intelligence [later OSINT] to develop new techniques using the Internet as the main information source (3, p.339).

The open source intelligence refers to all information and knowledge that can be gathered from publicly available sources (1; 3, p.331; 2, p.129) and OSINT has moved into the front of intelligence gathering disciplines (4, p.85). Open source intelligence as a concept is old, as throughout the history societies have valued available information over surrounding circumstances to derive better conclusions (2, p.132). The gathered knowledge is critical as it often provides an advantage over another, let it be a matter of solving a crime, winning a battle, or succeeding better in business operations (4, p.85).

What has changed over time is the amount of available data and the methods to collect it. When earlier open source intelligence focused on gathering information from newspapers, public speeches, interviews, to name examples, the data today is in the Internet and methodologies retrieving the data are becoming much more sophisticated, technologically advanced and open for all.

(1) The use of OSINT is emerging to a wide range of different user groups such as international organizations and corporate businesses (5)

The emerge of OSINT is a consequence of the following key drivers (2, p.132; 6, p.11-12):

1. Emerge of the Internet as a global platform for sharing and exchanging information world-wide
2. Exponential growth, explosion, of useful information available over the Internet allowing access even to formerly denied areas
3. Potential risks to public security changing to new non-traditional digital threads

Open source intelligence is a growing field in the security domain and beyond (3, p.339). Hence, the topic is very current as a research area. To study open source intelligence is meaningful also as future predictions forecast a further rise of the OSINT (7). It is estimated that already now 80% of intelligence comes from open sources (6). More focus should be turned into how to find the best data and what is the best method to understand that information to derive useful intelligence (6). As such, this thesis presents three OSINT tools to demonstrate and evaluate their suitability for the purpose, aiming to provide a good understanding and insight of possibilities and limitations of OSINT solutions available today.

1.1 Thesis Objectives and Research Questions

The objective of this paper is to study what open source intelligence is and to demonstrate the use of selected OSINT tools. In the theory sections, this paper also considers the current state of OSINT and evaluates its future. The challenges of open source intelligence are also discussed. Overall, this thesis aims to provide a good understanding on open source intelligence.

That said, the main research question of this thesis is formulated to encompass the overall purpose of the study. The sub-research questions are then formulated to divide the main research question into smaller entities for better

capturing the underlying contents in each, finally then bringing all together for conclusions.

The main research question of the study is:

1. How can OSINT applications help in finding information from open sources, and how do the applications help in understanding the retrieved information?

Two sub-research questions are formulated to assist in answering to the main research question. The first sub-research question aims at understanding open source intelligence as a concept first – what it is about, what benefits and challenges it has, and who needs it. These questions are answered based on the available literature on the subject. Hence the first sub-research question of the study is:

2. What characteristics specify open source intelligence?

The second sub-research questions are formulated to understand better the example OSINT applications – what kinds of possible OSINT solutions are available, and what information they provide focusing only on those OSINT solutions that are possibly accessible without any further authorizations or payment fees:

- 3a. What kinds of OSINT solutions are freely available?
- 3b. What information can be collected by OSINT solutions and how the information is provided?

The research approach of the study is described in the following sub-chapter providing an overall view for the reader how the objectives of the study are planned to be achieved. The same chapter also describes the known limitations for the study.

1.2 Research Methodology, and Limitations

The study in this thesis is conducted as a demonstration assessment, where the use and results of selected OSINT tools are recorded and observed. This paper acts as an explanation for the demonstrations and findings.

This study has limitations that should be considered when interpreting the findings. The world of OSINT solutions is widespread and scattered, and the biggest limitation of this study derives from that circumstance. This thesis can only introduce and demonstrate a couple of available solutions to limit the scope of the research. The limitation for the scope is required to conduct the study within the available time and resourcing for the work.

To provide a comprehensive and solid representation of the world of available OSINT solutions is simply too wide in the context of this bachelor's thesis. That said, it must be recognized that the findings of this study might lack a possibility for generalisation, considering the whole magnitude of OSINT solutions.

It must also be noted that an assumingly large portion of OSINT solutions are not accessible by a student and this should be acknowledged when considering the findings. The world of OSINT solutions beyond this thesis might be at a completely different level of what is presented here.

What should also be considered with the findings is that no API keys have been acquired for the demonstrations performed in this thesis. The API keys would allow more advanced data searches but are left out from the focus as the use of them may reveal data that is out of scope of the demonstrations of this thesis.

1.3 Thesis Structure

The introduction chapter of the paper is followed by theoretical chapters dealing with open source intelligence. The theoretical chapters concentrate on describing open source intelligence as a concept, and the main elements of it: types, users, process, benefits, challenges and its future. The third chapter introduces the selected OSINT tools used in this study and compares them with each other after use. The Chapter 4 concludes the paper providing the main

findings of the study and summarizing the answers to the research questions.
The paper is finalized with suggestions for a future research in the topic area.

2 DEFINITION OF OPEN SOURCE INTELLIGENCE

The term open source intelligence is known to originate from military, security and law enforcement agencies (3, p.331). There is a wide range of descriptions and definitions provided to characterize open source intelligence, although with a tendency of being broad and non-specific (4, p.87-89). Some view OSINT more as a definition of 'act' to collect and process information from publicly available sources (cf. 3, p.331), where some emphasize more the 'outcome' of the data collection acts, i.e. the actual intelligence derived from the data collection and analysis activities (cf. 2, p.129). The definitions of OSINT are provided by academics and but also by different bodies utilizing the open source intelligence. Hassan & Hijazi (1) provide one example based on the U.S. Department of Defense's definition of OSINT as follows:

“Open-source intelligence (OSINT) is an intelligence that is produced from publicly available information and is collected, exploited, and disseminated in a timely manner to an appropriate audience for the purpose of addressing a specific intelligence requirement.” (1)

What seems to be common for all definitions of OSINT is that a) OSINT is expected to generate valuable insight and knowledge on matters that are approached, and b) the extraction of information is done from publicly available information sources, as opposed to closed or classified sources.

Open source intelligence and open source movement on the software development are not usually mixed with each other but are regarded as two different arenas (8). These concepts are kept separated also in this thesis. It is, however, acknowledged that some OSINT solutions are developed as open source software projects and according to related principles.

2.1 Sources of OSINT

The sources of intelligence in general can be divided into three different sources (3, p.331-332) (figure 1.):

- Signal intelligence (SIGINT): intelligence gathered from different signal intercepts, wire taps and similar.
- Human intelligence (HUMINT): intelligence from confidential human sources.
- Open source intelligence (OSINT): intelligence gathered from publicly available information.

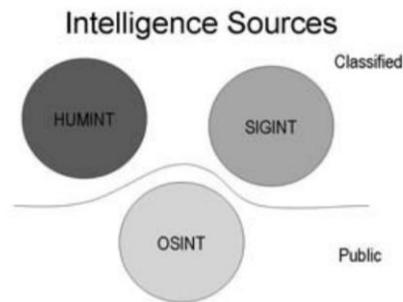


FIGURE 1. The three traditional intelligence sources (3, p.331)

From these three intelligence sources, OSINT is the only source where the intelligence is gathered from publicly available sources. Sources and means to gather SIGINT or HUMINT intelligence are often confidential (3). Best (3, p.331) also highlights that during the last 10 years, there has been an enormous growth in the OSINT area. Steele (2, p.129) adds that by applying OSINT more, the use of other intelligence sources can be decreased as OSINT allows to focus only on those questions that cannot be answered by open sources.

According to the NATO Open Source Intelligence Handbook (9, p.2-3), there are four categories of open information and intelligence.

- **Open source data (OSD)** is raw data coming from a primary source, and it can be a photograph, satellite image, or a personal letter (9).
- **Open source information (OSINF)** is comprised data, which has undergone some filtering first. It can also be called a secondary source. Newspapers, books, or daily reports as an example are part of the OSIF world (2, p.132). Best (3, p.333) adds that OSINF data is not necessarily free information but may include commercial subscription services and

commercial satellite imagery. To collect OSINF data, the best known search engines such as Google are heavily utilized as main tools for the purpose. CIA agents are said to gather 80% of intelligence from Google. However, also dedicated web crawlers are developed to monitor web sites of interest to detect and download updates on the pages. Most blogs are available as RSS feeds allowing them to be monitored as well. (3, p.333-338)

- **Open source intelligence OSINT** differs from the two above with its ability to already answer to specific questions – it is the output of the intelligence cycle. The open source material has been discovered, filtered, processed to the extent that the processed information can be used directly in the intelligence context. (9)
- **Validated OSINT (OSINT-V)** is one step further from the above where the outcome of intelligence cycle is confirmed and verified by other, possibly non-OSINT, sources. These validations are important in ensuring that the open sources utilized in the intelligence process were not misleading (9). The validation of the OSINT data can come from supporting findings from confidential intelligence sources, or simply sheer volume of same data publicly shared (e.g. same pictures all over the Internet). (2, p.132).

Although open source intelligence is based on open source data, it must be noted that the Internet may contain/provide access to data and documents that are classified or shared without the permission from authors. This type of information is called NOSINT, as opposed to OSINT, and this information is included in OSINT sources regardless of the legal accessibility. The information deriving from these sources are called grey literature and include any material (e.g. journals, books, reports, commercial, and internal documents) that has a known producer. These sources are a major element of OSINF and can be utilized in intelligence process once permissions are acquired. (1)

Open source information consists of the following general categories (2, p.138):

- Traditional media resources (e.g., television, radio, newspapers, books, magazines)

- Commercial online premium sources
- Other niche commercial online sources
- The Internet and the world wide web including the following and more: forums, blogs, social networking sites, video-sharing sites such as YouTube.com, wikis, Whois records of registered domain names, metadata and digital files, dark web resources, IP addresses, people search engines (1). Today the largest source of open source information is the Internet (3, p.331)
- Grey literature
- Overt human experts
- Commercial imagery and geospatial information (including metadata)

To list all details of all possible sources for OSINT information today is rather a consuming activity, yet the OSINT Framework provides a comprehensive overview (figure 2.) (10)

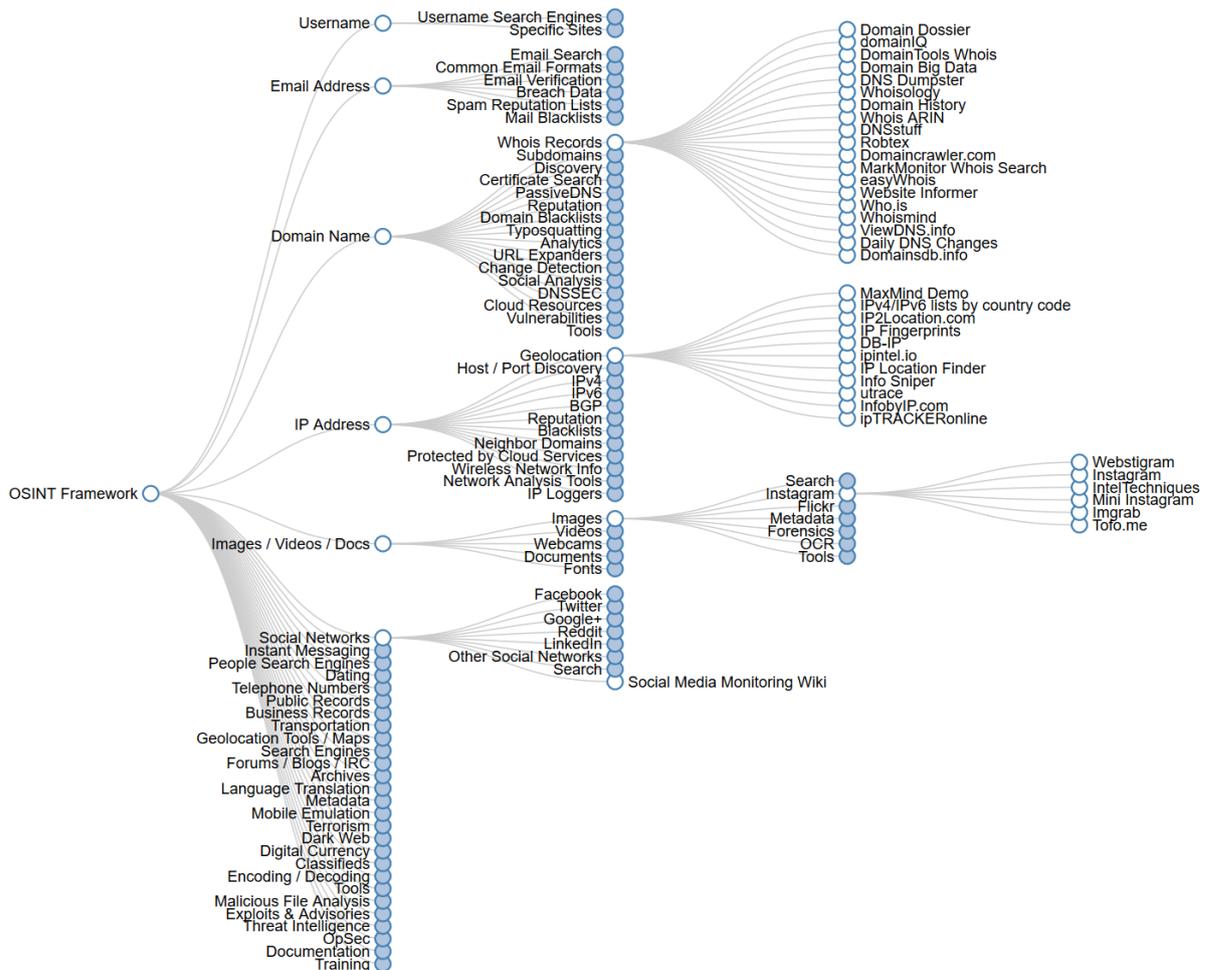


FIGURE 2. An illustration of one fraction of possible OSINT sources (10)

As the volume of available data is expanding, also businesses are turning more towards OSINT to gather market intelligence. The sources that businesses utilize for OSINT are along the lines of the above listing but also entail the company's internal master data according to Fleisher (5, p.854). The company master data refers to internal databases and systems (i.e. ERP, CRM) and documents, such as minutes of meetings, business plans, reports, which bring value to analyses when combined with external data sources. (5)

OSINT sources do not come alone from online sources as highlighted afore. However, online sources comprise the largest segment of OSINT. In this information age, most sources are turning their process into digital formats, not forgetting the culture of sharing among Internet users. These days social media sites are collecting a growing number of subscribers. A huge increase in volume

of data is expected also along the expansion of the Internet of Things (IoT) with all sensors and equipment ending their data across the Internet. It is forecasted that by 2020 there will be 20.4 billion IoT devices in use. Consequently, there is a trend of most OSINT sources moving into online sources. (1)

There are three types of methods to collect information in general: passive, semipassive, and active. The most used collection method in OSINT is the passive collection method which is characterized by two factors: a) the data originates purely and only from open information sources, b) the target cannot identify anything about activities to collect intelligence data from the target as the searches are completely anonymous from the technical perspective.

Technical methods utilized for the data collection in the passive category do not send any traffic/packets for the target servers. Therefore, the passive OSINT data collection may also result in limited information about the target. OSINT data collection modes where some, or limited, traffic is sent to the target to gather information is categorized as semipassive. These enquiries to target usually attempts to resemble the typical Internet traffic to avoid any unnecessary attention, yet while not being completely invisible. Active collection, however, takes a direct contact with the system where the intelligence is tried to be collected from using advanced techniques to harvest technical data. Semipassive and active data collection methods are not usually seen in OSINT as they can be seen infringing the essence of open source intelligence. (1)

The OSINT data collection can be on a small-scale with some targeted single queries and a very large-scale OSINT that only larger organisations have resources and capability to perform (e.g. CIA) (11).

A key with OSINT is to realize the difference between data, information and knowledge; data is a set of facts (e.g. the price per potato kg \$5), information is a proper interpretation of data in a specific context (e.g. the price of potato kg has raised from \$5 to \$7), and knowledge is a combination of information, insight, and experience that could be used in similar contexts (e.g. when the price of potato kg raises, the price of meat will raise too). (1)

2.2 Who needs OSINT?

Most commonly open source intelligence is related to military intelligence and organizations. In reality, the range of OSINT users is much larger. Large multinational companies, banks and various industries are increasingly turning towards OSINT to gather insights and business intelligence for decision making, competitive advantage and for protecting their business. (3, p.332)

The main user groups can be listed as in the following (1):

- Government/Government bodies including military, security and law enforcement agencies
- International organizations
- Business corporations
- Penetration testers, hackers
- Criminal organizations, terrorist groups
- Privacy-conscious people

From the above the government bodies are considered as the largest consumer group of open source intelligence (3). The government uses OSINT for different purposes, such as national security, counterterrorism, crime prevention, criminal profiling, analysing domestic and foreign views and events on matters of interest. They also use OSINT to support policy makers with supporting information. (1).

Government bodies differ from the other OSINT user groups with their possibility to combine OSINT intelligence with confidential intelligence they have gathered by other means. Government bodies also tend to have more capacity and resources for the data collection and analysis, compared to other user groups, and this trend is also expected to continue in the future where government bodies are seen putting even more focus and resources on OSINT. Government organizations are also considered as best sources for OSINT because of their resources and capability to derive an OSINT analysis. (1)

International organizations use OSINT to establish unbiased and transparent views on matters of interest, instead of reports produced by powerful nations, or

any other sources that may be providing analyses in favour of their own interests. A good example of an international organization utilizing OSINT is United Nations (UN) which uses OSINT for supporting peacekeeping operations world-wide. (1)

Business corporations have also realized the power of information utilizing open source intelligence in an ever-increasing manner. The rise of the OSINT among this user group is explained by the Internet, and consequently the emerge of available information, making OSINT available also for small businesses. Earlier, it was possible only for businesses with the biggest budgets (5).

OSINT among business corporates is used for market and marketing activities to investigate current and new markets, monitor competitors' activities, evaluate their operating environments and occurring trends and changes in it.

Businesses also use OSINT also for protecting against any data leakages monitoring confidential data breaches, and for monitoring network behaviours protecting against cyber threads. (5, p.852) Many private corporations have developed advanced programs and techniques to gather data from public sources for a commercial gain (1).

Penetration testers and black hat hackers utilize OSINT in a more targeted manner. Their objective often is to gather intelligence about specific targets online in preparation for penetration testing or social engineering attacks. (1)

Criminal organizations and terrorist groups unfortunately take advantage of OSINT sources to plan attacks, collect information about targets, recruit new members for their group by analysing social media, gathering military information revealed by governments and the use OSINT to design the best channels to spread their propaganda (1).

Concerns of ordinary people's online exposures and security of any private data are guiding privacy-conscious people to utilize OSINT too. They utilize it for monitoring their digital identities with the attempt of protecting their privacy. (1)

The typical cycle of intelligence gathering begins by identifying the need for an additional insight, followed by planning of the activity and possible information sources. The actual process then follows the pattern of (3, p.332-333):

1. Collection: Information retrieval
2. Process: Information extraction
3. Analyse: Trend analysis/Link analysis
4. Visualize: Data visualization
5. Collaboration

Best (3) highlights the importance of an experienced and skilled analyst to derive meaningful insights for the collected information. Similarly, Glassman and Kang (12, p.679-680.) conclude that the most critical skills in OSINT relate to search, organization and differentiation of information. Those having the required skills are embracing the opportunity and there are an increasing number of OSINT-related service providers in the commercial sector promoting OSINT tools and expertise with them (3, p.332).

2.3 Benefits and challenges of open source intelligence

In this information age, the benefits that open source intelligence provides should not be underestimated, nor should the challenges of OSINT be neglected. Like any other intelligence discipline, open source intelligence entails both attributes. The benefits and challenges of OSINT are generally the same, but with their own perspectives, for instance considering the volume of available data; The amount of accessible data is in the core of OSINT benefits – the whole emerge of OSINT is based on it. However, the same volume of data enabling the open source intelligence is also its problem as the amount of data is enormous creating true challenges to find meaningful bits from it, even for professionals.

As the benefits of OSINT are mostly two-sided, the following table (table 1) provides collections of OSINT elements describing in condensed manner all the good that OSINT enable but displaying at the same the challenges that are brought with the elements.

TABLE 1. The two-sided benefits and challenges of open source intelligence

Benefits of OSINT	Challenges of OSINT
Volume of data	
<p>“The volume of available data translates in the world of OSINT into ability to see, hear, know, understand, decide, and act on ‘all information, all languages, all the time’” (2, p.133)</p>	<p>“The sheer volume is daunting and separating meaningful information requires true effort to be considered as valuable intelligence” (7).</p>
Access and availability of data for all	
<p>“OSINT sources are always available, accessible, and up-to-date, and can be utilized by different parties to derive conclusions.” (1)</p> <p>“Information is always transparent, always open access, always readily available, and treated more as a community resource than an individual commodity” (12, p.679-680).</p> <p>“Open information sources are not the exclusive domain of intelligence staffs” (2, p.129).</p>	<p>“The use of term ‘publicly available’ is misleading and open for interpretation as different user groups do not have same authorization to all data (military vs business as an example). Many data services and databases are open only for paying customers, and for restricted users and not available for wider public. One might also question whether it is ‘fair game’ collect personal data from platform where users have shared their data behind ‘password’ -protection from the Internet.” (4, p.87-89)</p> <p>“It is virtually impossible to maintain a viable collection of open source materials that address all information needs instantly” (2, p.130).</p>
Reliability	
<p>“OSINT has one advantage over the other sources: its exposure to millions of pairs of eyeballs. As it commonly understood in the open source software world, put enough eyeballs on it and no bug is invisible. OSINT also offers analytics frames of reference that have stood the test of time. This differentiates OSINT from other intelligence sources.” (2, p.139).</p>	<p>“OSINT sources, especially when used in the intelligence context, need to be verified thoroughly by classified sources before they can be trusted” (1).</p> <p>“OSINT sources can also be manipulated to broadcast inaccurate information misleading OSINT outcomes” (5, p.856-857)</p> <p>“Page and sites frequently exhibit short life span and content may change constantly, and there might be struggles for organizations to keep up with changes” (5, p.856-857)</p>
Cost-effectiveness	
<p>“Collecting OSINT is generally less expensive compared with other intelligence sources. For instance, using human sources or spying satellite to collect data is costly. Small businesses with limited intelligence budgets can exploit OSINT sources with minimal costs.” (1)</p> <p>“OSINT products can reduce the demands on classified intelligence collection resources by limiting requests for information only to those questions that cannot be answered by open sources” (2, p.129).</p>	<p>“Humans need to view the output of automated tools to know whether the collected data is reliable and trustworthy; they also need to compare it with some classified data (this is applicable for some military and commercial information) to assure its reliability and relevance. This will effectively consume time and precious human resources.” (1)</p> <p>“Constant changes in sources and content of the sources require ability to archive targeted data for subsequent processing that requires applications, time and effort from analysts, and cost of additional memory resources” (5, p.856-857).</p>

Ease of OSINT technologies	
<p>“Unlike other intelligence sources that may require using spy satellite images or secret agents to collect information, all you need to gather OSINT online resources is a computer and an Internet connection” (1).</p>	<p>“There is no one offering that meets the need for a fully integrated OSINT analyst toolkit. This is partially because of the lack of agreement on standards in the part, and partly because the lack of coherence in government and corporate contracting, there the emphasis has been hardware and proprietary software instead of generic functionality and ease of data integration.” (2, p.138).</p> <p>“Not all data in Internet is indexed, and data analyst need to be able to deep-dive into the “invisible web” knowing how to access required information” (5, p856-857).</p>
Legal and ethical considerations	
<p>“OSINT resources can be shared between different parties without worrying about breaching any copyright license as these resources are already published publicly” (1).</p>	<p>“OSINT has its legal concerns for instance in a case where someone acquires OSINT sources by illegal means to justify an honest case, or when the OSINT sample is minimized or selected according to the collector’s need effectively discarding important sources purposely in favour of bringing about a specific outcome.” (1)</p>

The challenge that OSINT has yet to overcome is its equal standing between other forms of intelligence. Wells and Gibson (4, p.86.) report OSINT sometimes having a difficulty in being taken seriously. Whether being taken into consideration with well-deserved seriousness or not, OSINT has a bidirectional relationship with other intelligence disciplines providing a very robust foundation for other intelligence disciplines enabling an alternative source to validating findings generated by other means (2, p.129). This also works other way around when other intelligence disciplines validate findings generated through open source intelligence.

