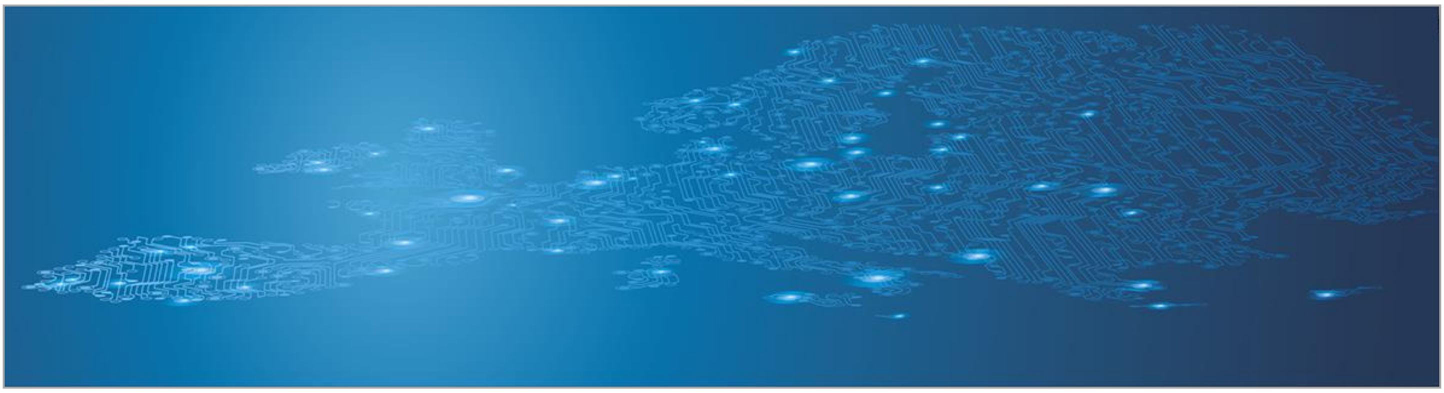

Common Framework for Artifact Analysis Activities

Artifact analysis training material

December 2014

European Union Agency for Network and Information Security www.enisa.europa.eu

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Authors

This document was created by Lauri Palkmets, Cosmin Ciobanu, Yonas Leguesse, and Christos Sidiropoulos in consultation with DFN-CERT Services[1] (Germany), ComCERT[2] (Poland), and S-CURE[3] (The Netherlands).

Contact

For contacting the authors please use cert-relations@enisa.europa.eu

For media enquires about this paper, please use press@enisa.europa.eu

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[1] Klaus Möller, and Mirko Wollenberg

[2] Mirosław Maj, Tomasz Chlebowski, Krystian Kochanowski, Dawid Osojca, Paweł Weżgowiec, and Adam Ziaja

[3] Michael Potter, Alan Robinson, and Don Stikvoort

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Table of Contents

Main Objective	In this exercise the student will learn how to collect, store and correlate different types of information about samples and how to make use of this information with the assumption that having a structured and organised database is a good way to reaching synergy in the area of artifact analysis and incident investigation. Students will learn what kind of data can be collected, what standards are relevant and how they can be used during analysis and investigations. Students will learn how to design their “Threat Intelligence” environment and what kind of tools they can use.	
Targeted Audience	CERT staff involved in the process of incident handling, especially those responsible for detection of new threats related directly to the CERT customers.	
Total duration	4 hours	
Time Schedule	**Introduction to the exercise**	0.5 hour
	Task 1: MANTIS	1.5 hour
	Task 2: CRITs	1.0 hours
	Task 3: Python and common data formats	1.0 hour
Frequency	Every time a new member joins the team.	

1 Introduction to the exercise

Threat and vulnerability information exchange has become one of the most burning issues within the security community. New vulnerabilities in popular software packages are discovered daily and new threats are identified. However, most of them are published in “human readable” formats – as vendors’ web notes, pdf reports, forum posts, and so on. It’s not easy to follow such a stream of unstructured information effectively enough to quickly implement file searches and network traffic patterns into own defence systems such as IDS/IPS or malware scanners.

We are also aware that some of the most notable vendors of network defence and endpoint protection systems focus only on vulnerabilities and threats that have been already addressed by software vendors and where patches are available. This is a sensible practice in terms of security products marketing but a complete failure in terms of information security practice. No 0-day vulnerabilities would be known in the systems ‘protected’ if security managers relied only on these products.

Security systems – IDS/IPS or endpoint protection – often give the possibility of creating own threat and vulnerability definitions to close or at least narrow the gap between threat/vulnerability detection and vendor’s response. Again, however, we encounter the problem of unstructured security information that slows down the implementation of countermeasures and requires much higher skill level from the implementers.