One major element with OSINT is the language. In order to utilize global data interpreting properly sources in different languages translation capacity is required. The translations also need to meet certain quality standards to enable deriving any conclusions. This multilingual source environment creates a strong need for translation skills and knowledge of cultural nuances. (5)

2.4 Future of OSINT

Although open source intelligence is an old approach, it has witnessed some major changes in recent years mainly due to the rise of the Internet and explosion of digital data sources but also due to developing technologies and techniques. Despite the age of the open source intelligence, Glassman and Kang (12, p.679-680) conclude OSINT still being at its early stages and still developing. The developments that have taken place with OSINT so far show that OSINT can be considered a distinct phenomenon that is slowly finding its own identity, maturing from a practice "in itself" to one "for itself" (13, p.2).

As open source intelligence is still quite young as a distinct practice, it faces few challenges. First, there is the issue of scale. Compared to traditional broadcast media, OSINT projects are still very small and the growth might not come easily for many projects. Second, there is an issue of economics. Most OSINT projects are pure volunteer projects and resources are donated. The Internet economy does not necessarily make it easier to raise funds, which becomes more important as the projects grow in size and the infrastructure/bandwidth needs increase. Compared to traditional production and publishing models, OSINT projects are outside of the traditional economy, thus new ways of financing OSINT projects need to be found. It is likely that OSINT projects will develop into a model of involving direct revenues (e.g. subscription, advertisement), goodwill donations and volunteer efforts. Despite the challenges of OSINT, there are strong believers in its future because it is becoming the mainstream to process and learn from bigger data amounts, OSINT tools and methods are becoming better known, and the threshold of using them is getting lower. (13, p.9)

The use of OSINT within the military domain is expected only to increase. The military cannot neglect the amount of information available online but will continue to embrace the easy access to such information source. OSINT is also seen as a prominent part of also e.g. NATO's future vision. Intelligence based on open, unclassified information is easy to develop and share between member states and international operations, for organizations like NATO. With OSINT intelligence there is no risk of sharing or revealing any confidential

intelligence collections methodologies. OSINT will continue to have a strong role also in supporting the classified intelligence production. It has been stated that *“The Internet is now the default Command and Control, Communications, Computing, and Intelligence (C4I) architecture for virtually the entire world (2, p.129.)”*.

Whereas military organizations, such as NATO, recognize the importance of embracing the open sources, it is clear from the development that OSINT is taking on a life of its own outside of the government according to Steele (2, p.131). As such, the same bright future of OSINT is also seen emerging among businesses where Fleisher predicts that the rise of OSINT will create opportunities in the marketplace for OSINT service providers (5, p.862). Stalder and Hirsh (13, p.10) also predict a rise of the technologies in the OSINT arena seeing OSINT as a major supporting element of human cognitive learning in the future. They see the culture of technology increasingly becoming part of the culture of learning.

That said, it reads that the focus is turning towards the available technologies to produce intelligence from open sources. Steele (2, p.131) states that the focus should be turned from maintaining a collection of open source materials into a viable collection of OSINT sources: what are the best sources to be utilized to answer certain questions, and what tools should be used to provide the best search methods.

The growing data amounts require advanced software tools to allow coping with the overflow of information (3, p.331). The development activities around the OSINT arena are, however, dispersed as the emerging field of OSINT is made up of numerous, independent projects (13, p.2), and also the number of developers and marketers is growing in the commercial sector (5). There are also new initiatives around the subject area from which the EUROSINT Forum is one good example. The EUROSINT forum was established in 2016 for coordinating EU level development activities on OSINT between government agencies and businesses (14). The research community is also increasingly putting focus on developing tools and techniques to support the OSINT process (3, p.332). Best (3) predicts that the future research trend will also focus on

techniques to visualize a summary of textual information providing a better insight from open source intelligence.

Based on the aforementioned developments, it could be predicted that the open source intelligence arena will continue to develop further maturing towards more precise definitions, rules of the game, and advanced techniques and users serving even larger audiences. Citing CIA (7):

“An organization that invests in open source today is akin to an individual who invested in Google in its first year. --- An organization with an appreciation for OSINT’s value and potential will be the most effective in the future.” (7)

3 STUDY OF OPEN SOURCE INTELLIGENCE TOOLS

This chapter introduces and demonstrates three OSINT tools for gathering intelligence from open sources. The set of selected tools presented here is a good example of how OSINT tools differ from each other. The solutions represent different types of OSINT applications, providing a wider view on the scale of available OSINT solutions. The range of OSINT solutions is generally very broad – solutions may be designed to focus only on single queries, whereas more powerful OSINT solutions have an ability to perform inquiries of a much larger scale (11).

Many of the larger scale OSINT solutions are custom made and designed with huge budgets for governments and giant companies, and accessible naturally only by the owner of the solutions. These solutions are powerful with automated processes, with artificial intelligence and advanced filtering technics (1). Consequently, the access to such solutions is restricted. However, the number of tools and resources generally accessible by public is also remarkable allowing for powerful searches (15).

However, as stated in the previous chapter, critical for the future of OSINT is the capability of the tools for data search and analysis processes, and therefore it is important to study and evaluate the solutions. Steele (2, p.138) concludes that there is currently no solution that would comply with all fully-integrated-analyst-toolkit requirements (exception larger organizations) and as a solution, Glassman and Kang (12, p.679) provide that users may need to establish their own sets of tools.

The demonstrated tools in this thesis are accessible by any Internet user. The following paragraphs introduce each of the tools individually. The individual introductions of the tools are followed by an actual demonstration of the solutions. The Chapter 3.5 then summarizes the findings and compares the solutions with each other.

3.1 Tinfoleak.com

The simplest of the solutions presented in this thesis is Tinfoleak.com [later Tinfoleak]. Tinfoleak.com is a website where you can get detailed information about any Twitter user. It is a web interface (figure 3.) for the OSINT tool "Tinfoleak", authored by Vicente Aguilera Diaz (16). Tinfoleak.com is fully web-based and does not require any installations by the user. Tinfoleak.com is a good example of a web-based OSINT solution for this thesis demonstrating how easily one can have access to OSINT queries.

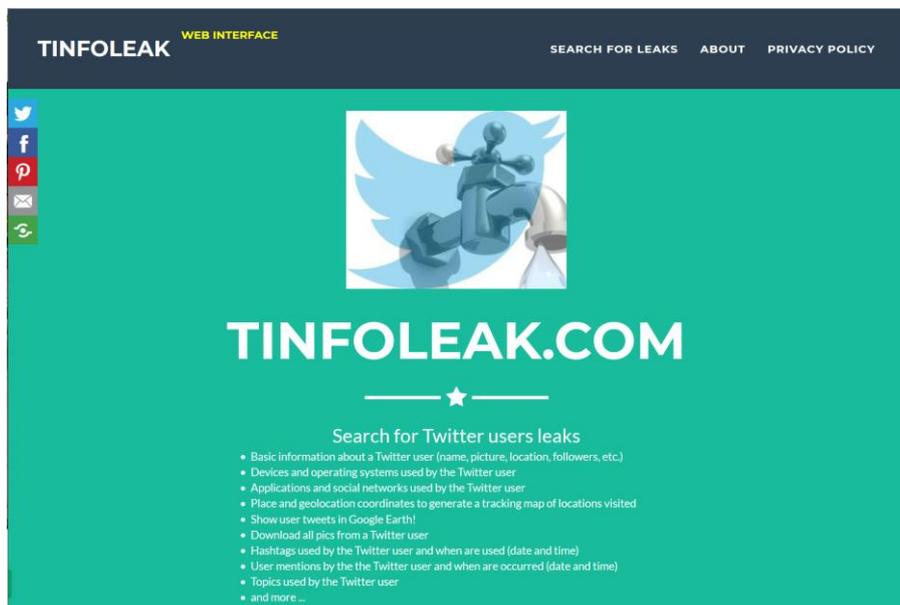
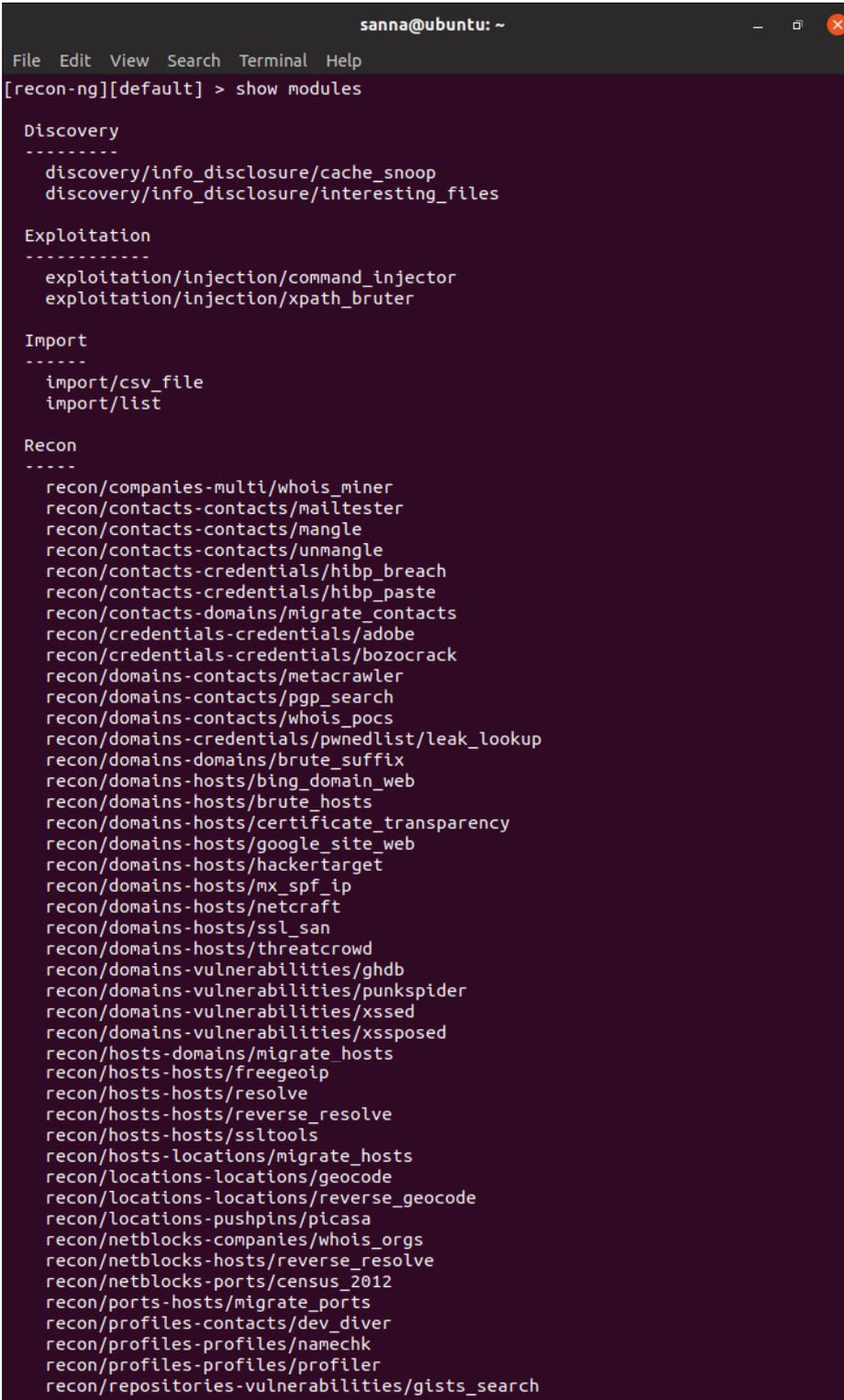


FIGURE 3. Tinfoleak web interface (16)

To fetch user related data from Twitter with Tinfoleak, only a Twitter username of the user of interest is required, and that is public information. As a result of a query, Tinfoleak provides a detailed report on the Twitter user. The report provides basic information (e.g. name, picture, location, followers) of the user and information on devices, operating systems, applications and social networks used by the Twitter user, place and geolocation coordinates of locations visited by the Twitter user, allowing to download all pictures from a Twitter user, showing also all hashtags, and topics used by the Twitter user (with date and time), and also who the Twitter user has mentioned in their

The list of build-in reconnaissance tools of Recon-ng is relatively long containing currently 75 recon-, 8 reporting-, 2 importing-, 2 exploitation, and 2 discovery modules (figure 5.).

A terminal window titled 'sanna@ubuntu: ~' with a menu bar (File, Edit, View, Search, Terminal, Help). The prompt is '[recon-ng][default] > show modules'. The output lists modules categorized into Discovery, Exploitation, Import, and Recon. The Recon category contains the most modules, including various tools for reconnaissance like whois_miner, mailtester, and geocode.

```
sanna@ubuntu: ~
File Edit View Search Terminal Help
[recon-ng][default] > show modules

Discovery
-----
discovery/info_disclosure/cache_snoop
discovery/info_disclosure/interesting_files

Exploitation
-----
exploitation/injection/command_injector
exploitation/injection/xpath_bruter

Import
-----
import/csv_file
import/list

Recon
-----
recon/companies-multi/whois_miner
recon/contacts-contacts/mailtester
recon/contacts-contacts/mangle
recon/contacts-contacts/unmangle
recon/contacts-credentials/hibp_breach
recon/contacts-credentials/hibp_paste
recon/contacts-domains/migrate_contacts
recon/credentials-credentials/adobe
recon/credentials-credentials/bozocrack
recon/domains-contacts/metacrawler
recon/domains-contacts/pgp_search
recon/domains-contacts/whois_pocs
recon/domains-credentials/pwnedlist/leak_lookup
recon/domains-domains/brute_suffix
recon/domains-hosts/bing_domain_web
recon/domains-hosts/brute_hosts
recon/domains-hosts/certificate_transparency
recon/domains-hosts/google_site_web
recon/domains-hosts/hackertarget
recon/domains-hosts/mx_spf_ip
recon/domains-hosts/netcraft
recon/domains-hosts/ssl_san
recon/domains-hosts/threatcrowd
recon/domains-vulnerabilities/ghdb
recon/domains-vulnerabilities/punkspider
recon/domains-vulnerabilities/xssed
recon/domains-vulnerabilities/xssposed
recon/hosts-domains/migrate_hosts
recon/hosts-hosts/freegeoip
recon/hosts-hosts/resolve
recon/hosts-hosts/reverse_resolve
recon/hosts-hosts/sslttools
recon/hosts-locations/migrate_hosts
recon/locations-locations/geocode
recon/locations-locations/reverse_geocode
recon/locations-pushpins/picasa
recon/netblocks-companies/whois_orgs
recon/netblocks-hosts/reverse_resolve
recon/netblocks-ports/census_2012
recon/ports-hosts/migrate_ports
recon/profiles-contacts/dev_diver
recon/profiles-profiles/namechk
recon/profiles-profiles/profiler
recon/repositories-vulnerabilities/gists_search
```

```
Reporting
-----
reporting/csv
reporting/html
reporting/json
reporting/list
reporting/proxifier
reporting/pushpin
reporting/xlsx
reporting/xml

[recon-ng][default] > █
```

FIGURE 5. Available modules in Recon-ng

It should be noted that Recon-ng is an open-source project. Due to its programming language, Python, and modular structure with independent modules, it has been made easy for developers to contribute to the project, yet the original developer Tim Tomes still maintains the framework. (18)

If one would like to perform any advanced reconnaissance with Recon-ng, the API keys would be required for the tool. The API keys would allow listing all server-side technologies, discover vulnerabilities and implemented technologies with configurations, identify weaknesses in physical security, and search for credentials. (17)

3.3 Maltego CE

From the two already introduced OSINT solutions, Maltego is the most powerful tool providing also visual graphs of the findings and a link analysis between the found records. The version of Maltego used in this thesis is Maltego CE. Maltego CE is the community version of Maltego which is available for free after an online registration. There are three versions of the Maltego available; Maltego CE, Maltego Classic and Maltego XL, from which the Maltego CE is the limited version from the other two commercial versions. The limitations apply to a maximum number of findings displayed per inquiry and to restrictions of graph export capabilities. Maltego is developed by a South-African company called Paterva in 2008 and they claim to have 500,000 registered community users and commercial clients from various industries; from law enforcement and intelligence agencies to finance and banking. (20)

The strength and beauty of Maltego CE comes from its capability to identify real-world relationships between the records it finds from various publicly available data sources in the Internet. Maltego CE visually displays the findings for the user allowing an easy interpretation of the results making the patterns obvious. Maltego can query the Internet infrastructure (e.g. domains, DNS names, netblocks, IP addresses), search information about people (e.g. names, email addresses, aliases) and organizations. Maltego inquires these information sources through whois records, search engines, social networks, online APIs and from metadata. (20)

Maltego is an application which one must install locally. It uses Java and hence runs on Windows, Mac, and Linux. Maltego CE also comes readily with Kali Linux. Maltego comes with multiple different data partners in the solutions that can be used to extend the data search capability (20). The user interface of Maltego is clear, intuitive and easy to use (figure 6.).

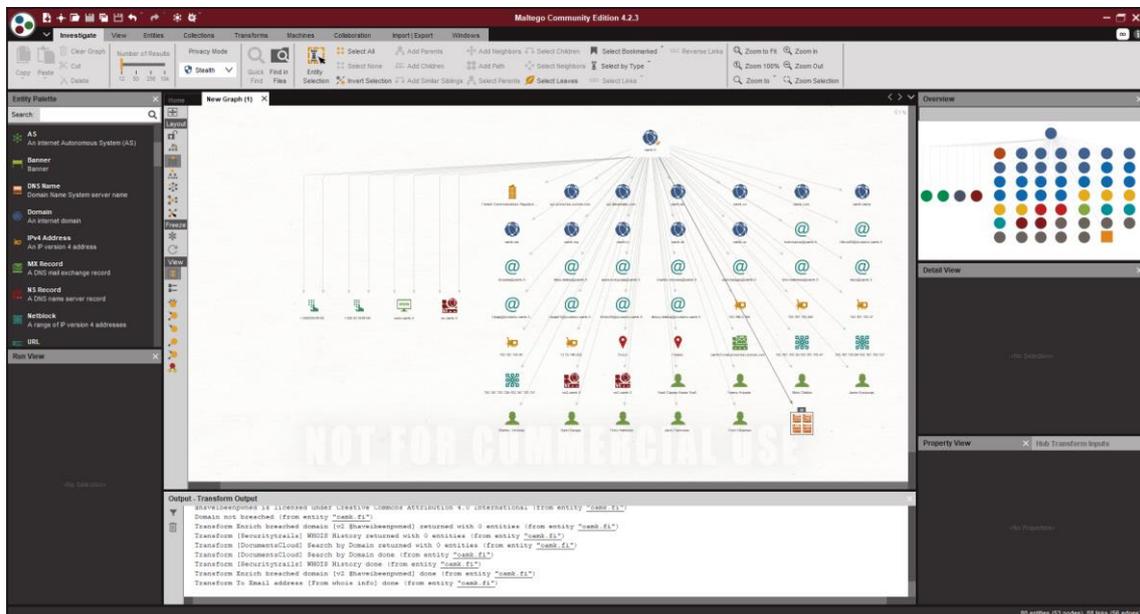


FIGURE 6. The Maltego CE user interface

3.4 Demonstration of the tools

The demonstration of the selected OSINT tools in this thesis was conducted using Oamk.fi as an example case. The idea is to show what basic data can be collected with OSINT tools of the subject of interest and how the data is collected. The focus in this chapter is on showing how the tools are operated and how the findings are displayed, rather than actively seeking and revealing any vulnerabilities from Oamk.fi.

Oamk.fi acts as a starting point for the demonstration. It is the only data that is needed for the tools to move forward with investigations. The demonstrations in this chapter start from Tinfoleak, moving onwards to the use of Recon-ng, and finalizing with Maltego CE demonstration.

3.4.1 Tinfoleak.com

As Tinfoleak provides information on Twitter users, the first task is to find Oamk's Twitter user account name. This task can easily be done utilizing any search engine and finding the link to Oamk's Twitter account (figure 7.). The username of any Twitter account is available, for instance, in the URL/web address of the Twitter account.

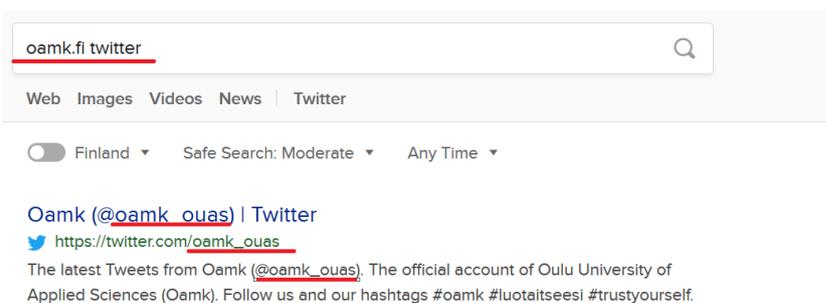


FIGURE 7. Using a search engine to find Oamk's official Twitter account name

The next step is to go to Tinfoleak.com and perform a query based on the found Oamk Twitter user name; *oamk_ouas*. It is mandatory to provide an email address for Tinfoleak to receive a link to the outcome of the query (figure 8.).

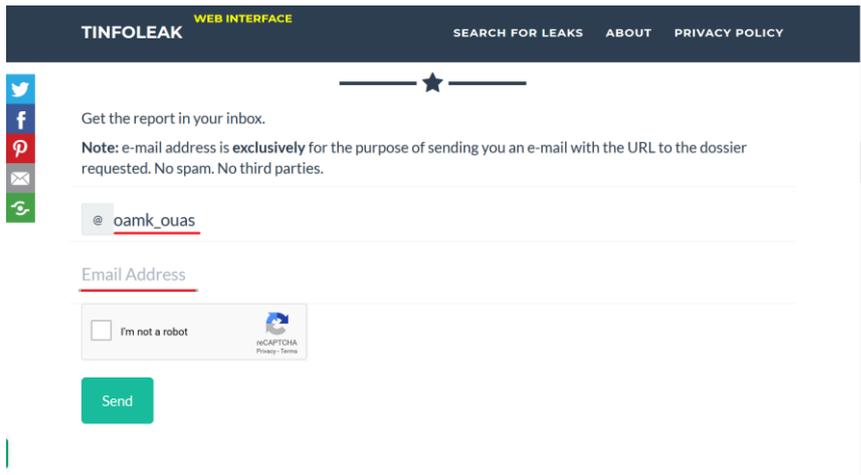


FIGURE 8. Requesting the report on oamk_ouas Twitter account from Tinfoleak.com

The length of the Tinfoleak.com report varies per user depending on their activity within Twitter. In case of oamk_ouas, the length of the report is approximately 27 pages (A4 size) (APPENDIX 1.). The following paragraphs show screenshots of the report to keep the length of this chapter reasonable.

The report on the Twitter user that Tinfoleak.com provides is rather an extensive one. The report lists the basic information (e.g. Twitter ID, creation date, location, language) together with client applications that are used for the Tweets, and social networks that the Twitter account is connected to (figure 9.).

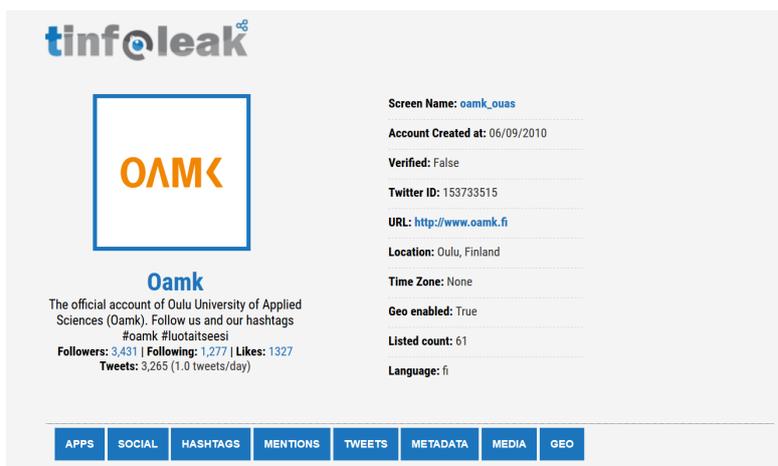


FIGURE 9. Basic information of oamk_ouas Twitter account provided by Tinfoleak

The report lists hashtags which have been used in the Tweets (with date, time, likes, and further details), hashtag details containing statistics per each hashtag that has been used, a list of users that have been mentioned in the in the Tweets, and details on the user mentions, including the top user mentions in the tweets. The Tinfoleak report also provides user images and videos, not forgetting geo-location information of the tweets if geo-location of the user is enabled. It will also provide top locations for the tweets if available.

Based on the report, one can learn from *oamk_ouas*'s user equipment and interfaces used for Tweets. The tweets are done with iPhone, Twitter Web Client, TweetDeck or Twitter Web App (figure 10.). It is also visible in the report that tweets have been done from Oulu, Finland, and Stavanger, Norway.

CLIENT APPLICATIONS						
Source	Uses	Percentage	First Use	First Tweet	Last Use	Last Tweet
Twitter for iPhone	46	11.5 %	07/06/2018	view	05/02/2019	view
Twitter Web Client	324	81.0 %	06/08/2018	view	04/30/2019	view
TweetDeck	28	7.0 %	06/14/2018	view	03/20/2019	view
Twitter Web App	2	0.5 %	02/06/2019	view	02/08/2019	view

FIGURE 10. Client applications used by aomk_ouas for tweeting

It is also interesting to see who Twitter user mentions in their Tweets. In case of *oamk_ouas*, there are 150 users mentioned in the tweets altogether (figure 11.). Now, one can imagine that in case of looking at individual person's profile, this report certainly allows to start understanding the social networks of the Twitter users.

Total: 150 results.

USER MENTION DETAIL

Date (since)	Date (until)	RT's	Likes	Count	Name	Mention
09/19/2018	05/02/2019	43	80	6	Sinä osaat!	@TeknologiaTytot
05/02/2019	05/02/2019	3	2	1	Biotalous erikoistumiskoulutus	@BiotalousERKO
03/19/2019	05/02/2019	8	12	2	JAMK	@JAMK_fi
03/19/2019	05/02/2019	8	12	2	SeAMK	@SeAMK
08/21/2018	05/02/2019	78	261	35	Oamk	@oamk_ouas
05/02/2019	05/02/2019	3	2	1	Lapin AMK Biotalous	@LapinAMKbio
04/30/2019	04/30/2019	10	12	1	Ammattikorkeakouluun	@Ammattikorkeaan
08/24/2018	04/24/2019	6	14	2	Päivi Laajala	@PaiviLaajala
04/24/2019	04/24/2019	2	6	1	Pohjois-Pohjanmaan liitto	@ppliitto
06/25/2018	04/24/2019	45	128	16	University of Oulu	@UniOulu
09/03/2018	04/24/2019	13	44	7	Oamk Amok	@OamkAmok
10/08/2018	04/24/2019	2	9	2	UAS Journal	@UASJournal
04/17/2019	04/17/2019	3	10	1	Johanna Jalas	@j_johanna_29
10/02/2018	04/17/2019	9	47	7	Oamk_raksa	@OamkRaksa
08/21/2018	04/17/2019	24	85	12	Oamk_energyautomatio	@Oamkenergyautom
08/31/2018	04/12/2019	58	200	10	Arene	@Arene_ry
11/05/2018	04/11/2019	4	15	2	Osuuskauppa Arina	@Osuuskauppani
04/09/2019	04/09/2019	2	6	1	Hirsitaloteollisuus ry	@Hirsikoti
10/05/2018	04/09/2019	6	60	4	Kati Mäenpää	@Kamielisa
04/04/2019	04/04/2019	4	7	1	Erja Sormunen	@ErjaSormunen
04/04/2019	04/04/2019	2	1	1	Anne Rännäli	@AnneRannali
03/28/2019	03/28/2019	4	11	1	Talotekniikka	@tateteollisuus
03/28/2019	03/28/2019	4	11	1	OAMK	@OAMK
10/03/2018	03/28/2019	4	25	3	Jouni Käriäinen	@jokaaria

FIGURE 11. A partial screenshot of the list that users of oamk_ouas have been mentioning in their tweets

As such, Tinfoleak.com provides a comprehensive collection and overview on a single user's activity and entries in Twitter surprisingly easily.

3.4.2 Recon-ng

Recon-ng is used in this demonstration with its basic setup, meaning that after installation no additional features or API keys are installed to the tool. The installation process, environment, and set-up of the Recon-ng used in this thesis are described in the APPENDIX 2.

The first step with Recon-ng before commencing data searches is to create a workspace where the findings are collected. This can be done with the following steps in terminal:

Adding a workspace

```
[recon-ng][default] > workspace add oamk.fi
```

Checking the workspace in the list (figure 12.):

```
[recon-ng][default] > workspaces list
```

```
[recon-ng][default] > workspaces list
+-----+
| Workspaces |
+-----+
| oamk.fi    |
| default    |
+-----+
[recon-ng][default] >
```

FIGURE 12. The created oamk.fi workspace in Recon-ng

To start using the oamk.fi workspace, the following commands are used, followed by commands to add oamk.fi as a domain of interest for that workspace (figure 13.):

```
[recon-ng][default] > workspaces select oamk.fi
```

```
[recon-ng][oamk.fi] >
[recon-ng][oamk.fi] >
[recon-ng][oamk.fi] > add domains
domain (TEXT): oamk.fi
[recon-ng][oamk.fi] > show domains
+-----+
| rowid | domain | module |
+-----+
| 1     | oamk.fi | user_defined |
+-----+
[*] 1 rows returned
[recon-ng][oamk.fi] >
```

FIGURE 13. Adding domains to the oamk.fi workspace in Recon-ng

As highlighted in the Recon-ng introduction in the previous chapters, the tool contains multiple different modules (=search tools) to perform data searches. To demonstrate the use of each module is beyond the scope of this thesis and that said, this demonstration focuses on showing the functioning and results of the following modules, to show examples of the use of Recon-ng:

- recon/domains-contacts/whois_pocs
- recon/domains-hosts/bing_domain_web
- recon/domains-hosts/brute_hosts

- recon/domains-hosts/google_site_web
- recon/hosts-hosts/resolve
- recon/hosts-hosts/reverse_resolve
- discovery/info_disclosure/interesting_files

RECON/DOMAINS-CONTACTS/WHOIS_POCS

Checking contact info per domain using whois_pocs. Whois_pocs uses the ARIN Whois RWS to harvest POC data from whois queries for the given domain. This updates the recon-ng 'contacts' table with the results. Running Whois_pocs to search Oamk.fi does not find any contacts (figure 14.), thus moving on to the next query.

```
[*] 1 rows returned
[recon-ng][oamk.fi] > use whois_pocs
[recon-ng][oamk.fi][whois_pocs] > show info

    Name: Whois POC Harvester
    Path: modules/recon/domains-contacts/whois_pocs.py
    Author: Tim Tomes (@LaNMaSteR53)

Description:
  Uses the ARIN Whois RWS to harvest POC data from whois queries for the given domain. Updates the
  'contacts' table with the results.

Options:
  Name      Current Value  Required  Description
  -----
SOURCE     default        yes       source of input (see 'show info' for details)

Source Options:
  default   SELECT DISTINCT domain FROM domains WHERE domain IS NOT NULL
  <string>  string representing a single input
  <path>    path to a file containing a list of inputs
  query <sql> database query returning one column of inputs

[recon-ng][oamk.fi][whois_pocs] > run

-----
OAMK.FI
-----
[*] URL: http://whois.arin.net/rest/pocs;domain=oamk.fi
[*] No contacts found.
[recon-ng][oamk.fi][whois_pocs] > █
```

FIGURE 14. Running Whois_pocs to search Oamk.fi

RECON/DOMAINS-HOSTS/BING_DOMAIN_WEB

Using bing_domain_web to harvest hosts from Bing.com by using the 'site' search operator. This updates the Recon-ng 'hosts' table with the results. Recon-ng finds 31 new hosts from oamk.fi as a result (figure 15.).

```
[recon-ng][oamk.fi] > use bing_domain_web
[recon-ng][oamk.fi][bing_domain_web] > show info

Name: Bing Hostname Enumerator
Path: modules/recon/domains-hosts/bing_domain_web.py
Author: Tim Tomes (@LaNMaSteR53)

Description:
Harvests hosts from Bing.com by using the 'site' search operator. Updates the 'hosts' table with the
results.

Options:
Name      Current Value  Required  Description
-----
SOURCE    default        yes       source of input (see 'show info' for details)

Source Options:
default   SELECT DISTINCT domain FROM domains WHERE domain IS NOT NULL
<string> string representing a single input
<path>   path to a file containing a list of inputs
query <sql> database query returning one column of inputs

[recon-ng][oamk.fi][bing_domain_web] > run
-----
```

[The list not pasted here due its length]

```
-----
SUMMARY
-----
[*] 31 total (31 new) hosts found.
[recon-ng][oamk.fi][bing_domain_web] > |
```

```
[recon-ng][oamk.fi][bing_domain_web] > show hosts
+-----+-----+-----+-----+-----+-----+-----+-----+
| rowid | host | ip_address | region | country | latitude | longitude | module |
+-----+-----+-----+-----+-----+-----+-----+-----+
| 1 | cord.oamk.fi | | | | | | bing_domain_web |
| 2 | www.students.oamk.fi | | | | | | bing_domain_web |
| 3 | www.oamk.fi | | | | | | bing_domain_web |
| 4 | koulutushaku.oamk.fi | | | | | | bing_domain_web |
| 5 | vilho.oamk.fi | | | | | | bing_domain_web |
| 6 | media.oamk.fi | | | | | | bing_domain_web |
| 7 | oiva.oamk.fi | | | | | | bing_domain_web |
| 8 | it.oamk.fi | | | | | | bing_domain_web |
| 9 | moodle.oamk.fi | | | | | | bing_domain_web |
| 10 | www.teknikka.oamk.fi | | | | | | bing_domain_web |
| 11 | blogi.oamk.fi | | | | | | bing_domain_web |
| 12 | u.oamk.fi | | | | | | bing_domain_web |
| 13 | idp.oamk.fi | | | | | | bing_domain_web |
| 14 | wwwnew.oamk.fi | | | | | | bing_domain_web |
| 15 | lukkarit.oamk.fi | | | | | | bing_domain_web |
| 16 | blogit.oamk.fi | | | | | | bing_domain_web |
| 17 | copack.oamk.fi | | | | | | bing_domain_web |
| 18 | ep.oamk.fi | | | | | | bing_domain_web |
| 19 | cave.oamk.fi | | | | | | bing_domain_web |
| 20 | pr.oamk.fi | | | | | | bing_domain_web |
| 21 | lehtiarkisto.talentum.com.ezp.oamk.fi | | | | | | bing_domain_web |
| 22 | tool.oamk.fi | | | | | | bing_domain_web |
| 23 | ezp.oamk.fi | | | | | | bing_domain_web |
| 24 | eve.oamk.fi | | | | | | bing_domain_web |
| 25 | kirjasto.oamk.fi | | | | | | bing_domain_web |
| 26 | moko.oamk.fi | | | | | | bing_domain_web |
| 27 | login.ezp.oamk.fi | | | | | | bing_domain_web |
| 28 | radio.oamk.fi | | | | | | bing_domain_web |
| 29 | tl.oamk.fi | | | | | | bing_domain_web |
| 30 | libguides.oamk.fi | | | | | | bing_domain_web |
| 31 | amok- uutiskirje.oamk.fi | | | | | | bing_domain_web |
+-----+-----+-----+-----+-----+-----+-----+-----+
```

FIGURE 15. Results of searching oamk.fi with bing_domain_web

RECON/DOMAINS-HOSTS/BRUTE_HOSTS

Brute_hosts can be used to force host names using DNS. This updates the Recon-ng 'hosts' table with the results. As a result, it finds 52 new hosts, the

overall result now totalling to 83 hosts found proving some host and IP addresses information on oamk.fi (figure 16.).

```
[recon-ng][oamk.fi][brute_hosts] > show info
Name: DNS Hostname Brute Forcer
Path: modules/recon/domains-hosts/brute_hosts.py
Author: Tim Tomes (@LaNMaSteR53)

Description:
Brute forces host names using DNS. Updates the 'hosts' table with the results.

Options:
Name          Current Value          Required  Description
-----
SOURCE        default                yes       source of input (see 'show info' for details)
WORDLIST      /usr/share/recon-ng/data/hostnames.txt yes       path to hostname wordlist

Source Options:
default      SELECT DISTINCT domain FROM domains WHERE domain IS NOT NULL
<string>    string representing a single input
<path>     path to a file containing a list of inputs
query <sql> database query returning one column of inputs

[recon-ng][oamk.fi][brute_hosts] >
-----
SUMMARY
-----
[*] 64 total (52 new) hosts found.
[recon-ng][oamk.fi][brute_hosts] >
-----
recon-ng][oamk.fi][brute_hosts] > show hosts
-----
| rowid | host | ip_address | region | country | latitude | longitude | module | |
|---|---|---|---|---|---|---|---|---|
| 1 | cord.oamk.fi | | | | | | |bing_domain_web|
| 2 | www.students.oamk.fi | | | | | | |bing_domain_web|
| 3 | www.oamk.fi | | | | | | |bing_domain_web|
| 4 | koulutushaku.oamk.fi | | | | | | |bing_domain_web|
| 5 | vilho.oamk.fi | | | | | | |bing_domain_web|
| 6 | media.oamk.fi | | | | | | |bing_domain_web|
| 7 | olva.oamk.fi | | | | | | |bing_domain_web|
| 8 | it.oamk.fi | | | | | | |bing_domain_web|
| 9 | moodle.oamk.fi | | | | | | |bing_domain_web|
| 10 | www.teknikka.oamk.fi | | | | | | |bing_domain_web|
| 11 | blogi.oamk.fi | | | | | | |bing_domain_web|
| 12 | u.oamk.fi | | | | | | |bing_domain_web|
| 13 | idp.oamk.fi | | | | | | |bing_domain_web|
| 14 | wwwnew.oamk.fi | | | | | | |bing_domain_web|
| 15 | lukkarit.oamk.fi | | | | | | |bing_domain_web|
| 16 | blogit.oamk.fi | | | | | | |bing_domain_web|
| 17 | copack.oamk.fi | | | | | | |bing_domain_web|
| 18 | ep.oamk.fi | | | | | | |bing_domain_web|
| 19 | cave.oamk.fi | | | | | | |bing_domain_web|
| 20 | pr.oamk.fi | | | | | | |bing_domain_web|
| 21 | lehtiarkisto.talentum.com.ezp.oamk.fi | | | | | | |bing_domain_web|
| 22 | tool.oamk.fi | | | | | | |bing_domain_web|
| 23 | ezp.oamk.fi | | | | | | |bing_domain_web|
| 24 | eve.oamk.fi | | | | | | |bing_domain_web|
| 25 | kirjasto.oamk.fi | | | | | | |bing_domain_web|
| 26 | moko.oamk.fi | | | | | | |bing_domain_web|
| 27 | login.ezp.oamk.fi | | | | | | |bing_domain_web|
| 28 | radio.oamk.fi | | | | | | |bing_domain_web|
| 29 | tl.oamk.fi | | | | | | |bing_domain_web|
| 30 | libguides.oamk.fi | | | | | | |bing_domain_web|
| 31 | amok-uutiskirje.oamk.fi | | | | | | |bing_domain_web|
| 32 | autodiscover.outlook.com | | | | | | |brute_hosts|
| 33 | autodiscover.oamk.fi | | | | | | |brute_hosts|
| 34 | auth.oamk.fi | 193.167.100.67 | | | | |brute_hosts|
| 35 | autod.ha.office365.com | | | | | | |brute_hosts|
| 36 | autod.ms-acdc.office.com | | | | | | |brute_hosts|
| 37 | autodiscover.oamk.fi | 40.101.50.168 | | | | |brute_hosts|
| 38 | autodiscover.oamk.fi | 40.101.31.136 | | | | |brute_hosts|
| 39 | autodiscover.oamk.fi | 40.101.49.104 | | | | |brute_hosts|
| 40 | autodiscover.oamk.fi | 40.101.127.104 | | | | |brute_hosts|
| 41 | cc.oamk.fi | | | | | | |brute_hosts|
| 42 | cc.oamk.fi | 193.167.100.88 | | | | |brute_hosts|
| 43 | cm.oamk.fi | 195.148.0.129 | | | | |brute_hosts|
| 44 | crm.oamk.fi | 83.241.201.234 | | | | |brute_hosts|
| 45 | forums.oamk.fi | 193.167.100.244 | | | | |brute_hosts|
| 46 | irc.oamk.fi | 130.231.242.254 | | | | |brute_hosts|
| 47 | ircd.oamk.fi | | | | | | |brute_hosts|
| 48 | ircd.oamk.fi | 130.231.242.254 | | | | |brute_hosts|
| 49 | it.oamk.fi | 193.167.100.80 | | | | |brute_hosts|
| 50 | ldap.oamk.fi | 193.167.100.70 | | | | |brute_hosts|
| 51 | loghost.oamk.fi | 193.167.100.42 | | | | |brute_hosts|
| 52 | mailhost.oamk.fi | 193.167.100.68 | | | | |brute_hosts|
| 53 | media.oamk.fi | 193.167.100.167 | | | | |brute_hosts|
| 54 | micky.oamk.fi | 193.167.100.51 | | | | |brute_hosts|
| 55 | ms.oamk.fi | 193.167.100.98 | | | | |brute_hosts|
```

56	multimedia.oamk.fi				brute_hosts
57	multimedia.oamk.fi	193.167.100.88			brute_hosts
58	ns.oamk.fi	193.167.100.37			brute_hosts
59	ns2.oamk.fi	193.167.100.40			brute_hosts
60	ns3.oamk.fi	13.79.146.252			brute_hosts
61	time.oamk.fi				brute_hosts
62	ntp.oamk.fi				brute_hosts
63	ntp.oamk.fi	193.167.100.42			brute_hosts
64	pa.oamk.fi	193.167.100.3			brute_hosts
65	p.oamk.fi				brute_hosts
66	p.oamk.fi	193.167.100.168			brute_hosts
67	pr.oamk.fi	193.167.100.168			brute_hosts
68	radio.oamk.fi	193.167.100.167			brute_hosts
69	relay.oamk.fi	193.167.100.68			brute_hosts
70	sec.oamk.fi	193.167.100.72			brute_hosts
71	prot.oamk.fi				brute_hosts
72	security.oamk.fi				brute_hosts
73	security.oamk.fi	193.167.100.52			brute_hosts
74	smtp.oamk.fi	193.167.100.68			brute_hosts
75	staff.oamk.fi	193.167.100.101			brute_hosts
76	storage.oamk.fi	172.20.2.18			brute_hosts
77	time.oamk.fi	193.167.100.42			brute_hosts
77	time.oamk.fi	193.167.100.42			brute_hosts
78	titan.oamk.fi	193.167.100.33			brute_hosts
79	tool.oamk.fi	193.167.100.88			brute_hosts
80	u.oamk.fi	193.167.100.88			brute_hosts
81	vpn.oamk.fi	193.167.100.114			brute_hosts
82	webmatl.oamk.fi	193.167.100.135			brute_hosts
83	www.oamk.fi	193.167.100.88			brute_hosts