In this exercise we want to show some open formats that gain much attention[4] and are promoted by US organisations and agencies[5] to be used by vendors, especially whose products are deployed in critical infrastructure systems[6].

[4] https://www.bluecoat.com/security-blog/2014-08-26/stix-and-taxii-road-becoming-de-facto-standard

[5] See http://csrc.nist.gov/publications/drafts/800-150/sp800_150_draft.pdf for a draft version of new NIST publication on cyber threat information sharing

[6] http://www.networkworld.com/article/2225414/cisco-subnet/the-international-security-community-should-embrace-the-stix-and-taxii-standards.html

1.1 Various types of data formats related to malware analysis[7]

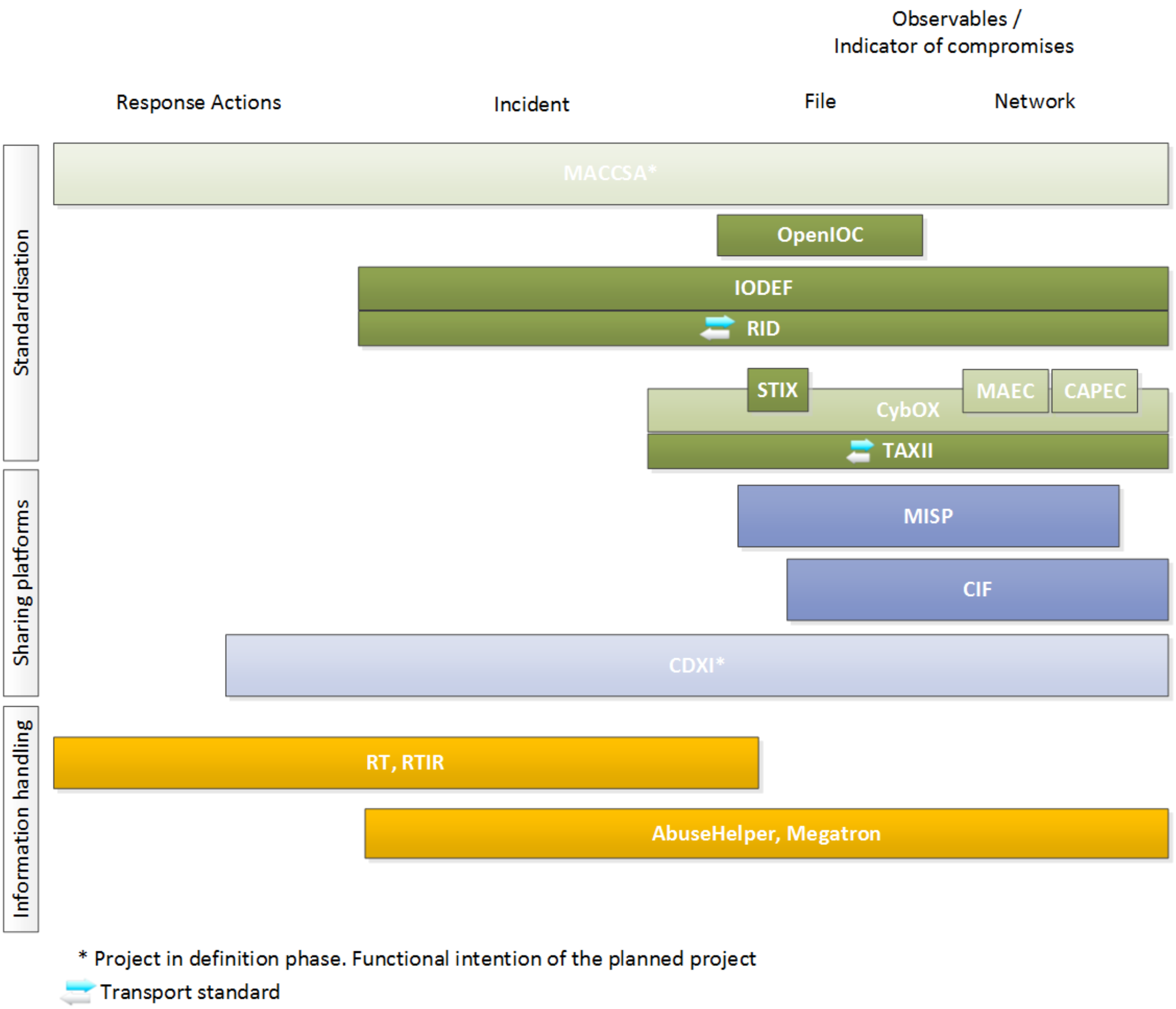


Figure 1. Mapping of Standardisation and Solutions for Response, Incident, and IoC Information Sharing

Several practices have emerged in Europe and worldwide that aim at addressing effective information exchange and sharing data about cyber incidents. These efforts can be considered as possible approaches to secure information exchange.