FIGURE 16. Results of searching oamk.fi with brute_force module

RECON/DOMAINS-HOSTS/GOOGLE_SITE_WEB

Google_site_web allows checking more Hosts using Google.com by using the 'site' search operator. It updates the Recon-ng 'hosts' table with the results. Google_site_web finds 21 results among them 3 new hosts that previous queries missed (figure 17.).

```
[recon-ng][oamk.fi][google_site_web] > run
-----
OAMK.FI
-----
[*] Searching Google for: site:oamk.fi
[*] [host] koulutushaku.oamk.fi (<blank>)
[*] [host] noodle.oamk.fi (<blank>)
[*] [host] blogl.oamk.fi (<blank>)
[*] [host] lukkarit.oamk.fi (<blank>)
[*] [host] radio.oamk.fi (<blank>)
[*] [host] oiva.oamk.fi (<blank>)
[*] [host] www.teknikka.oamk.fi (<blank>)
[*] [host] it.oamk.fi (<blank>)
[*] [host] libguides.oamk.fi (<blank>)
[*] [host] www.oamk.fi (<blank>)
[*] [host] pianokilpailu.oamk.fi (<blank>)
[*] Searching Google for: site:oamk.fi -site:koulutushaku.oamk.fi -site:noodle.oamk.fi -site:blogl.oamk.fi -site:lukkarit.oamk.fi -site:radio.oamk.fi -site:oiva.oamk.fi -site:www.teknikka.oamk.fi -site:it.oamk.fi -site:libguides.oamk.fi -site:www.oamk.fi -site:pianokilpailu.oamk.fi
[*] [host] aleksi.btj.fi.ezp.oamk.fi (<blank>)
[*] [host] ep.oamk.fi (<blank>)
[*] [host] idp.oamk.fi (<blank>)
[*] [host] www.students.oamk.fi (<blank>)
[*] [host] copack.oamk.fi (<blank>)
[*] [host] blogit.oamk.fi (<blank>)
[*] [host] www.otek.oamk.fi (<blank>)
[*] Searching Google for: site:oamk.fi -site:koulutushaku.oamk.fi -site:noodle.oamk.fi -site:blogl.oamk.fi -site:lukkarit.oamk.fi -site:radio.oamk.fi -site:oiva.oamk.fi -site:www.teknikka.oamk.fi -site:it.oamk.fi -site:libguides.oamk.fi -site:www.oamk.fi -site:pianokilpailu.oamk.fi -site:aleksi.btj.fi.ezp.oamk.fi -site:ep.oamk.fi -site:idp.oamk.fi -site:www.student
s.oamk.fi -site:copack.oamk.fi -site:blogit.oamk.fi -site:www.otek.oamk.fi -site:cave.oamk.fi -site:login.ezp.oamk.fi -site:pr.oamk.fi
[*] [host] cave.oamk.fi (<blank>)
[*] [host] login.ezp.oamk.fi (<blank>)
[*] [host] pr.oamk.fi (<blank>)
[*] Searching Google for: site:oamk.fi -site:koulutushaku.oamk.fi -site:noodle.oamk.fi -site:blogl.oamk.fi -site:lukkarit.oamk.fi -site:radio.oamk.fi -site:oiva.oamk.fi -site:www.teknikka.oamk.fi -site:it.oamk.fi -site:libguides.oamk.fi -site:www.oamk.fi -site:pianokilpailu.oamk.fi -site:aleksi.btj.fi.ezp.oamk.fi -site:ep.oamk.fi -site:idp.oamk.fi -site:www.student
s.oamk.fi -site:copack.oamk.fi -site:blogit.oamk.fi -site:www.otek.oamk.fi -site:cave.oamk.fi -site:login.ezp.oamk.fi -site:pr.oamk.fi
[*] No New Subdomains Found on the Current Page. Jumping to Result 201.
[*] Searching Google for: site:oamk.fi -site:koulutushaku.oamk.fi -site:noodle.oamk.fi -site:blogl.oamk.fi -site:lukkarit.oamk.fi -site:radio.oamk.fi -site:oiva.oamk.fi -site:www.teknikka.oamk.fi -site:it.oamk.fi -site:libguides.oamk.fi -site:www.oamk.fi -site:pianokilpailu.oamk.fi -site:aleksi.btj.fi.ezp.oamk.fi -site:ep.oamk.fi -site:idp.oamk.fi -site:www.student
s.oamk.fi -site:copack.oamk.fi -site:blogit.oamk.fi -site:www.otek.oamk.fi -site:cave.oamk.fi -site:login.ezp.oamk.fi -site:pr.oamk.fi
-----
SUMMARY
-----
[*] 21 total (3 new) hosts found.
[recon-ng][oamk.fi][google_site_web] >
[recon-ng][oamk.fi][google_site_web] >
```

FIGURE 17. Results of searching oamk.fi with google_site_web module

RECON/HOSTS-HOSTS/RESOLVE AND REVERSE_RESOLVE

Recon/hosts-hosts/resolve finds IP addresses for hosts and updates the Recon/hosts table with the results. Running the Recon/hosts-hosts/resolve with the oamk.fi domain results in 101 hosts / domains with IP information (figure 18.).

```
recon-ng[oamk.fi][resolve] > show hosts
```

rowid	host	ip_address	region	country	latitude	longitude	module
1	cord.oamk.fi	193.167.100.88					bing_domain_web
2	www.students.oamk.fi	193.167.100.74					bing_domain_web
3	www.oamk.fi	193.167.100.88					bing_domain_web
4	koulutushaku.oamk.fi	193.167.100.205					bing_domain_web
5	vilho.oamk.fi	193.167.100.169					bing_domain_web
6	media.oamk.fi	193.167.100.167					bing_domain_web
7	oiva.oamk.fi	193.167.100.81					bing_domain_web
8	it.oamk.fi	193.167.100.80					bing_domain_web
9	moodle.oamk.fi	3.120.120.108					bing_domain_web
10	www.teknikka.oamk.fi	193.167.100.88					bing_domain_web
11	blogi.oamk.fi	193.167.100.76					bing_domain_web
12	u.oamk.fi	193.167.100.88					bing_domain_web
13	idp.oamk.fi	193.167.100.182					bing_domain_web
14	wwwnew.oamk.fi	193.167.100.88					bing_domain_web
15	lukkarit.oamk.fi	193.167.100.205					bing_domain_web
16	blogit.oamk.fi	193.167.100.76					bing_domain_web
17	copack.oamk.fi	193.167.100.88					bing_domain_web
18	ep.oamk.fi	193.167.100.73					bing_domain_web
19	cave.oamk.fi	193.167.100.88					bing_domain_web
20	pr.oamk.fi	193.167.100.168					bing_domain_web
21	lehtiarkisto.talentum.com.ezp.oamk.fi	193.167.100.88					bing_domain_web
22	tool.oamk.fi	193.167.100.88					bing_domain_web
23	ezp.oamk.fi	193.167.100.88					bing_domain_web
24	eve.oamk.fi	193.167.100.88					bing_domain_web
25	kirjasto.oamk.fi	193.167.100.88					bing_domain_web
26	moko.oamk.fi	193.167.100.167					bing_domain_web
27	login.ezp.oamk.fi	193.167.100.88					bing_domain_web
28	radio.oamk.fi	193.167.100.167					bing_domain_web
29	tl.oamk.fi	193.167.100.245					bing_domain_web
30	libguides.oamk.fi	34.246.144.218					bing_domain_web
31	amok-uitiskirje.oamk.fi	188.117.16.111					bing_domain_web
32	autodiscover.outlook.com	40.101.84.24					brute_hosts
33	autodiscover.oamk.fi	40.101.50.200					brute_hosts
34	auth.oamk.fi	193.167.100.67					brute_hosts
35	autod.ha.office365.com	40.101.65.232					brute_hosts
36	autod.ms-acdc.office.com	40.101.84.24					brute_hosts
37	autodiscover.oamk.fi	40.101.50.200					brute_hosts
38	autodiscover.oamk.fi	40.101.50.200					brute_hosts
39	autodiscover.oamk.fi	40.101.50.200					brute_hosts
40	autodiscover.oamk.fi	40.101.50.200					brute_hosts
41	cc.oamk.fi	193.167.100.88					brute_hosts
42	cc.oamk.fi	193.167.100.88					brute_hosts
43	cn.oamk.fi	195.148.0.129					brute_hosts
44	crm.oamk.fi	83.241.201.234					brute_hosts
45	forums.oamk.fi	193.167.100.244					brute_hosts
46	irc.oamk.fi	130.231.242.254					brute_hosts
47	ircd.oamk.fi	130.231.242.254					brute_hosts
48	ircd.oamk.fi	130.231.242.254					brute_hosts
49	it.oamk.fi	193.167.100.80					brute_hosts
50	ldap.oamk.fi	193.167.100.70					brute_hosts
51	loghost.oamk.fi	193.167.100.42					brute_hosts
52	mailhost.oamk.fi	193.167.100.68					brute_hosts
53	media.oamk.fi	193.167.100.167					brute_hosts
54	mickey.oamk.fi	193.167.100.51					brute_hosts
55	ms.oamk.fi	193.167.100.98					brute_hosts
56	multimedia.oamk.fi	193.167.100.88					brute_hosts
57	multimedia.oamk.fi	193.167.100.88					brute_hosts
58	ns.oamk.fi	193.167.100.37					brute_hosts
59	ns2.oamk.fi	193.167.100.40					brute_hosts
60	ns3.oamk.fi	13.79.146.252					brute_hosts
61	time.oamk.fi	193.167.100.42					brute_hosts
62	ntp.oamk.fi	193.167.100.42					brute_hosts
63	ntp.oamk.fi	193.167.100.42					brute_hosts
64	pa.oamk.fi	193.167.100.3					brute_hosts
65	p.oamk.fi	193.167.100.168					brute_hosts
66	p.oamk.fi	193.167.100.168					brute_hosts
67	pr.oamk.fi	193.167.100.168					brute_hosts
68	radio.oamk.fi	193.167.100.167					brute_hosts
69	relay.oamk.fi	193.167.100.68					brute_hosts
70	sec.oamk.fi	193.167.100.72					brute_hosts
71	prot.oamk.fi	193.167.100.52					brute_hosts
72	security.oamk.fi	193.167.100.52					brute_hosts
73	security.oamk.fi	193.167.100.52					brute_hosts
74	sntp.oamk.fi	193.167.100.68					brute_hosts
75	staff.oamk.fi	193.167.100.101					brute_hosts

76	storage.oamk.fi	172.20.2.18				brute_hosts
77	time.oamk.fi	193.167.100.42				brute_hosts
78	titan.oamk.fi	193.167.100.33				brute_hosts
79	tool.oamk.fi	193.167.100.88				brute_hosts
80	u.oamk.fi	193.167.100.88				brute_hosts
81	vpn.oamk.fi	193.167.100.114				brute_hosts
82	webmail.oamk.fi	193.167.100.135				brute_hosts
83	www.oamk.fi	193.167.100.88				brute_hosts
84	pianokilpailu.oamk.fi	193.167.100.88				google_site_web
85	aleksi.btj.fi.ezp.oamk.fi	193.167.100.88				google_site_web
86	www.otek.oamk.fi	193.167.100.88				google_site_web
87	moodle.oamk.fi	54.93.80.195				resolve
88	libguides.oamk.fi	34.251.94.81				resolve
89	libguides.oamk.fi	52.48.240.72				resolve
90	autodiscover.outlook.com	40.101.50.200				resolve
91	autodiscover.outlook.com	40.101.50.184				resolve
92	autodiscover.outlook.com	40.101.65.232				resolve
93	autodiscover.oamk.fi	40.101.65.232				resolve
94	autodiscover.oamk.fi	40.101.50.184				resolve
95	autodiscover.oamk.fi	40.101.84.24				resolve
96	autod.ha.office365.com	40.101.84.24				resolve
97	autod.ha.office365.com	40.101.50.184				resolve
98	autod.ha.office365.com	40.101.50.200				resolve
99	autod.ms-acdc.office.com	40.101.65.232				resolve
100	autod.ms-acdc.office.com	40.101.50.200				resolve
101	autod.ms-acdc.office.com	40.101.50.184				resolve

FIGURE 18. Hosts updated with IP addresses by using Recon/hosts-hosts/resolve

Recon/hosts-hosts/reverse_resolve can be used to conduct a reverse IP addresses lookup for each IP address to resolve the host name. The query updates the Recon-ng 'hosts' table with the results. The reverse_resolve in this demonstration resolved 16 new host names.

The overall result after these five queries on oamk.fi hosts and IP addresses is 101 entities (figure 19.). To move forward to find, for instance, geolocation information for the collected hosts, some API keys would be required, thus the demonstration is finalized here. It is believed that this demonstration is adequate to show how to operate Recon-ng and complete some information gathering.

econ-ng][oamk.fi][reverse_resolve] > show hosts

rowid	host	ip_address	region	country	latitude	longitude	module
1	cord.oamk.fi	193.167.100.88					bing_domain_web
2	www.students.oamk.fi	193.167.100.74					bing_domain_web
3	www.oamk.fi	193.167.100.88					bing_domain_web
4	koulutushaku.oamk.fi	193.167.100.205					bing_domain_web
5	vilho.oamk.fi	193.167.100.169					bing_domain_web
6	media.oamk.fi	193.167.100.167					bing_domain_web
7	oiva.oamk.fi	193.167.100.81					bing_domain_web
8	it.oamk.fi	193.167.100.80					bing_domain_web
9	moodle.oamk.fi	3.120.120.108					bing_domain_web
10	www.tekniikka.oamk.fi	193.167.100.88					bing_domain_web
11	blogi.oamk.fi	193.167.100.76					bing_domain_web
12	u.oamk.fi	193.167.100.88					bing_domain_web
13	idp.oamk.fi	193.167.100.182					bing_domain_web
14	wwwnew.oamk.fi	193.167.100.88					bing_domain_web
15	lukkarit.oamk.fi	193.167.100.205					bing_domain_web
16	blogit.oamk.fi	193.167.100.76					bing_domain_web
17	copack.oamk.fi	193.167.100.88					bing_domain_web
18	ep.oamk.fi	193.167.100.73					bing_domain_web
19	cave.oamk.fi	193.167.100.88					bing_domain_web
20	pr.oamk.fi	193.167.100.168					bing_domain_web
21	lehtiarkisto.talentum.com.ezp.oamk.fi	193.167.100.88					bing_domain_web
22	tool.oamk.fi	193.167.100.88					bing_domain_web
23	ezp.oamk.fi	193.167.100.88					bing_domain_web
24	eve.oamk.fi	193.167.100.88					bing_domain_web
25	kirjasto.oamk.fi	193.167.100.88					bing_domain_web
26	moko.oamk.fi	193.167.100.167					bing_domain_web
27	login.ezp.oamk.fi	193.167.100.88					bing_domain_web
28	radio.oamk.fi	193.167.100.167					bing_domain_web
29	tl.oamk.fi	193.167.100.245					bing_domain_web
30	libguides.oamk.fi	34.246.144.218					bing_domain_web
31	amok-uitiskirje.oamk.fi	188.117.16.111					bing_domain_web
32	autodiscover.outlook.com	40.101.84.24					brute_hosts
33	autodiscover.oamk.fi	40.101.50.200					brute_hosts
34	auth.oamk.fi	193.167.100.67					brute_hosts
35	autod.ha.office365.com	40.101.65.232					brute_hosts
36	autod.ms-acdc.office.com	40.101.84.24					brute_hosts
37	autodiscover.oamk.fi	40.101.50.200					brute_hosts
38	autodiscover.oamk.fi	40.101.50.200					brute_hosts
39	autodiscover.oamk.fi	40.101.50.200					brute_hosts
40	autodiscover.oamk.fi	40.101.50.200					brute_hosts
41	cc.oamk.fi	193.167.100.88					brute_hosts
42	cc.oamk.fi	193.167.100.88					brute_hosts
43	cn.oamk.fi	195.148.0.129					brute_hosts
44	crn.oamk.fi	83.241.201.234					brute_hosts
45	forums.oamk.fi	193.167.100.244					brute_hosts
46	irc.oamk.fi	130.231.242.254					brute_hosts
47	ircd.oamk.fi	130.231.242.254					brute_hosts
48	ircd.oamk.fi	130.231.242.254					brute_hosts
49	it.oamk.fi	193.167.100.80					brute_hosts
50	ldap.oamk.fi	193.167.100.70					brute_hosts
51	loghost.oamk.fi	193.167.100.42					brute_hosts
52	mailhost.oamk.fi	193.167.100.68					brute_hosts
53	media.oamk.fi	193.167.100.167					brute_hosts
54	mickey.oamk.fi	193.167.100.51					brute_hosts
55	ms.oamk.fi	193.167.100.98					brute_hosts
56	multimedia.oamk.fi	193.167.100.88					brute_hosts
57	multimedia.oamk.fi	193.167.100.88					brute_hosts
58	ns.oamk.fi	193.167.100.37					brute_hosts
59	ns2.oamk.fi	193.167.100.40					brute_hosts
60	ns3.oamk.fi	13.79.146.252					brute_hosts
61	time.oamk.fi	193.167.100.42					brute_hosts
62	ntp.oamk.fi	193.167.100.42					brute_hosts
63	ntp.oamk.fi	193.167.100.42					brute_hosts
64	pa.oamk.fi	193.167.100.3					brute_hosts
65	p.oamk.fi	193.167.100.168					brute_hosts
66	p.oamk.fi	193.167.100.168					brute_hosts
67	pr.oamk.fi	193.167.100.168					brute_hosts
68	radio.oamk.fi	193.167.100.167					brute_hosts
69	relay.oamk.fi	193.167.100.68					brute_hosts
70	sec.oamk.fi	193.167.100.72					brute_hosts
71	prot.oamk.fi	193.167.100.52					brute_hosts
72	security.oamk.fi	193.167.100.52					brute_hosts
73	security.oamk.fi	193.167.100.52					brute_hosts
74	smtp.oamk.fi	193.167.100.68					brute_hosts
75	staff.oamk.fi	193.167.100.101					brute_hosts
76	storage.oamk.fi	172.20.2.18					brute_hosts
77	time.oamk.fi	193.167.100.42					brute_hosts
78	titan.oamk.fi	193.167.100.33					brute_hosts
79	tool.oamk.fi	193.167.100.88					brute_hosts
80	u.oamk.fi	193.167.100.88					brute_hosts
81	vpn.oamk.fi	193.167.100.114					brute_hosts
82	webmail.oamk.fi	193.167.100.135					brute_hosts
83	www.oamk.fi	193.167.100.88					brute_hosts
84	pianokilpailu.oamk.fi	193.167.100.88					google_site_web
85	aleksi.btj.fi.ezp.oamk.fi	193.167.100.88					google_site_web
86	www.otek.oamk.fi	193.167.100.88					google_site_web
87	moodle.oamk.fi	54.93.80.195					resolve
88	libguides.oamk.fi	34.251.94.81					resolve
89	libguides.oamk.fi	52.48.240.72					resolve
90	autodiscover.outlook.com	40.101.50.200					resolve
91	autodiscover.outlook.com	40.101.50.184					resolve
92	autodiscover.outlook.com	40.101.65.232					resolve
93	autodiscover.oamk.fi	40.101.65.232					resolve
94	autodiscover.oamk.fi	40.101.50.184					resolve
95	autodiscover.oamk.fi	40.101.84.24					resolve
96	autod.ha.office365.com	40.101.84.24					resolve
97	autod.ha.office365.com	40.101.50.184					resolve
98	autod.ha.office365.com	40.101.50.200					resolve
99	autod.ms-acdc.office.com	40.101.65.232					resolve
100	autod.ms-acdc.office.com	40.101.50.200					resolve
101	autod.ms-acdc.office.com	40.101.50.184					resolve
102	ec2-3-120-120-108.eu-central-1.compute.amazonaws.com	3.120.120.108					reverse_resolve
103	oralinux3.oamk.fi	193.167.100.73					reverse_resolve
104	mulkkeri.net	193.167.100.245					reverse_resolve

```

105 | ec2-34-246-144-218.eu-west-1.compute.amazonaws.com | 34.246.144.218 | | | | | reverse_resolve
106 | front.mailpv.net | 188.117.16.111 | | | | | reverse_resolve
107 | 234.201.241.83.in-addr.dgcsystems.net | 83.241.201.234 | | | | | reverse_resolve
108 | irc.oulu.fi | 130.231.242.254 | | | | | reverse_resolve
109 | noc.oamk.fi | 193.167.100.42 | | | | | reverse_resolve
110 | relay1.oamk.fi | 193.167.100.68 | | | | | reverse_resolve
111 | janus.oamk.fi | 193.167.100.98 | | | | | reverse_resolve
112 | titan.oamk.fi | 193.167.100.40 | | | | | reverse_resolve
113 | orainux1.oamk.fi | 193.167.100.33 | | | | | reverse_resolve
114 | cas.oamk.fi | 193.167.100.135 | | | | | reverse_resolve
115 | ec2-54-93-80-195.eu-central-1.compute.amazonaws.com | 54.93.80.195 | | | | | reverse_resolve
116 | ec2-34-251-94-81.eu-west-1.compute.amazonaws.com | 34.251.94.81 | | | | | reverse_resolve
117 | ec2-52-48-240-72.eu-west-1.compute.amazonaws.com | 52.48.240.72 | | | | | reverse_resolve
] 117 rows returned
recon-ng][oamk.fi][reverse_resolve] >

```

FIGURE 19. The complete table of 'host' records after conducting the last recon with Recon/hosts-hosts/resolve

DISCOVERY/INFO_DISCLOSURE/INTERESTING_FILES

To give one more example of Recon-ng, this demonstration also shows how to check any related interesting files. Module 'interesting_files' with Recon-ng checks hosts for interesting files in predictable locations. The files can be in a format of robots.txt, sitemap.xml, sitemap.xml.gz, crossdomain.xml, phpinfo.php, test.php, elmah.axd, server-status, jmx-console/, admin-console/, web-console/. As a result, Recon-ng finds 21 interesting files (figure 20.).

```

sanna@ubuntu:~/recon-ng/workspaces/oamk.fi$ ls -la
total 2944
drwxr-xr-x 2 root root 4096 May 5 06:08 .
drwxr-xr-x 4 root root 4096 May 4 22:20 ..
-rw-r--r-- 1 root root 400 May 5 00:41 config.dat
-rw-r--r-- 1 root root 73728 May 5 06:08 data.db
-rw-r--r-- 1 root root 26 May 4 23:05 http_amok-uutiskirje.oamk.fi_robots.txt
-rw-r--r-- 1 root root 67 May 4 23:04 http_blogi.oamk.fi_robots.txt
-rw-r--r-- 1 root root 106 May 4 23:04 http_cave.oamk.fi_robots.txt
-rw-r--r-- 1 root root 481 May 4 23:05 http_cc.oamk.fi_robots.txt
-rw-r--r-- 1 root root 405998 May 4 23:05 http_cc.oamk.fi_sitemap.xml
-rw-r--r-- 1 root root 106 May 4 23:05 http_eve.oamk.fi_robots.txt
-rw-r--r-- 1 root root 481 May 4 23:04 http_ezp.oamk.fi_robots.txt
-rw-r--r-- 1 root root 405998 May 4 23:05 http_ezp.oamk.fi_sitemap.xml
-rw-r--r-- 1 root root 67 May 4 23:04 http_it.oamk.fi_robots.txt
-rw-r--r-- 1 root root 481 May 4 23:04 http_lehtiarkisto.talentum.com.ezp.oamk.fi_robots.txt
-rw-r--r-- 1 root root 405998 May 4 23:04 http_lehtiarkisto.talentum.com.ezp.oamk.fi_sitemap.xml
-rw-r--r-- 1 root root 481 May 4 23:05 http_login.ezp.oamk.fi_robots.txt
-rw-r--r-- 1 root root 405998 May 4 23:05 http_login.ezp.oamk.fi_sitemap.xml
-rw-r--r-- 1 root root 481 May 4 23:09 http_multimedia.oamk.fi_robots.txt
-rw-r--r-- 1 root root 405998 May 4 23:09 http_multimedia.oamk.fi_sitemap.xml
-rw-r--r-- 1 root root 366 May 4 23:10 http_p.oamk.fi_robots.txt
-rw-r--r-- 1 root root 126 May 4 23:04 http_u.oamk.fi_robots.txt
-rw-r--r-- 1 root root 481 May 4 23:04 http_wwwnew.oamk.fi_robots.txt
-rw-r--r-- 1 root root 405998 May 4 23:04 http_wwwnew.oamk.fi_sitemap.xml
-rw-r--r-- 1 root root 481 May 4 23:03 http_www.oamk.fi_robots.txt
-rw-r--r-- 1 root root 405998 May 4 23:04 http_www.oamk.fi_sitemap.xml

```

FIGURE 20. Files found and retrieved with interesting_files module

Recon-ng also provides a possibility to extract the reconnaissance report into a CSV or HTML format.

3.4.3 Maltego CE

Maltego CE is the most advanced solution of these three OSINT applications, at least when representing the results. Maltego CE provides the most visual interpretation of the results and shows linkages between any found instance. It is also the most advanced from these three tools, in the sense that it performs multiple inquiries with one search.

Installing Maltego CE is also simple. All that is needed is a registration to the Maltego community edition, uploading the appropriate software package and running the installation. The registration and the software packages are available on Paterva's Maltego CE homepages (20). Maltego CE can be downloaded basically to any computer as it runs on Windows, Mac or Linux.

Once Maltego is installed, the application is ready for use. Similarly, as with Recon-ng, Maltego can perform more powerful queries if the user is able to provide API keys. However, in these demonstrations no API keys are fed into the system, and queries are performed with the basic setup.

Operating Maltego CE is easy. Visual enquiries are prompted by creating a new graph (which could better be described as canvas) and selecting the wanted entity under study. In this thesis, the starting point for any inquiry has been *oamk.fi*, and thus it is also with Maltego CE. That said, the *oamk.fi* inquiry is commenced by selecting a domain as a search entity and typing *oamk.fi* on it. As a next step the user can select individually which 'transforms' are run to perform the query, or alternatively select all 'transformations' to be run at once. 'Transformation' is the term used in Maltego for the query logic and activity.

After the selected transformations are run (in this demonstration, all that was possible without API keys), Maltego CE displays the results on the graph/canvas as an illustration. The details for each record can be viewed on the side bar of the Maltego user interface by activating the record of interest. The transformations that were run, together with their results, are also provided in a written list format in one of the sub-windows on the user interface. For the *oamk.fi* domain search, there were altogether 142 notions on run transformations (APPENDIX 3). The graph created from the *oamk.fi* domain

search is shown in the below figure (figure 21.). Each different icon in the graph illustrates a different type of finding, whether it is a linked domain, IP address, DNS name, netblocks, NS record, MX record (mail exchanger record), email address, person, phone number, webpage, or linked organization or company. Maltego found 64 linked records simply based on the domain name *oamk.fi*.

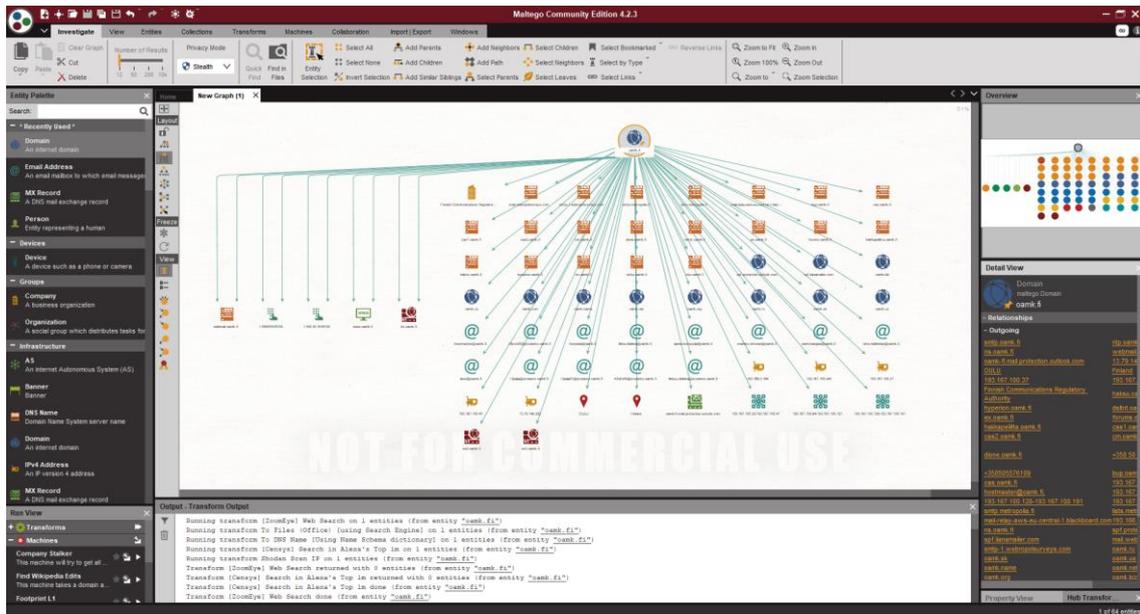


FIGURE 21. Result of *oamk.fi* domain search with Maltego CE

The user can choose any of the displayed records to drill-down further and find additional data. This is done simply by clicking on a record and running the transformations again (commands can be found by mouse right-click). The records that are found are drawn to the graph as extensions (figure 22.). Links between records are identified with arrows.

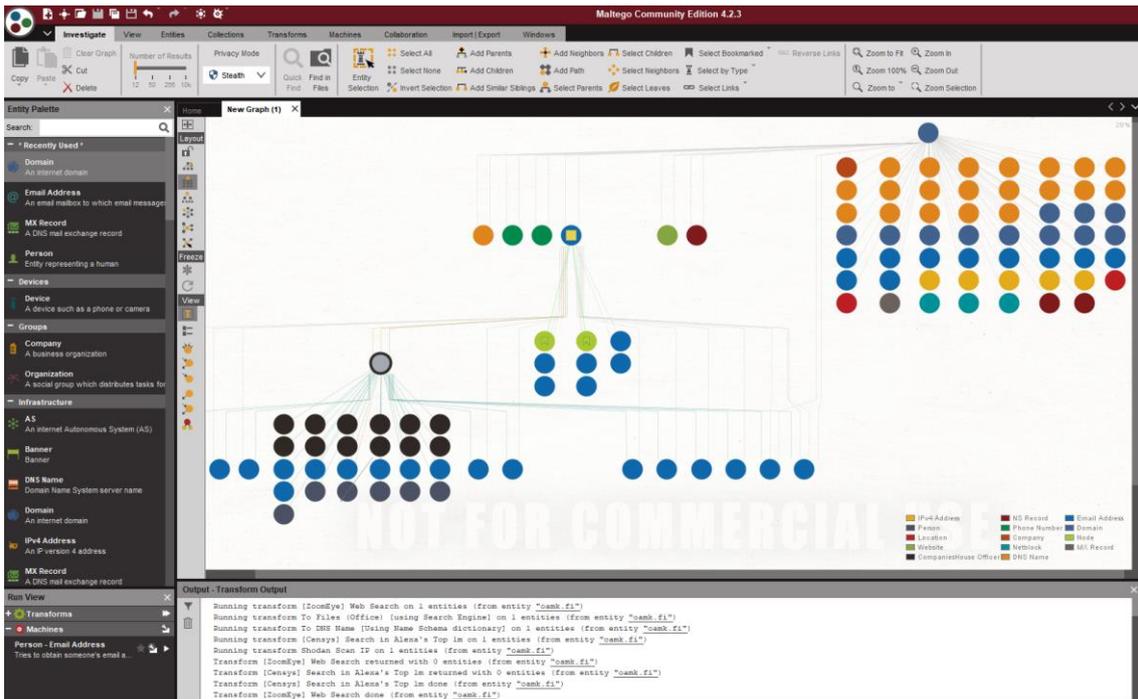


FIGURE 22. Extending the search from found records in Maltego CE

It should be noted that the user can also choose the style of the displayed graphs. The same data can be shown in multiple different formats with Maltego (figure 23.).

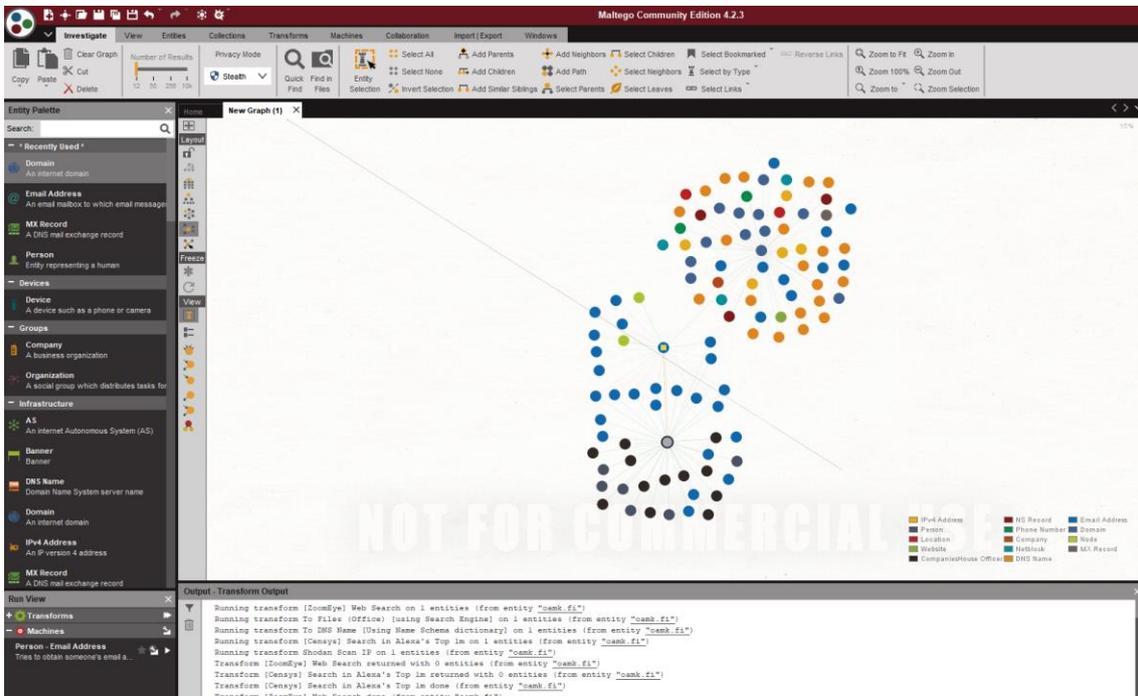


FIGURE 23. Different format of displaying the records and the links between them in Maltego

It must be noted that Maltego can perform more extensive searches as well when all API keys and all possible transforms would be enabled. The Maltego tool contains a hub for the reviewing and adding an additional transformation capacity in the solution (figure 24.).

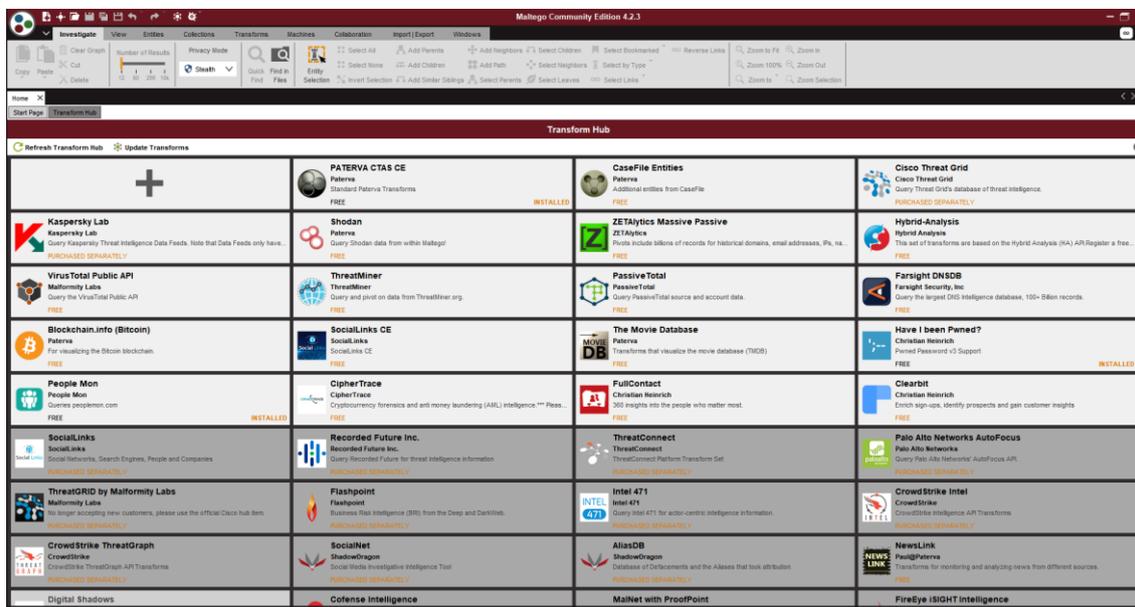


FIGURE 24. The transform Hub of Maltego CE

3.5 Comparison of the tools

This chapter summarizes the demonstrations of the selected OSINT tools by comparing the solutions with each other for a good final overview on the solutions. As stated in the beginning of this chapter, the selected tools represent different approaches to OSINT applications and are good examples highlighting how differently OSINT data can be gathered. Each of them also provides the results of the data gatherings in different formats.

The following table (table 2.) is comparing the solutions with the selected attributes that were found meaningful for the comparison and describing the differing nature of the solutions.

TABLE 2. The comparison of the presented OSINT tools on selected attributes

	Tinfoleak.com	Recon-ng	Maltego CE
Installation effort	None	Medium	Moderate

Operating platform	Web-based	Linux	Windows, Mac, Linux
Type of inquiries	Automated	Command line	Automated, GIU based
Type of inquiry method	Passive	Semipassive-Active, depending on used query method within the tool	Semipassive-Active, depending on used query method within the tool
Scale of inquiries	Single-inquiry at once	Medium, collects results from multiple queries together, but each query must be run individually	Large-scale automated queries
Provided data set	Narrow – provides data on individual Twitter user	Large, can fetch data from multiple different sources utilizing multiple different search methods	Large, can fetch data from multiple different sources utilizing multiple different search methods
Format of results	HTML report with listing of details	Text view summarizing all findings per category (export to CSV and HTML possible)	Visual graph of all found records and their links with other found records
Main benefits	+Quick and easy to use +Good overview on individual user	+Range of available searches +Open-source, free to use +Strong community of supportive users	+Visual illustration of the results +Illustration of the links between records +Multiple searches performed at once
Main Challenges	-Limited to single queries	-Requires familiarization and reading through tutorials to get started -Only Linux-based	-Commercial version chargeable

As outlined in the above table, the characteristics of the demonstrated tools varied quite noticeably, yet each of the tools performed their own assigned tasks. The user has very little, if any, possibility to see or affect how the data search logics worked within these tools. It was also noticed that if the intent would have been to summarize the findings from all three solutions in a concise manner, manual data processing work would have been required as each of the solutions provided the results in different formats.

4 CONCLUSION

The availability and the quality of the nets tossed out into the ocean of information, including the how fine the mesh, are critical to the search process. (12, p.678)

The objective of this thesis was to study what open source intelligence is and demonstrate the use of selected OSINT tools. In the theory sections, this paper considered the current state of OSINT and evaluated its future. The main research question of this thesis was formulated to encompass the overall purpose of the study and it was further divided into sub-research questions for capturing the underlying contents in each. Finally, they all were brought for conclusions. Hence, in this chapter the conclusions are drawn moving from sub-research questions towards the main.

The first sub-research question aimed at understanding open source intelligence as a concept first asking what characteristics specify open source intelligence.

The characteristics specifying open source intelligence based on the theory could be summarized as following:

- The information utilised in the open source intelligence is from various differentiating sources
- In theory, the open sources should be available for all but in practice some are behind paywalls and behind separate authorizations
- The group of users range from governments to regular citizens
- The popularity of OSINT is constantly increasing, and the usage of OSINT is expanding to new arenas
- Main challenge with OSINT is the data amounts, and thus finding the meaningful bits from available information

The second sub-research questions were formulated to understand better the example OSINT applications – what kinds of possible OSINT solutions are available, and what information they provide focusing only on those OSINT

solutions that are possibly accessible without any further authorizations or payment fees. The questions were:

3a. What kinds of OSINT solutions are freely available?

3b. What information can be collected by OSINT solutions and how the information is provided?

This thesis introduced and demonstrated three available OSINT solutions and displayed to some extent the nature and the differing attributes of available solutions. The range of the OSINT solutions seems to be rather wide and there are no standardized approaches to build up such applications. However, each of the solutions did their assigned part in the data search function and that leads to the main research question of the study:

How can OSINT applications help in finding information from open sources, and how do the applications help in understanding the retrieved information?

The presented OSINT applications certainly found information from the subject of the search. The searches were also automated so that searches performed the data retrieval they were designed to do. None of the tools however provided access or visibility to modify any search logic within the tools (Recon-ng might be an exception), hence optimizing the searches for the user's tastes was not possible.

The wide range of the solutions and their disjointedness became rather obvious based on this study. Each performs their own tasks, in their own designed way, providing their results in their own way. Combining the data from different OSINT solutions for a comprehensive overview and analysis is a challenge at least to some extent. Where Steele (2, p.138) concluded that there is currently no solution that would comply with all fully-integrated-analyst-toolkit requirements (exception larger organizations), it seems to be the case based on the findings of this study as well. Glassman and Kang (12, p.679) conclude that users may need to establish their own sets of tools, and this would be

supported by the findings of this study as well. The word 'set-of-tools' might be the key in the OSINT arena due to the disjointedness of separate solutions.

Interestingly, Hassan & Hijazi (1) argued in the theory chapters that semipassive and active data collection methods are not usually seen in OSINT as they can be seen infringing the essence of open source intelligence. The two of the used OSINT tools in this thesis were characterised as semipassive or active, hence one could argue these not being compliant OSINT solutions at all. I could assume that quite many of the OSINT solutions available in the market are in this grey area – what is the “openness” of the data they acquire and is it collected by utilizing only passive methodologies?

How did the applications help in understanding the retrieved information varied per solution – mostly the found records were simply listed and the conclusions were left for the user, whereas the most advanced solution in representation of results visually aided the user to understand linkages between different data records. The visualization of the findings should be where to put focus on with the OSINT solutions development in the future. Supported also by Best (3), the focus of the future research in this OSINT arena should be on techniques of visualizing summaries. The future focus should also be put on individuals' skills on data search and processing, whether it is for the ability to utilise the available OSINT solutions better, but more so for an ability to develop more sophisticated OSINT solutions in the future.

As a final note for the study, it could be concluded that the importance of OSINT contributing to our understanding of the world in this era of information age is becoming rather fundamental.

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APPENDICES

The list of appendices in this thesis:

Appendix 1: Tinfoleak.com report of oamk_ouas user

Appendix 2: Installing recon-ng on VMware virtual server with ubuntu

Appendix 3: Maltego CE outputs from transforms run on oamk.fi domain

TINFOLEAK.COM REPORT OF OAMK_OUAS USER

[REPORT RETRIEVED MAY 5th, 2019]

@VAguileraDiaz vaguilera@isecauditors.com Internet Security Auditors TINFOLEAK.com





Oamk

The official account of Oulu University of Applied Sciences (Oamk). Follow us and our hashtags
#oamk #luotaitseesi

Followers: 3,431 | Following: 1,277 | Likes: 1327
Tweets: 3,265 (1.0 tweets/day)

Screen Name: oamk_ouas

Account Created at: 06/09/2010

Verified: False

Twitter ID: 153733515

URL: <http://www.oamk.fi>

Location: Oulu, Finland

Time Zone: None

Geo enabled: True

Listed count: 61

Language: fi

APPS SOCIAL HASHTAGS MENTIONS TWEETS METADATA MEDIA GEO

Client Applications



Source	Uses	Percentage	First Use	First Tweet
Twitter for iPhone	46	11.5 %	07/06/2018	view
Twitter Web Client	324	81.0 %	06/08/2018	view
TweetDeck	28	7.0 %	06/14/2018	view
Twitter Web App	2	0.5 %	02/06/2019	view

Total: 4 results.

Social Networks



Social Network Username Picture Name Additional info

[Twitter](#) [oamk_ouas](#)  Oamk Oulu, Finland

Total: 1 results.

Hashtags



Hashtags in Tweets

Date	Time	RT's	Likes	Tweet	User	Profile Img	Location	#Hashtags
04/30/2019	10:20:12	1	4	view	@oamk_ouas		Oulu, Finland	#vappu #kesäaikohti #munkkiajasimaa
04/25/2019	12:20:30	0	2	view	@oamk_ouas		Oulu, Finland	#oamk #ePooki
04/24/2019	05:34:49	1	4	view	@UASjournal		Finland	#Osaamisperusteisuus
04/04/2019	12:51:20	4	7	view	@ErjaSormunen		Oulu, Työterveyslaitos	#sote
04/04/2019	06:34:29	2	1	view	@AnneRannali		Oulu, Suomi	#EU
04/03/2019	10:08:29	0	1	view	@oamk_ouas		Oulu, Finland	#oamk #epooki #musiikkipedagogit
04/02/2019	11:18:54	0	4	view	@oamk_ouas		Oulu, Finland	#Oamk
04/01/2019	05:51:23	0	0	view	@oamk_ouas		Oulu, Finland	#elintavat #lapset #lihavuus #painonhallinta #puheeksiotto
03/29/2019	12:04:58	0	2	view	@oamk_ouas		Oulu, Finland	#Oamk
03/28/2019	08:36:40	0	2	view	@oamk_ouas		Oulu, Finland	#luotaitseesi #ylpeästi oamk

03/27/2019 11:14:37 13 14 [view](#) [@okmfi](#)

Suomi - Finland #Eurostudent

03/27/2019 11:05:22 4 7 [view](#) [@Kuutos aika](#)

Suomi

#6Aika

03/27/2019	09:07:10	0	1	view	@oamk_ouas		Oulu, Finland	#oamk #ePooki
03/25/2019	06:42:11	0	0	view	@oamk_ouas		Oulu, Finland	#vivianiitti
03/19/2019	08:03:57	1	2	view	@oamk_ouas		Oulu, Finland	#minnacanthinpäivä #tasaarvo #oamk #koulutus
03/12/2019	13:11:26	1	2	view	@oamk_ouas		Oulu, Finland	#viitearkkitehtuurityö #oamk #ePooki #oulun yliopisto #viitearkkitehturi
03/01/2019	12:10:40	0	14	view	@oamk_ouas		Oulu, Finland	#oamk #luotaitseesi #ylpeästiAMK #YTHS
02/27/2019	06:10:51	2	0	view	@oamk_ouas		Oulu, Finland	#oamk #ePooki #johtaminen
02/14/2019	09:45:11	0	2	view	@oamk_ouas		Oulu, Finland	#oamk #AR #lisättytodellisuus
02/06/2019	08:19:31	1	2	view	@oamk_ouas		Oulu, Finland	#oamk #luotaitseesi
02/05/2019	12:50:06	0	2	view	@oamk_ouas		Oulu, Finland	#oamk #ePooki #tiede #tutkimus #tutkimusetiikka
02/04/2019	11:18:13	1	1	view	@oamk_ouas		Oulu, Finland	#oamk
01/29/2019	09:08:04	3	6	view	@BusinessOulu		Oulu, Suomi	#Oulu #Kickstart
01/23/2019	06:32:22	1	3	view	@OamkRaksa		Oulu, Suomi	#oamk_raksa #oamk_ouas
01/18/2019	11:51:36	2	5	view	@oamk_ouas		Oulu, Finland	#kickstart
01/18/2019	11:32:07	0	0	view	@oamk_ouas		Oulu, Finland	#oamk #ePooki #imetys
01/18/2019	06:33:27	2	12	view	@Arene_ry		Helsinki	#rahoitusmalli

01/17/2019	13:48:05	0	4	view	@oamk_ouas		Oulu, Finland	#oamk #luotaitseesi
01/17/2019	12:51:03	25	43	view	@okmfi		Suomi - Finland	#Jatkuvaoppiminen
01/17/2019	12:46:46	9	23	view	@Arene_ry		Helsinki	#TKI #YAMK
01/17/2019	12:35:11	0	3	view	@oamk_ouas		Oulu, Finland	#oamk #ePooki #hot #hops
01/14/2019	10:56:01	0	0	view	@oamk_ouas		Oulu, Finland	#oamk #ePooki #matkailu #silmät #silmätaudit #terveys
01/11/2019	11:38:20	4	25	view	@honkamakila			#Arctic #Oulu
01/09/2019	13:14:04	10	17	view	@oamk_ouas		Oulu, Finland	#oamk #yhteiskampus #luotaitseesi
01/08/2019	12:48:19	10	17	view	@oamk_ouas		Oulu, Finland	#oamk #yhteiskampus #luotaitseesi
01/08/2019	06:06:12	1	8	view	@oamk_ouas		Oulu, Finland	#luotaitseesi
01/03/2019	08:35:43	1	3	view	@oamk_ouas		Oulu, Finland	#Oamk
12/27/2018	09:36:45	10	47	view	@LempinenPetri		Helsinki	#YlpeästiAMK
12/21/2018	06:00:53	6	9	view	@oamk_ouas		Oulu, Finland	#oamk #ylpeästiAMK #insinööri #koulutus #automaatio
12/19/2018	13:48:08	0	2	view	@oamk_ouas		Oulu, Finland	#oamk #koulutus #yhteistyö #YlpeästiAMK
12/19/2018	13:44:26	1	5	view	@oamk_ouas		Oulu, Finland	#oamk #amk
12/10/2018	07:17:23	3	4	view	@Arene_ry		Helsinki	#Terwa
12/05/2018	12:23:22	0	0	view	@oamk_ouas		Oulu, Finland	#sukupolvenvaihdos #oamk #ePooki #maatalousyritykset #maatilat #omistajanvaihdos
12/05/2018	06:22:41	2	8	view	@Kuutos aika		Suomi	#6Aika #EduDigi

12/04/2018	08:00:33	0	1	view	@oamk_ouas		Oulu, Finland	#oamk #ePooki #opettajuus
12/03/2018	11:58:33	0	0	view	@oamk_ouas		Oulu, Finland	#yhteiskehittäminen
11/29/2018	06:54:03	1	14	view	@SAlaluusua		Haukipudas, Suomi	#fiilis
11/27/2018	10:47:28	2	2	view	@Export_team		Suomi	#elintarvikevienti #vienti #ruokavienti
11/27/2018	08:42:42	0	2	view	@oamk_ouas		Oulu, Finland	#oamk #ePooki #hankkeet
11/26/2018	08:09:36	1	1	view	@oamk_ouas		Oulu, Finland	#oamk #ePooki #digiviihde #sosiaalinenmedia #digipelit #pelaaminen
11/23/2018	10:10:09	0	2	view	@oamk_ouas		Oulu, Finland	#oamk #ePooki #myllyt #vesimyllyt #tuulimyllyt
11/19/2018	13:45:46	0	5	view	@oamk_ouas		Oulu, Finland	#InnoStartti2018
11/12/2018	13:16:13	0	1	view	@oamk_ouas		Oulu, Finland	#bioanalytiikka #henkilöstövaihto
11/09/2018	07:57:29	1	5	view	@oamk_ouas		Oulu, Finland	#oamk #ePooki #digiohjaus
10/15/2018	05:42:04	2	9	view	@Oamkeneryautom		Oulu, Suomi	#Kolmeks #Belimo #oamk
10/08/2018	11:43:30	1	5	view	@oamk_ouas		Oulu, Finland	#campusonline
10/05/2018	09:20:40	0	2	view	@oamk_ouas		Oulu, Finland	#Oulu #Kuusamo
10/03/2018	12:41:15	0	2	view	@oamk_ouas		Oulu, Finland	#oamk #ePooki #erityislapset #liikunta
10/03/2018	05:29:58	1	4	view	@jokaaria		Oulu, Suomi	#talotekniikka #oamkelsa #yrittisyhteistyö
10/01/2018	11:19:43	0	3	view	@oamk_ouas		Oulu, Finland	#SatujenSaaret
09/28/2018	20:02:19	4	19	view	@JNiinimki			#luotaitseesi

09/27/2018	08:28:08	1	6	view	@johannalaitala		Oulu / Nivala	#energia #hiilineutraali #Oulu #rakentaminen #energiatehokkuus #digitalisaatio
09/27/2018	08:27:57	7	0	view	@LukeFinland		Suomi	#elintarvikeala #tutkimus #vienti
09/25/2018	12:26:21	0	3	view	@oamk_ouas		Oulu, Finland	#NordicEdge2018
09/19/2018	06:14:27	1	3	view	@insinoorilehti			#ralliauto
09/13/2018	14:13:14	2	5	view	@Kaleva_fi		Oulu, Pohjois-Pohjanmaa	#Oulu
09/13/2018	12:30:19	1	3	view	@Arene_ry		Helsinki	#yhteistyö
09/12/2018	13:32:00	1	5	view	@oamk_ouas		Oulu, Finland	#Oamk
09/12/2018	07:56:43	1	3	view	@oamkit		Oulu, Suomi	#itpäivät2018
09/11/2018	20:38:00	1	2	view	@oamk_ouas		Oulu, Finland	#Oamk
09/07/2018	16:37:00	1	2	view	@oamk_ouas		Oulu, Finland	#Oamk
09/06/2018	10:56:13	0	2	view	@oamk_ouas		Oulu, Finland	#oamk #luotaitseesi #ylpeästiAMK
09/06/2018	10:47:59	0	0	view	@oamk_ouas		Oulu, Finland	#oamk
09/06/2018	05:11:26	0	5	view	@oamk_ouas		Oulu, Finland	#Oamk
09/04/2018	09:33:12	1	6	view	@oamk_ouas		Oulu, Finland	#Oamk
08/31/2018	11:49:15	2	1	view	@Ehkeskus		Finland	#Hieho #lehmät #eläimet
08/31/2018	08:22:50	1	3	view	@Arene_ry		Helsinki	#robotiikka
08/30/2018	09:46:43	0	4	view	@oamk_ouas		Oulu, Finland	#oamk #ePooki #maatilat

08/30/2018	07:14:28	2	5	view	@CityIoT1		Oulu, Finland	#cityiot #Oulu #iot #6Aika #oamk #unioulu #tty #Tampere
08/28/2018	09:40:12	0	8	view	@oamk_ouas		Oulu, Finland	#eisyrtji
08/21/2018	05:51:46	1	13	view	@Oamkenegyautom		Oulu, Suomi	#oulu #oamk
08/20/2018	05:46:58	2	6	view	@oamkit		Oulu, Suomi	#Oamk
08/17/2018	11:41:17	0	1	view	@oamk_ouas		Oulu, Finland	#toiminnallinen_opinnäytetyö #oamk #ePooki #opinnäytetyöt #video
08/14/2018	09:37:27	1	2	view	@oamk_ouas		Oulu, Finland	#Oamk
08/10/2018	05:56:03	0	1	view	@oamk_ouas		Oulu, Finland	#Oamk
08/10/2018	05:04:38	8	15	view	@LempinenPetri		Helsinki	#LUMATIKKA
08/08/2018	05:33:47	2	5	view	@oamkit		Oulu, Suomi	#oamk #tuudo
07/29/2018	09:35:28	0	5	view	@oamk_ouas		Oulu, Finland	#luotaitseesi
07/27/2018	17:38:44	0	2	view	@oamk_ouas		Oulu, Finland	#Qstock #Oamk #luotaitseesi
07/26/2018	10:48:05	0	3	view	@oamk_ouas		Oulu, Finland	#Oamk #luotaitseesi
07/26/2018	10:33:10	0	4	view	@oamk_ouas		Oulu, Finland	#luotaitseesi
06/20/2018	10:09:52	2	3	view	@oamk_ouas		Oulu, Finland	#oamk #ePooki #drone
06/18/2018	07:15:11	0	0	view	@oamk_ouas		Oulu, Finland	#ammattietiikka #etiikka #hoitoala
06/14/2018	09:44:40	0	0	view	@oamk_ouas		Oulu, Finland	#radiography #radiationtherapy

Total: 94 results.

Hashtag Detail

Date (since)	Date (until)	RT's	Likes	Count	#Hashtag
04/30/2019	04/30/2019	1	4	1	#vappu
04/30/2019	04/30/2019	1	4	1	#kesäkohti
04/30/2019	04/30/2019	1	4	1	#munkkijasimaa
06/20/2018	04/25/2019	52	184	49	#oamk
06/20/2018	04/25/2019	7	32	19	#ePooki
04/24/2019	04/24/2019	1	4	1	#Osaamisperusteisuus
04/04/2019	04/04/2019	4	7	1	#sote
04/04/2019	04/04/2019	2	1	1	#EU
04/03/2019	04/03/2019	0	1	1	#musiikkipedagogit
04/01/2019	04/01/2019	0	0	1	#elintavat
04/01/2019	04/01/2019	0	0	1	#lapset
04/01/2019	04/01/2019	0	0	1	#lihavuus
04/01/2019	04/01/2019	0	0	1	#painonhallinta
04/01/2019	04/01/2019	0	0	1	#puheeksiotto
07/26/2018	03/28/2019	26	99	13	#luotaitseesi
09/06/2018	03/28/2019	16	76	6	#ylpeästiamk
03/27/2019	03/27/2019	13	14	1	#Eurostudent
08/30/2018	03/27/2019	8	20	3	#6Aika
03/25/2019	03/25/2019	0	0	1	#vivianiitti
03/19/2019	03/19/2019	1	2	1	#minnacanthinpäivä
03/19/2019	03/19/2019	1	2	1	#tasaarvo
12/19/2018	03/19/2019	7	13	3	#koulutus
03/12/2019	03/12/2019	1	2	1	#viitearkkitehtuurityö
03/12/2019	03/12/2019	1	2	1	#oulunyliopisto
03/12/2019	03/12/2019	1	2	1	#viitearkkitehtuuri
03/01/2019	03/01/2019	0	14	1	#YTHS
02/27/2019	02/27/2019	2	0	1	#johtaminen
02/14/2019	02/14/2019	0	2	1	#AR
02/14/2019	02/14/2019	0	2	1	#lisättytodellisuus
02/05/2019	02/05/2019	0	2	1	#tiede
09/27/2018	02/05/2019	7	2	2	#tutkimus
02/05/2019	02/05/2019	0	2	1	#tutkimusetiikka
08/21/2018	01/29/2019	13	62	7	#Oulu
01/18/2019	01/29/2019	5	11	2	#Kickstart
01/23/2019	01/23/2019	1	3	1	#oamk_raksa
01/23/2019	01/23/2019	1	3	1	#oamk_ouas
01/18/2019	01/18/2019	0	0	1	#imetyt
01/18/2019	01/18/2019	2	12	1	#rahoitusmalli
01/17/2019	01/17/2019	25	43	1	#Jatkuvaoppiminen
01/17/2019	01/17/2019	9	23	1	#TKI

01/17/2019	01/17/2019	9	23	1	#YAMK
01/17/2019	01/17/2019	0	3	1	#hot
01/17/2019	01/17/2019	0	3	1	#hops
01/14/2019	01/14/2019	0	0	1	#matkailu
01/14/2019	01/14/2019	0	0	1	#silmät
01/14/2019	01/14/2019	0	0	1	#silmäaudit
01/14/2019	01/14/2019	0	0	1	#terveys
01/11/2019	01/11/2019	4	25	1	#Arctic
01/08/2019	01/09/2019	20	34	2	#yhteiskampus
12/21/2018	12/21/2018	6	9	1	#insinööri
12/21/2018	12/21/2018	6	9	1	#automaatio
09/13/2018	12/19/2018	1	5	2	#yhteistyö
12/19/2018	12/19/2018	1	5	1	#amk
12/10/2018	12/10/2018	3	4	1	#Terwa
12/05/2018	12/05/2018	0	0	1	#sukupolvenvaihdos
12/05/2018	12/05/2018	0	0	1	#maatalousyritykset
08/30/2018	12/05/2018	0	4	2	#maatilat
12/05/2018	12/05/2018	0	0	1	#omistajanvaihdos
12/05/2018	12/05/2018	2	8	1	#EduDigi
12/04/2018	12/04/2018	0	1	1	#opettajuus
12/03/2018	12/03/2018	0	0	1	#yhteiskehittäminen
11/29/2018	11/29/2018	1	14	1	#fiilis
11/27/2018	11/27/2018	2	2	1	#elintarvikevienti
09/27/2018	11/27/2018	9	2	2	#vienti
11/27/2018	11/27/2018	2	2	1	#ruokavienti
11/27/2018	11/27/2018	0	2	1	#hankkeet
11/26/2018	11/26/2018	1	1	1	#digiviihde
11/26/2018	11/26/2018	1	1	1	#sosiaalinenmedia
11/26/2018	11/26/2018	1	1	1	#digipelit
11/26/2018	11/26/2018	1	1	1	#pelaaminen
11/23/2018	11/23/2018	0	2	1	#myllyt
11/23/2018	11/23/2018	0	2	1	#vesimyllyt
11/23/2018	11/23/2018	0	2	1	#tuulimyllyt
11/19/2018	11/19/2018	0	5	1	#InnoStartti2018
11/12/2018	11/12/2018	0	1	1	#bioanalytiikka
11/12/2018	11/12/2018	0	1	1	#henkilöstövaihto
11/09/2018	11/09/2018	1	5	1	#digiohjaus
10/15/2018	10/15/2018	2	9	1	#Kolmeks
10/15/2018	10/15/2018	2	9	1	#Belimo
10/08/2018	10/08/2018	1	5	1	#campusonline
10/05/2018	10/05/2018	0	2	1	#Kuusamo

10/03/2018	10/03/2018	0	2	1	#erityislapset
10/03/2018	10/03/2018	0	2	1	#liikunta
10/03/2018	10/03/2018	1	4	1	#talotekniikka
10/03/2018	10/03/2018	1	4	1	#oamkelsa
10/03/2018	10/03/2018	1	4	1	#yrittisyhteistyö
10/01/2018	10/01/2018	0	3	1	#SatujenSaaret
09/27/2018	09/27/2018	1	6	1	#energia
09/27/2018	09/27/2018	1	6	1	#hiilineutraali
09/27/2018	09/27/2018	1	6	1	#rakentaminen
09/27/2018	09/27/2018	1	6	1	#energiatehokkuus
09/27/2018	09/27/2018	1	6	1	#digitalisaatio
09/27/2018	09/27/2018	7	0	1	#elintarvikeala
09/25/2018	09/25/2018	0	3	1	#NordicEdge2018
09/19/2018	09/19/2018	1	3	1	#ralliauto
09/12/2018	09/12/2018	1	3	1	#itpäivät2018
08/31/2018	08/31/2018	2	1	1	#Hieho
08/31/2018	08/31/2018	2	1	1	#lehmät
08/31/2018	08/31/2018	2	1	1	#eläimet
08/31/2018	08/31/2018	1	3	1	#robotiikka
08/30/2018	08/30/2018	2	5	1	#cityiot
08/30/2018	08/30/2018	2	5	1	#iot
08/30/2018	08/30/2018	2	5	1	#unioulu
08/30/2018	08/30/2018	2	5	1	#tty
08/30/2018	08/30/2018	2	5	1	#Tampere
08/28/2018	08/28/2018	0	8	1	#eisyryji
08/17/2018	08/17/2018	0	1	1	#toiminnallinen_opinnäytetyö
08/17/2018	08/17/2018	0	1	1	#opinnäytetyöt
08/17/2018	08/17/2018	0	1	1	#video
08/10/2018	08/10/2018	8	15	1	#LUMATIKKA
08/08/2018	08/08/2018	2	5	1	#tuudo
07/27/2018	07/27/2018	0	2	1	#Qstock
06/20/2018	06/20/2018	2	3	1	#drone
06/18/2018	06/18/2018	0	0	1	#ammattietiikka
06/18/2018	06/18/2018	0	0	1	#etiikka
06/18/2018	06/18/2018	0	0	1	#hoitoala
06/14/2018	06/14/2018	0	0	1	#radiography
06/14/2018	06/14/2018	0	0	1	#radiationtherapy

Total: 118 results.

Top Hashtags

Date (since)	Date (until)	RT's	Likes	Count	#Hashtag
06/20/2018	04/25/2019	52	184	49	#oamk
06/20/2018	04/25/2019	7	32	19	#ePooki
07/26/2018	03/28/2019	26	99	13	#luotaitseesi
08/21/2018	01/29/2019	13	62	7	#Oulu
09/06/2018	03/28/2019	16	76	6	#ylpeästiamk
08/30/2018	03/27/2019	8	20	3	#6Aika
12/19/2018	03/19/2019	7	13	3	#koulutus
09/27/2018	02/05/2019	7	2	2	#tutkimus
01/18/2019	01/29/2019	5	11	2	#Kickstart
08/30/2018	12/05/2018	0	4	2	#maatilat

Total: 10 results.

User Mentions

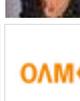


User Mentions in Tweets

Date	Time	RT's	Likes	Tweets	User	Profile Img	Location	Mentions
05/02/2019	11:22:08	9	9	view	@TeknologiaTytot			@TeknologiaTytot
05/02/2019	11:21:35	3	2	view	@BiotalousdenERKO			@BiotalousdenERKO @JAMK_fi @SeAMK @oamk_ouas @LapinAMKbio
04/30/2019	11:08:31	10	12	view	@Ammattikorkeaan			@Ammattikorkeaan
04/24/2019	06:37:06	3	10	view	@PaiviLaajala		Oulu, Suomi	@PaiviLaajala
04/24/2019	06:29:09	2	6	view	@ppliitto			@ppliitto @oamk_ouas @UniOulu
04/24/2019	05:57:47	2	15	view	@OamkAmok		Oulu, Suomi	@OamkAmok

04/24/2019	05:34:49	1 4	vie w	@UASjournal		Finland	@UASjournal
04/23/2019	08:48:52	9 21	vie w	@TeknologiaTytot			@TeknologiaTytot
04/23/2019	05:47:26	2 10	vie w	@oamk_ouas		Oulu, Finland	@UniOulu
04/18/2019	07:49:43	7 11	vie w	@TeknologiaTytot			@TeknologiaTytot
04/17/2019	07:04:57	3 10	vie w	@j_johanna_29		Oulu, Suomi	@j_johanna_29 @OamkRaksa @Oamkenergyautom
04/15/2019	07:28:51	8 15	vie w	@TeknologiaTytot			@TeknologiaTytot
04/12/2019	09:54:27	1 7 39	vie w	@Arene_ry		Helsinki	@Arene_ry
04/11/2019	09:55:50	4 11	vie w	@Osuuskauppani		Oulu, Suomi	@Osuuskauppani @UniOulu @oamk_ouas
04/09/2019	12:34:00	2 6	vie w	@Hirsikoti		Sotkamo, Suomi	@Hirsikoti @oamk_ouas
04/09/2019	05:13:32	1 5	vie w	@OamkAmok		Oulu, Suomi	@OamkAmok
04/09/2019	05:03:00	1 17	vie w	@Kamielisa		@oamk_ouas Finland	@Kamielisa
04/04/2019	12:51:20	4 7	vie w	@ErjaSormunen		Oulu, Työterveyslaitos	@ErjaSormunen
04/04/2019	06:34:29	2 1	vie w	@AnneRannali		Oulu, Suomi	@AnneRannali @UniOulu @oamk_ouas
04/04/2019	06:33:44	2 5	vie w	@Oamkenergyautom		Oulu, Suomi	@Oamkenergyautom @oamk_ouas
03/28/2019	06:55:39	4 11	vie w	@tateteollisuus		Helsinki, Suomi	@tateteollisuus @OAMK
03/28/2019	06:55:25	1 14	vie w	@jokaaria		Oulu, Suomi	@jokaaria @oamk_ouas
03/27/2019	11:14:37	1 3 14	vie w	@okmfi		Suomi - Finland	@okmfi

03/27/2019	11:05:22	4	7	vie w	@Kuutosaika	 6Aika	Suomi	@Kuutosaika
03/25/2019	14:28:26	1	3	vie w	@oamk_ouas	 OAMK	Oulu, Finland	@KitchenOulu
03/19/2019	13:36:59	1	3	vie w	@oamk_ouas	 OAMK	Oulu, Finland	@KitchenOulu
03/19/2019	10:01:48	5	10	vie w	@LukeFinland	 Luke	Suomi	@LukeFinland @TAMK_UAS @JAMK_fi @SeAMK @oamk_ouas @SavoniaAMK
03/19/2019	10:01:31	7	12	vie w	@TeknologiaTytot	 TeknologiaTytot		@TeknologiaTytot
03/19/2019	06:00:33	3	7	vie w	@oamk_kone	 OAMK	Oulu, Suomi	@oamk_kone
03/12/2019	06:34:38	1	3	vie w	@oajry	 OAJRY		@oajry
03/12/2019	06:27:52	3	17	vie w	@Kamielisa	 Kamielisa	@oamk_ouas Finland	@Kamielisa
03/01/2019	12:10:40	0	14	vie w	@oamk_ouas	 OAMK	Oulu, Finland	@YTHS_FIN
02/28/2019	06:38:18	1	3	vie w	@OamkAmok	 OAMK	Oulu, Suomi	@OamkAmok
02/26/2019	07:16:47	1	18	vie w	@Kamielisa	 Kamielisa	@oamk_ouas Finland	@Kamielisa @oamk_ouas
02/26/2019	06:28:22	3	6	vie w	@oamk_kone	 OAMK	Oulu, Suomi	@oamk_kone @Kaleva_fi
02/21/2019	12:01:15	3	13	vie w	@oamk_ouas	 OAMK	Oulu, Finland	@ramboll_fi
02/21/2019	06:21:19	1	5	vie w	@Oamkenergyautom	 OAMK Energy Autom	Oulu, Suomi	@Oamkenergyautom
02/21/2019	06:21:12	1	3	vie w	@Oamkenergyautom	 OAMK Energy Autom	Oulu, Suomi	@Oamkenergyautom
02/20/2019	07:13:22	1	6	vie w	@Oamkenergyautom	 OAMK Energy Autom	Oulu, Suomi	@Oamkenergyautom @oamk_ouas

02/19/2019	07:07:35	1	13	view	@LempinenPetri		Helsinki	@LempinenPetri @oamk_ouas @Arene_ry
02/18/2019	06:31:43	3	9	view	@Oamkenergyautom		Oulu, Suomi	@Oamkenergyautom @oamk_ouas @AlisaHast
02/11/2019	13:41:01	3	3	view	@KitchenOulu		Oulu	@KitchenOulu
02/11/2019	06:30:08	7	15	view	@JyrkiLaitinen			@JyrkiLaitinen
02/08/2019	13:49:04	$\frac{1}{2}$	44	view	@Arene_ry		Helsinki	@Arene_ry
02/08/2019	06:39:06	0	0	view	@oamk_ouas		Oulu, Finland	@tiahnkm_
02/07/2019	12:12:12	1	8	view	@oamk_ouas		Oulu, Finland	@UniOulu
01/29/2019	14:55:05	1	3	view	@poliisilauri		Oulu, Suomi	@poliisilauri @oamk_ouas
01/29/2019	09:08:04	3	6	view	@BusinessOulu		Oulu, Suomi	@BusinessOulu_
01/23/2019	07:29:29	0	0	view	@oamk_ouas		Oulu, Finland	@ValioFi
01/23/2019	06:32:31	5	11	view	@OamkAmok		Oulu, Suomi	@OamkAmok
01/23/2019	06:32:22	1	3	view	@OamkRaksa		Oulu, Suomi	@OamkRaksa @Buildpoint
01/23/2019	06:31:31	5	12	view	@ulla_v			@ulla_v
01/21/2019	12:20:18	0	3	view	@oamk_ouas		Oulu, Finland	@insinooriliitto @OulunInsinoorit
01/18/2019	11:45:31	0	1	view	@oamk_ouas		Oulu, Finland	@HennaMaa @UniOulu
01/18/2019	09:37:06	2	7	view	@JNiinimki			@JNiinimki
01/18/2019	06:33:27	2	12	view	@Arene_ry		Helsinki	@Arene_ry @Arene_ry @LempinenPetri

01/17/2019	12:51:03	2	43	vie	@okmfi		Suomi - Finland	@okmfi
01/17/2019	12:50:52	1	1	vie	@HagelNiklas			@HagelNiklas @oamk_ouas
01/17/2019	12:46:46	9	23	vie	@Arene_ry		Helsinki	@Arene_ry
01/17/2019	06:38:51	2	2	vie	@Digiohjaus		Oulu, Suomi	@Digiohjaus
01/16/2019	11:24:39	1	15	vie	@JNiinimki			@JNiinimki
01/16/2019	11:21:53	2	7	vie	@osaotweet		Oulu ja Koillismaa	@osaotweet
01/16/2019	11:21:40	2	2	vie	@oamk_kone		Oulu, Suomi	@oamk_kone
01/11/2019	11:38:20	4	25	vie	@honkamakila			@honkamakila
01/10/2019	06:17:20	2	5	vie	@Oamkenergyautom		Oulu, Suomi	@Oamkenergyautom @oamk_ouas
01/09/2019	13:14:04	1	17	vie	@oamk_ouas		Oulu, Finland	@oamk_ouas @UniOulu
01/09/2019	07:16:44	3	7	vie	@lauralaaveri		Oulu, Suomi	@lauralaaveri
01/08/2019	14:00:23	1	9	vie	@mizmaaps		Finland	@mizmaaps
01/08/2019	12:48:19	1	17	vie	@oamk_ouas		Oulu, Finland	@UniOulu
01/08/2019	06:06:12	1	8	vie	@oamk_ouas		Oulu, Finland	@Cision
01/07/2019	06:48:51	3	4	vie	@KitchenOulu		Oulu	@KitchenOulu @oamk_ouas @osaotweet @UniOulu
01/04/2019	09:07:47	3	7	vie	@OamkAmok		Oulu, Suomi	@OamkAmok
01/03/2019	08:33:52	1	24	vie	@Demolanet		Suomi	@Demolanet

12/27/2018	09:36:45	1	47	vie w	@LempinenPetri	 Helsinki	@LempinenPetri @Arene_ry @metropolia @HAAGAHELIAa mk
12/27/2018	09:34:11	2	4	vie w	@Oamkenergyautom	 Oulu, Suomi	@Oamkenergyautom @okmfi
12/21/2018	06:00:53	6	9	vie w	@oamk_ouas	 Oulu, Finland	@KemijokiOy
12/19/2018	13:48:08	0	2	vie w	@oamk_ouas	 Oulu, Finland	@Atria_Oyj
12/19/2018	13:44:26	1	5	vie w	@oamk_ouas	 Oulu, Finland	@PoyrySuomi
12/17/2018	08:34:11	0	5	vie w	@oamk_ouas	 Oulu, Finland	@Nordea
12/17/2018	08:26:36	0	3	vie w	@oamk_ouas	 Oulu, Finland	@liikesivistys
12/11/2018	06:00:27	1	9	vie w	@arvuuttelija	 Oulu	@arvuuttelija @oamk_ouas
12/10/2018	07:17:23	3	4	vie w	@Arene_ry	 Helsinki	@Arene_ry @oamk_ouas
12/05/2018	06:22:41	2	8	vie w	@Kuutosaika	 Suomi	@Kuutosaika
12/05/2018	06:22:24	2	4	vie w	@eamkhanke	 Finland	@eamkhanke @oamk_ouas
12/03/2018	11:58:33	0	0	vie w	@oamk_ouas	 Oulu, Finland	@Kaleva_fi
11/30/2018	07:34:05	1	1	vie w	@oamk_ouas	 Oulu, Finland	@Kaleva_fi
11/29/2018	06:54:03	1	14	vie w	@SAalaluusua	 Haukipudas, Suomi	@SAalaluusua
11/26/2018	12:46:07	1	6	vie w	@oamk_ouas	 Oulu, Finland	@JoukoPaaso
11/20/2018	15:19:41	2	7	vie w	@KitchenOulu	 Oulu	@KitchenOulu @oamk_ouas @UniOulu

11/20/2018	15:12:39	1	6	vie w	@OamkRaksa		Oulu, Suomi	@OamkRaksa
11/20/2018	09:52:04	0	17	vie w	@oamk_ouas		Oulu, Finland	@oulunkaupunki @UniOulu
11/19/2018	09:55:14	3	8	vie w	@Oamkenergyautom		Oulu, Suomi	@Oamkenergyautom @oamk_ouas
11/12/2018	07:42:21	2	7	vie w	@jokaaria		Oulu, Suomi	@jokaaria @osaotweet @UniOulu @oamk_ouas
11/08/2018	07:19:12	1	3	vie w	@OamkAmok		Oulu, Suomi	@OamkAmok
11/06/2018	15:56:21	1	4	vie w	@OamkRaksa		Oulu, Suomi	@OamkRaksa
11/06/2018	08:02:48	1	6	vie w	@OamkRaksa		Oulu, Suomi	@OamkRaksa
11/06/2018	08:02:21	9	12	vie w	@mmm_fi		Helsinki, Finland	@mmm_fi
11/05/2018	13:43:08	0	4	vie w	@oamk_ouas		Oulu, Finland	@Osuuskauppani
10/19/2018	08:00:24	2	9	vie w	@AijaSalo		Espoo, Finland	@AijaSalo @oamk_ouas
10/15/2018	07:30:45	2	15	vie w	@TyttiTup		Suomi	@TyttiTup @oamk_ouas @AnttiRinnepj
10/15/2018	05:42:04	2	9	vie w	@Oamkenergyautom		Oulu, Suomi	@Oamkenergyautom
10/12/2018	12:41:05	2	6	vie w	@UniOulu		Oulu	@UniOulu @oamk_ouas
10/08/2018	11:43:30	1	5	vie w	@oamk_ouas		Oulu, Finland	@UASjournal
10/05/2018	07:35:31	1	8	vie w	@Kamielisa		@oamk_ouas Finland	@Kamielisa @oamk_ouas
10/04/2018	12:38:45	3	8	vie w	@Oamkenergyautom		Oulu, Suomi	@Oamkenergyautom @oamk_ouas
10/04/2018	12:38:28	1	7	vie w	@OamkRaksa		Oulu, Suomi	@OamkRaksa

10/03/2018	05:29:58	1	4	view	@jokaaria		Oulu, Suomi	@jokaaria @UponorSuomi @oamk_ouas
10/02/2018	09:42:04	1	11	view	@OamkRaksa		Oulu, Suomi	@OamkRaksa
10/01/2018	12:04:12	1	3	view	@oamk_ouas		Oulu, Finland	@caritaslaiset
10/01/2018	12:01:10	2	8	view	@rtotter		Oulu	@rtotter
09/28/2018	20:02:19	4	19	view	@JNiinimki			@JNiinimki @oamk_ouas
09/28/2018	16:54:35	1	8	view	@oamk_ouas		Oulu, Finland	@PiiMega
09/28/2018	16:51:46	1	8	view	@oamk_ouas		Oulu, Finland	@nokia
09/27/2018	08:29:30	0	4	view	@oamk_ouas		Oulu, Finland	@Kaleva_fi
09/27/2018	08:28:08	1	6	view	@johannalaitala		Oulu / Nivala	@johannalaitala
09/27/2018	08:27:57	7	0	view	@LukeFinland		Suomi	@LukeFinland
09/26/2018	05:55:50	3	8	view	@oamk_kone		Oulu, Suomi	@oamk_kone @PentikOy
09/20/2018	12:47:25	1	1	view	@oamk_ouas		Oulu, Finland	@Kaleva_fi
09/19/2018	14:19:01	3	12	view	@oamk_ouas		Oulu, Finland	@TeknologiaTytot @POPELYkeskus
09/19/2018	10:21:52	3	4	view	@KitchenOulu		Oulu	@KitchenOulu
09/19/2018	06:14:27	1	3	view	@insinoorilehti			@insinoorilehti
09/17/2018	11:06:10	1	2	view	@pekkarahko			@pekkarahko @UniOulu @oamk_ouas
09/13/2018	14:13:14	2	5	view	@Kaleva_fi		Oulu, Pohjois- Pohjanmaa	@Kaleva_fi

09/13/2018	12:30:19	1	3	view	@Arene_ry	 Helsinki	@Arene_ry @Talenom @oamk_ouas
09/13/2018	08:20:45	0	3	view	@oamk_ouas	 Oulu, Finland	@Kaleva_fi
09/12/2018	11:34:28	1	2	view	@oamk_ouas	 Oulu, Finland	@Talenom
09/12/2018	07:56:43	1	3	view	@oamkit	 Oulu, Suomi	@oamkit
09/06/2018	07:41:57	2	9	view	@oamk_kone	 Oulu, Suomi	@oamk_kone
09/04/2018	09:33:12	1	6	view	@oamk_ouas	 Oulu, Finland	@osakoweb
09/03/2018	10:11:07	0	3	view	@oamk_ouas	 Oulu, Finland	@MindBusiness_fi
09/03/2018	08:32:59	0	1	view	@oamk_ouas	 Oulu, Finland	@Kaleva_fi
09/03/2018	06:56:34	0	0	view	@oamk_ouas	 Oulu, Finland	@Marliisi @OamkAmok
08/31/2018	11:49:15	2	1	view	@Ehkeskus	 Finland	@Ehkeskus @oamk_ouas
08/31/2018	08:22:50	1	3	view	@Arene_ry	 Helsinki	@Arene_ry @oamk_ouas
08/30/2018	07:14:28	2	5	view	@CityIoT1		@CityIoT1
08/28/2018	09:40:12	0	8	view	@oamk_ouas	 Oulu, Finland	@LapinAMK
08/24/2018	11:10:47	3	4	view	@oamk_ouas	 Oulu, Finland	@Vormanen @JNiinimki @OYYtwiittaa @UniOulu @oulunkaupunki @JoukoPaaso @PaiviLaajala
08/21/2018	05:51:46	1	13	view	@Oamkenergyautom	 Oulu, Suomi	@Oamkenergyautom @oamk_ouas
08/20/2018	05:46:58	2	6	view	@oamkit	 Oulu, Suomi	@oamkit

08/10/2018	05:04:38	8	15	view	@LempinenPetri		Helsinki	@LempinenPetri @helsinkiuni @AaltoUniversity
08/08/2018	05:33:47	2	5	view	@oamkit		Oulu, Suomi	@oamkit
07/30/2018	08:59:49	4	4	view	@dimmyoamk		Oulu, Suomi	@dimmyoamk
07/27/2018	13:56:37	0	0	view	@oamk_ouas		Oulu, Finland	@TiinaGall
07/27/2018	07:34:13	0	0	view	@oamk_ouas		Oulu, Finland	@kaaiia
07/27/2018	07:21:54	0	1	view	@oamk_ouas		Oulu, Finland	@kaaiia
07/26/2018	10:48:05	0	3	view	@oamk_ouas		Oulu, Finland	@Qstock
07/26/2018	10:33:10	0	4	view	@oamk_ouas		Oulu, Finland	@Qstock
07/02/2018	11:50:48	1	3	view	@osakoweb		Kajaanintie 32, Oulu	@osakoweb
06/25/2018	14:54:04	1	10	view	@oamk_ouas		Oulu, Finland	@jennyvaa @UniOulu @OYYtwiittaa @osakoweb
06/11/2018	06:21:57	1	1	view	@Kaleva_fi		Oulu, Pohjois- Pohjanmaa	@Kaleva_fi

Total: 150 results.

User Mention Detail

Date (since)	Date (until)	RT's	Like s	Coun t	Name	Mention
09/19/2018	05/02/2019	43	80	6	Sinä osaat!	@TeknologiaTytot
05/02/2019	05/02/2019	3	2	1	Biotalous- erikoistumiskoulutus	@BiotalousERKO
03/19/2019	05/02/2019	8	12	2	JAMK	@JAMK_fi
03/19/2019	05/02/2019	8	12	2	SeAMK	@SeAMK

08/21/2018	05/02/2019	78	261	35	Oamk	@oamk_ouas
05/02/2019	05/02/2019	3	2	1	Lapin AMK Biotalous	@LapinAMKbio
04/30/2019	04/30/2019	10	12	1	Ammattikorkeakouluun	@Ammattikorkeaan
08/24/2018	04/24/2019	6	14	2	Päivi Laajala	@PaiviLaajala
04/24/2019	04/24/2019	2	6	1	Pohjois-Pohjanmaan liitto	@ppliitto
06/25/2018	04/24/2019	45	128	16	University of Oulu	@UniOulu
09/03/2018	04/24/2019	13	44	7	Oamk Amok	@OamkAmok
10/08/2018	04/24/2019	2	9	2	UAS Journal	@UASjournal
04/17/2019	04/17/2019	3	10	1	Johanna Jalas	@j_johanna_29
10/02/2018	04/17/2019	9	47	7	Oamk_raksa	@OamkRaksa
08/21/2018	04/17/2019	24	85	12	Oamk_energyautomatio	@Oamkenergyautom
08/31/2018	04/12/2019	58	200	10	Arene	@Arene_ry
11/05/2018	04/11/2019	4	15	2	Osuuskauppa Arina	@Osuuskauppani
04/09/2019	04/09/2019	2	6	1	Hirsitaloteollisuus ry	@Hirsikoti
10/05/2018	04/09/2019	6	60	4	Kati Mäenpää	@Kamielisa
04/04/2019	04/04/2019	4	7	1	Erja Sormunen	@ErjaSormunen
04/04/2019	04/04/2019	2	1	1	Anne Rännäli	@AnneRannali
03/28/2019	03/28/2019	4	11	1	Talotekniikka	@tateteollisuus
03/28/2019	03/28/2019	4	11	1	OAMK	@OAMK
10/03/2018	03/28/2019	4	25	3	Jouni Kääriäinen	@jokaaria
12/27/2018	03/27/2019	40	61	3	Opetus- ja kulttuuriministeriö	@okmfi
12/05/2018	03/27/2019	6	15	2	Kuutos aika	@Kuutos aika

09/19/2018	03/25/2019	13	24	6	Business Kitchen	@KitchenOulu
09/27/2018	03/19/2019	12	10	2	Luonnonvarakeskus	@LukeFinland
03/19/2019	03/19/2019	5	10	1	TAMK	@TAMK_UAS
03/19/2019	03/19/2019	5	10	1	SavoniaAMK	@SavoniaAMK
09/06/2018	03/19/2019	13	32	5	oamk_kone	@oamk_kone
03/12/2019	03/12/2019	1	3	1	OAJ	@oajry
03/01/2019	03/01/2019	0	14	1	YTHS	@YTHS_FIN
06/11/2018	02/26/2019	8	22	9	Kaleva	@Kaleva_fi
02/21/2019	02/21/2019	3	13	1	Ramboll Finland	@ramboll_fi
08/10/2018	02/19/2019	21	87	4	Petri Lempinen	@LempinenPetri
02/18/2019	02/18/2019	3	9	1	Alisa H.	@AlisaHast
02/11/2019	02/11/2019	7	15	1	Jyrki Laitinen	@JyrkiLaitinen
02/08/2019	02/08/2019	0	0	1	Tiia Honkamaa	@tiahnkm_
01/29/2019	01/29/2019	1	3	1	poliisilauri	@poliisilauri
01/29/2019	01/29/2019	3	6	1	BusinessOulu	@BusinessOulu
01/23/2019	01/23/2019	0	0	1	Valio	@ValioFi
01/23/2019	01/23/2019	1	3	1	stephan Savic	@Buildpoint
01/23/2019	01/23/2019	5	12	1	Ulla Virranniemi	@ulla_v
01/21/2019	01/21/2019	0	3	1	Insinööriliitto	@insinooriliitto
01/21/2019	01/21/2019	0	3	1	Oulun Insinöörit ry.	@OulunInsinoorit
01/18/2019	01/18/2019	0	1	1	Henna Määttä	@HennaMaa
08/24/2018	01/18/2019	10	45	4	Jouko Niinimäki	@JNiinimki

01/17/2019	01/17/2019	1	1	1	Niklas Hagel	@HagelNiklas
01/17/2019	01/17/2019	2	2	1	Digiohjausta kaikille!	@Digiohjaus
11/12/2018	01/16/2019	7	18	3	Oulun seudun ammattiopisto OSAO	@osaotweet
01/11/2019	01/11/2019	4	25	1	Hanna Honkamäkilä	@honkamakila
01/09/2019	01/09/2019	3	7	1	Laura Lääveri	@lauralaaveri
01/08/2019	01/08/2019	1	9	1	Maria Mappes	@mizmaaps
01/08/2019	01/08/2019	1	8	1	Cision	@Cision
01/03/2019	01/03/2019	11	24	1	Demola Global	@Demolanet
12/27/2018	12/27/2018	10	47	1	Metropolia	@metropolia
12/27/2018	12/27/2018	10	47	1	Haaga-Helia amk	@HAAGAHELIAamk
12/21/2018	12/21/2018	6	9	1	Kemijoki Oy	@KemijokiOy
12/19/2018	12/19/2018	0	2	1	Atria Oyj	@Atria_Oyj
12/19/2018	12/19/2018	1	5	1	Pöyry Suomi	@PoyrySuomi
12/17/2018	12/17/2018	0	5	1	Nordea	@Nordea
12/17/2018	12/17/2018	0	3	1	Liikesivistysrahasto	@liikesivistys
12/11/2018	12/11/2018	1	9	1	Taru Pulkkinen	@arvuuttelija
12/05/2018	12/05/2018	2	4	1	eAMK	@eamkhanke
11/29/2018	11/29/2018	1	14	1	Susanna Alaluusua	@SAalaluusua
08/24/2018	11/26/2018	4	10	2	Jouko Paaso	@JoukoPaaso
08/24/2018	11/20/2018	3	21	2	Oulun kaupunki, Oulu	@oulunkaupunki
11/06/2018	11/06/2018	9	12	1	MMM	@mmm_fi
10/19/2018	10/19/2018	2	9	1	Aija Salo	@AijaSalo

10/15/2018	10/15/2018	2	15	1	Tytti Tuppurainen	@TyttiTup
10/15/2018	10/15/2018	2	15	1	Antti Rinne	@AnttiRinnepj
10/03/2018	10/03/2018	1	4	1	Uponor Suomi	@UponorSuomi
10/01/2018	10/01/2018	1	3	1	Caritaslaiset	@caritaslaiset
10/01/2018	10/01/2018	2	8	1	Riitta Tötterström	@rtotter
09/28/2018	09/28/2018	1	8	1	PiiMega Oy	@PiiMega
09/28/2018	09/28/2018	1	8	1	Nokia	@nokia
09/27/2018	09/27/2018	1	6	1	Johanna Laitala	@johannalaitala
09/26/2018	09/26/2018	3	8	1	Pentik Oy	@PentikOy
09/19/2018	09/19/2018	3	12	1	PohjoisPohjanmaanEL Y	@POPELYkeskus
09/19/2018	09/19/2018	1	3	1	Insinööri-lehti	@insinoorilehti
09/17/2018	09/17/2018	1	2	1	Pekka Rahko	@pekkarahko
09/12/2018	09/13/2018	2	5	2	Talenom	@Talenom
08/08/2018	09/12/2018	5	14	3	Oamk IT - OUAS IT	@oamkit
06/25/2018	09/04/2018	3	19	3	Student Union OSAKO	@osakoweb
09/03/2018	09/03/2018	0	3	1	MindBusiness	@MindBusiness_fi
09/03/2018	09/03/2018	0	0	1	Marja-Liisa Kettunen	@Marliisi
08/31/2018	08/31/2018	2	1	1	EHK	@Ehkeskus
08/30/2018	08/30/2018	2	5	1	CityIoT	@CityIoT1
08/28/2018	08/28/2018	0	8	1	Lapin AMK	@LapinAMK
08/24/2018	08/24/2018	3	4	1	Valtteri Törmänen	@Vormanen
06/25/2018	08/24/2018	4	14	2	OYY	@OYYtwiittaa

08/10/2018	08/10/2018	8	15	1	University of Helsinki	@helsinkiuni
08/10/2018	08/10/2018	8	15	1	Aalto University	@AaltoUniversity
07/30/2018	07/30/2018	4	4	1	DIMMY-hanke	@dimmyoamk
07/27/2018	07/27/2018	0	0	1	Tiina Gallén	@TiinaGall
07/27/2018	07/27/2018	0	1	2	Katariina	@kaaiia
07/26/2018	07/26/2018	0	7	2	Qstock Festival	@Qstock
06/25/2018	06/25/2018	1	10	1	Jenny Vaara	@jennyvaaa

Total: 99 results.

Top Mentions

Date (since)	Date (until)	RT's	Likes	Counts	Name	Mention
08/21/2018	05/02/2019	78	261	35	Oamk	@oamk_ouas
06/25/2018	04/24/2019	45	128	16	University of Oulu	@UniOulu
08/21/2018	04/17/2019	24	85	12	Oamk_energyautomatio	@Oamkenergyautom
08/31/2018	04/12/2019	58	200	10	Arene	@Arene_ry
06/11/2018	02/26/2019	8	22	9	Kaleva	@Kaleva_fi
09/03/2018	04/24/2019	13	44	7	Oamk Amok	@OamkAmok
10/02/2018	04/17/2019	9	47	7	Oamk_raksa	@OamkRaksa
09/19/2018	03/25/2019	13	24	6	Business Kitchen	@KitchenOulu
09/19/2018	05/02/2019	43	80	6	Sinä osaat!	@TeknologiaTytot
09/06/2018	03/19/2019	13	32	5	oamk_kone	@oamk_kone

Total: 10 results.

Tweets



Date Time User Profile Img Name Location Tweet (filter: '['ok'])

Total: 0 results.

METADATA



Profile Image

Pic Description

OAMK

Copyright	Original Datetime	Make	Model
Software	Subject Distance	Platform	ICC Date
Thumbnail	Coordinates		

User images and videos



Images Directory

/home/tinfoleak/scripts2/files/oamk_ouas

Media Resources

Media	App	In Reply To	RT	Likes	Source	User	RT User	Tweet
	Twitter Web Client		1	4		@oamk_ouas	04/30/2019 10:20:12	view

- Size: 1162x1200 px

	Twitter Web Client		0	2		@oamk_ouas 03/28/2019 08:36:40	view
---	--------------------------	--	---	---	---	--	----------------------

- Size:
1200x900
px
- Platform:
Microsoft
Corporation
- ICC Date:
1998/02/09
06:49:00

	Twitter Web Client		1	2		@oamk_ouas 03/19/2019 08:03:57	view
---	--------------------------	--	---	---	---	--	----------------------

- Size:
1067x1067
px

	Twitter Web Client		10	17		@oamk_ouas 01/08/2019 12:48:19	view
---	--------------------------	--	----	----	---	--	----------------------

- Size:
1200x1200
px

	Twitter for Android		1	4		@jokaaria 10/02/2018 13:18:32		@oamk_ouas 10/03/2018 05:29:58	view
---	---------------------------	--	---	---	---	---	---	--	----------------------

- Size:
1200x900
px



Twitter
for
iPhone

4 19



[@JNiinimki](#)
09/28/2018
18:36:22

OAMK

[@oamk_ouas](#)
09/28/2018
20:02:19 [view](#)

- Size:
1200x900
px



Twitter
for
iPhone

0 2



[@oamk_ouas](#)
09/06/2018
10:56:13

[view](#)

- Size:
1200x900
px

Total: 7 results.

Geolocation Information



Tweets with geolocation enabled

Date	Time	Coordinates	Media	App	Tweet	Location
11/02/2018	17:23:04				view	Oulu
09/25/2018	12:26:21				view	Stavanger

Total: 2 results.

User route

Tweets	Date-Time (since)	Date-Time (until)	Days	Location	Coordinates
1 [1]	2018-11-02 17:23:04	2018-11-02 17:23:04	1	Oulu	2
1 [1]	2018-09-25 12:26:21	2018-09-25 12:26:21	1	Stavanger	2

Total: 2 results.

Top Locations

Tweets	Date	Time	Mo	Tu	We	Th	Fr	Sa	Su	Coordinates	Place
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Total: 0 results.

www.vicenteaguileradiaz.com

Web interface provided by tinfoleak.com



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INSTALLING RECON-NG ON VMWARE VIRTUAL SERVER WITH UBUNTU

Recon-ng exercises in this thesis were done by using VMvare virtual server with UBUNTU Linux OS. In order to get it Recon-ng working it had to be installed by using Linux terminal with following commands. It should be noted also that actions need to be done as root user – simply type `sudo -s` in the Linux terminal.

First install Recon-ng tool in /opt/ folder

Install Recon-ng

apt-get update && apt-get install recon-ng

```
Resolving deltas: 100% (4562/4562), done.  
root@ubuntu:/opt# ls  
recon-ng  
root@ubuntu:/opt# cd recon-ng/  
root@ubuntu:/opt/recon-ng# apt-get update && apt-get install recon-ng
```

Then installing/cloning repository source

Clone the Recon-ng repository.

git clone https://LaNMaSteR53@bitbucket.org/LaNMaSteR53/recon-ng.git

```
root@ubuntu:~# cd /opt/  
root@ubuntu:/opt# git clone https://LaNMaSteR53@bitbucket.org/LaNMaSteR53/recon-ng.git
```

Then adding proper dependencies packets which are needed Recong-ng tool.

sudo apt-get install libxml2-dev libxslt-dev python-dev lib32z1-dev

```
root@ubuntu:/opt/recon-ng# sudo apt-get install libxml2-dev libxslt-dev python-dev lib32z1-dev
```

and then installing python installer in order to get pip tool working properly.

apt-get install python-pip

```
root@ubuntu:/opt/recon-ng#  
root@ubuntu:/opt/recon-ng# apt-get install python-pip
```

Once dependencies and pip are installed, pip can be used to install requirements by following command.

MALTEGO CE OUTPUTS FROM TRASFORMS RUN ON OAMK.FI DOMAIN

Running transform [ZoomEye] Web Search on 1 entities (from entity "oamk.fi")
Running transform To Files (Office) [using Search Engine] on 1 entities (from entity "oamk.fi")
Running transform To DNS Name [Using Name Schema dictionary] on 1 entities (from entity "oamk.fi")
Running transform [Censys] Search in Alexa's Top 1m on 1 entities (from entity "oamk.fi")
Running transform Shodan Scan IP on 1 entities (from entity "oamk.fi")
Transform [ZoomEye] Web Search returned with 0 entities (from entity "oamk.fi")
Transform [Censys] Search in Alexa's Top 1m returned with 0 entities (from entity "oamk.fi")
Transform [Censys] Search in Alexa's Top 1m done (from entity "oamk.fi")
Transform [ZoomEye] Web Search done (from entity "oamk.fi")
Running transform To DNS Name - SPF (sender policy framework) on 1 entities (from entity "oamk.fi")
Running transform [Securitytrails] Associated Domains on 1 entities (from entity "oamk.fi")
Invalid API Key Provided (from entity "oamk.fi")
Transform To DNS Name [Using Name Schema dictionary] returned with 0 entities (from entity "oamk.fi")
Bing Transforms can only be used with paid versions of Maltego (from entity "oamk.fi")
Transform To Files (Office) [using Search Engine] returned with 0 entities (from entity "oamk.fi")
Transform To DNS Name [Using Name Schema dictionary] done (from entity "oamk.fi")
Transform To Files (Office) [using Search Engine] done (from entity "oamk.fi")
Running transform [FullContact] Search on 1 entities (from entity "oamk.fi")
Running transform To Domain [Find other TLDs] on 1 entities (from entity "oamk.fi")
401 Unauthorized (from entity "oamk.fi")
Transform Shodan Scan IP returned with 0 entities (from entity "oamk.fi")
Transform Shodan Scan IP done (from entity "oamk.fi")
Running transform [Securitytrails] DNS History Field NS on 1 entities (from entity "oamk.fi")
Transform [FullContact] Search returned with 0 entities (from entity "oamk.fi")
Transform [FullContact] Search done (from entity "oamk.fi")
Running transform To Phone Numbers [using Search Engine] on 1 entities (from entity "oamk.fi")
Transform [Securitytrails] Associated Domains returned with 0 entities (from entity "oamk.fi")
Transform [Securitytrails] Associated Domains done (from entity "oamk.fi")
Running transform [Securitytrails] Domain Details on 1 entities (from entity "oamk.fi")
The domain spf.protection.outlook.com was included in the SPF entry for oamk.fi (from entity "oamk.fi")
The domain spf.lianamailer.com was included in the SPF entry for oamk.fi (from entity "oamk.fi")
Transform To DNS Name - SPF (sender policy framework) returned with 12 entities (from entity "oamk.fi")
Transform To DNS Name - SPF (sender policy framework) done (from entity "oamk.fi")
Running transform [Securitytrails] List Subdomains on 1 entities (from entity "oamk.fi")
Transform [Securitytrails] DNS History Field NS returned with 0 entities (from entity "oamk.fi")
Transform [Securitytrails] DNS History Field NS done (from entity "oamk.fi")
Running transform To Person [PGP] on 1 entities (from entity "oamk.fi")
Bing Transforms can only be used with paid versions of Maltego (from entity "oamk.fi")
Transform To Phone Numbers [using Search Engine] returned with 0 entities (from entity "oamk.fi")
Transform To Phone Numbers [using Search Engine] done (from entity "oamk.fi")
Transform To Domain [Find other TLDs] returned with 10 entities (from entity "oamk.fi")
Transform To Domain [Find other TLDs] done (from entity "oamk.fi")
Transform [Securitytrails] Domain Details returned with 0 entities (from entity "oamk.fi")
Transform [Securitytrails] Domain Details done (from entity "oamk.fi")
Running transform To DNS Name [Robtex] on 1 entities (from entity "oamk.fi")
Running transform [Censys] Details on 1 entities (from entity "oamk.fi")
Running transform [ZoomEye] Host Search on 1 entities (from entity "oamk.fi")
Transform [Securitytrails] List Subdomains returned with 0 entities (from entity "oamk.fi")
Transform [Securitytrails] List Subdomains done (from entity "oamk.fi")
Running transform To Domains [DNS] on 1 entities (from entity "oamk.fi")
Transform [ZoomEye] Host Search returned with 0 entities (from entity "oamk.fi")
Transform [ZoomEye] Host Search done (from entity "oamk.fi")

Running transform To Website mentioning domain [Bing] on 1 entities (from entity "oamk.fi")
Transform [Censys] Details returned with 0 entities (from entity "oamk.fi")
Transform [Censys] Details done (from entity "oamk.fi")
Running transform To DNS Name - SOA (Start of Authority) on 1 entities (from entity "oamk.fi")
Transform To Domains [DNS] returned with 1 entities (from entity "oamk.fi")
Transform To DNS Name [Robtex] returned with 12 entities (from entity "oamk.fi")
Bing Transforms can only be used with paid versions of Maltego (from entity "oamk.fi")
Transform To Website mentioning domain [Bing] returned with 0 entities (from entity "oamk.fi")
Transform To Website mentioning domain [Bing] done (from entity "oamk.fi")
Transform To DNS Name [Robtex] done (from entity "oamk.fi")
Transform To Domains [DNS] done (from entity "oamk.fi")
Running transform [Securitytrails] DNS History Field A on 1 entities (from entity "oamk.fi")
Running transform To DNS Name - NS (name server) on 1 entities (from entity "oamk.fi")
Running transform To Website using domain [Bing] on 1 entities (from entity "oamk.fi")
Transform To DNS Name - SOA (Start of Authority) returned with 2 entities (from entity "oamk.fi")
Transform To DNS Name - SOA (Start of Authority) done (from entity "oamk.fi")
Running transform To Email addresses [using Search Engine] on 1 entities (from entity "oamk.fi")
Transform [Securitytrails] DNS History Field A returned with 0 entities (from entity "oamk.fi")
Transform [Securitytrails] DNS History Field A done (from entity "oamk.fi")
Running transform To Files (Interesting) [using Search Engine] on 1 entities (from entity "oamk.fi")
Bing Transforms can only be used with paid versions of Maltego (from entity "oamk.fi")
Transform To Email addresses [using Search Engine] returned with 0 entities (from entity "oamk.fi")
Transform To Email addresses [using Search Engine] done (from entity "oamk.fi")
Running transform To Website [Quick lookup] on 1 entities (from entity "oamk.fi")
Transform To DNS Name - NS (name server) returned with 3 entities (from entity "oamk.fi")
Transform To DNS Name - NS (name server) done (from entity "oamk.fi")
Running transform To Emails @domain [using Search Engine] on 1 entities (from entity "oamk.fi")
Bing Transforms can only be used with paid versions of Maltego (from entity "oamk.fi")
Transform To Files (Interesting) [using Search Engine] returned with 0 entities (from entity "oamk.fi")
Transform To Files (Interesting) [using Search Engine] done (from entity "oamk.fi")
Bing Transforms can only be used with paid versions of Maltego (from entity "oamk.fi")
Transform To Website using domain [Bing] returned with 1 entities (from entity "oamk.fi")
Transform To Website using domain [Bing] done (from entity "oamk.fi")
Running transform To DNS Name [Attempt zone transfer] on 1 entities (from entity "oamk.fi")
Running transform [Censys] Search in IPv4 on 1 entities (from entity "oamk.fi")
Transform To Website [Quick lookup] returned with 1 entities (from entity "oamk.fi")
Transform To Website [Quick lookup] done (from entity "oamk.fi")
Running transform [Securitytrails] DNS History Field MX on 1 entities (from entity "oamk.fi")
Bing Transforms can only be used with paid versions of Maltego (from entity "oamk.fi")
Transform To Emails @domain [using Search Engine] returned with 0 entities (from entity "oamk.fi")
Transform To Emails @domain [using Search Engine] done (from entity "oamk.fi")
Transform [Censys] Search in IPv4 returned with 0 entities (from entity "oamk.fi")
Transform [Censys] Search in IPv4 done (from entity "oamk.fi")
Running transform To DNS Name - MX (mail server) on 1 entities (from entity "oamk.fi")
Running transform [Securitytrails] WHOIS Details on 1 entities (from entity "oamk.fi")
Transform [Securitytrails] DNS History Field MX returned with 0 entities (from entity "oamk.fi")
Transform [Securitytrails] DNS History Field MX done (from entity "oamk.fi")
Running transform To DNS Name [Find common DNS names] on 1 entities (from entity "oamk.fi")
The server ns3.oamk.fi doesn't allow IXFR transfers (from entity "oamk.fi")
The server ns2.oamk.fi doesn't allow AXFR transfers (from entity "oamk.fi")
The server ns3.oamk.fi doesn't allow AXFR transfers (from entity "oamk.fi")
The server ns2.oamk.fi doesn't allow IXFR transfers (from entity "oamk.fi")
The server ns.oamk.fi doesn't allow AXFR transfers (from entity "oamk.fi")
The server ns.oamk.fi doesn't allow IXFR transfers (from entity "oamk.fi")
Transform To DNS Name [Attempt zone transfer] returned with 0 entities (from entity "oamk.fi")
Transform To DNS Name - MX (mail server) returned with 1 entities (from entity "oamk.fi")

Transform To DNS Name - MX (mail server) done (from entity "oamk.fi")
Transform To DNS Name [Attempt zone transfer] done (from entity "oamk.fi")
Running transform To Email addresses [PGP] on 1 entities (from entity "oamk.fi")
Running transform To Phone numbers [From whois info] on 1 entities (from entity "oamk.fi")
Transform To DNS Name [Find common DNS names] returned with 4 entities (from entity "oamk.fi")
Transform To DNS Name [Find common DNS names] done (from entity "oamk.fi")
Running transform [Censys] Search in Certificates on 1 entities (from entity "oamk.fi")
Transform [Censys] Search in Certificates returned with 0 entities (from entity "oamk.fi")
Transform [Censys] Search in Certificates done (from entity "oamk.fi")
Running transform [DocumentsCloud] Search by Domain on 1 entities (from entity "oamk.fi")
Transform [Securitytrails] WHOIS Details returned with 0 entities (from entity "oamk.fi")
Transform [Securitytrails] WHOIS Details done (from entity "oamk.fi")
Running transform To Entities from WHOIS [IBM Watson] on 1 entities (from entity "oamk.fi")
Transform To Phone numbers [From whois info] returned with 3 entities (from entity "oamk.fi")
Transform To Phone numbers [From whois info] done (from entity "oamk.fi")
Running transform Enrich breached domain [v2 @haveibeenpwned] on 1 entities (from entity "oamk.fi")
Transform [DocumentsCloud] Search by Domain returned with 0 entities (from entity "oamk.fi")
Transform [DocumentsCloud] Search by Domain done (from entity "oamk.fi")
Running transform To Email address [From whois info] on 1 entities (from entity "oamk.fi")
@haveibeenpwned is licensed under Creative Commons Attribution 4.0 International (from entity "oamk.fi")
Domain not breached (from entity "oamk.fi")
Transform Enrich breached domain [v2 @haveibeenpwned] returned with 0 entities (from entity "oamk.fi")
Transform Enrich breached domain [v2 @haveibeenpwned] done (from entity "oamk.fi")
Transform To Entities from WHOIS [IBM Watson] returned with 9 entities (from entity "oamk.fi")
Transform To Entities from WHOIS [IBM Watson] done (from entity "oamk.fi")
Running transform To DNS Name (interesting) [Robtex] on 1 entities (from entity "oamk.fi")
Running transform [Securitytrails] WHOIS History on 1 entities (from entity "oamk.fi")
Transform [Securitytrails] WHOIS History returned with 0 entities (from entity "oamk.fi")
Transform [Securitytrails] WHOIS History done (from entity "oamk.fi")
Transform To Email address [From whois info] returned with 1 entities (from entity "oamk.fi")
Transform To DNS Name (interesting) [Robtex] returned with 1 entities (from entity "oamk.fi")
Transform To DNS Name (interesting) [Robtex] done (from entity "oamk.fi")
Transform To Email address [From whois info] done (from entity "oamk.fi")
Too much content.for
<http://keyserver.ubuntu.com:11371/pks/lookup?exact=off&op=vindex&search=oamk.fi> (from entity "oamk.fi")
Request read time out.for <http://pgp.mit.edu:11371/pks/lookup?exact=off&op=vindex&search=oamk.fi>
(from entity "oamk.fi")
Transform To Person [PGP] returned with 0 entities (from entity "oamk.fi")
Transform To Person [PGP] done (from entity "oamk.fi")
Too much content.for
<http://keyserver.ubuntu.com:11371/pks/lookup?exact=off&op=vindex&search=oamk.fi> (from entity "oamk.fi")
Request read time out.for <http://pgp.mit.edu:11371/pks/lookup?exact=off&op=vindex&search=oamk.fi>
(from entity "oamk.fi")
Transform To Email addresses [PGP] returned with 12 entities (from entity "oamk.fi")
Transform To Email addresses [PGP] done (from entity "oamk.fi")