Any piece of information that can be used to search for or identify potentially compromised systems is known as an indicator of compromise (IoC). These IoCs can include IP address/domain name, URL, file hash, email address, X-mailer, HTTP user agent, and file mutex. This information can be compiled into incident reports and enriched with analysis and remediation reports. Several standards exist for formatting information, but there is not a single leading one in place. However, the trend to share structured information rather than unstructured in plain emails can be observed. While, as mentioned, there is currently no single standard for data format that is generally accepted, it is crucial for an automated processing of received information. We provide an overview of existing

[7] Contents of the chapters "Various types of data formats related to malware analysis" and "Common data formats (STIX, Cybox, IODEF)" come from “4. Data Exchange Formats and Current Efforts for Secure and Effective Data Exchange” available from ENISA at https://www.enisa.europa.eu/activities/cert/support/data-sharing and https://www.us-cert.gov/Information-Sharing-Specifications-Cybersecurity

standards below, followed by a summary and discussion of known challenges related to automated IoC exchanges.

Multiple initiatives exist, or are currently in development, that aim to address the aforementioned barriers in a systematic way: CERTs still find it difficult to exchange information about (targeted) malware and attacks within a group of trusted partners or by bilateral agreement.

Despite the trend to exchange structured information, much of the information sharing nowadays still occurs through unstructured reports. Where, in order to process the data, it is necessary to manually copy & paste the information into text files that have to be parsed to be exported to (N)IDS and systems or used in log searches.

Some solutions to overcome these problems are being developed by CERTs, NATO, and private organizations, often with the participation of multiple stakeholders. In this document a few of them that enjoy a certain degree of support in the CERT community, which have reached a good level of development, and might address the barriers presented in this report are presented. Adopting these solutions more widely would help CERTs in forming and building larger sharing communities to exchange the benefits of previous detections and remediation efforts. This approach ultimately would lead to more confident and efficient incident response.

1.2 Standardisation Efforts for Sharing Indicators of Compromise

In this chapter we present a choice of security information sharing standardisation efforts. A more complete landscape of security information sharing methods – both structured and not can be found in the ENISA 'Detect, SHARE, Protect' document[8]

1.2.1 OpenIOC

OpenIOC[9] is an extensible XML schema that enables to describe the technical characteristics of threats, an attacker's methodology, or other evidence of compromise. Originally, it was designed to enable some commercial products to codify intelligence in order to rapidly search for potential security breaches. In response to requests from across the user community, the company (Mandiant) has standardised and open-sourced the OpenIOC schema to allow communication of threat information at machine speed (meaning automatically). Future versions of OpenIOC will include more flexible indicators and metadata extensions to the IoC (comments, confidentiality, criticality, etc.).

1.2.2 MACCSA (Multinational Alliance for Collaborative for Cyber Situational Awareness)

MACCSA is a continuation of MNE7 (Multinational Experiment 7), which aims to create the conditions to enable the development, implementation, and operation of the Information Sharing Framework (ISF)[10] for Collaborative Cyber Situational Awareness (CCSA).

Organisations targeted by MACCSA include international and multinational bodies such as the EU Military Staff, Europol, NATO, the U.S., countries from Europe and Asia/Pacific, and a number of private companies such as security vendors, operators, industrial companies, and consultancies. The ISF of MACCSA includes two main components: information sharing model and information sharing management. The information sharing model describes the means required for sharing information

[8] https://www.enisa.europa.eu/activities/cert/support/data-sharing/detect-share-protect-solutions-for-improving-threat-data-exchange-among-certs/at_download/fullReport

[9] http://www.openioc.org/

[10] https://www.terena.org/mail-archives/refeds/pdfjJz1CRtYC4.pdf

– proactive (push) and reactive (pull) – on alerts and warnings, best practices, security quality management, and for handling proactive artefacts.

Information sharing management focuses on ensuring the quality of the shared information. MACCSA proposes a mesh of hubs and nodes to coordinate information sharing. The model is based on existing federated secure collaboration capabilities in defence, intelligence, and industry, comprising independent entities bound together by information sharing agreements and further united by collaborative and community-centric governance authorities.

1.2.3 Common data formats (STIX, CybOX, IODEF)[11]

TAXII, STIX, and CybOX (all free for public use) are community-driven technical specifications designed to enable automated information sharing for cyber security situational awareness, real-time network defence, and sophisticated threat analysis.

- TAXII™, the Trusted Automated eXchange of Indicator Information
- STIX™, the Structured Threat Information eXpression
- CybOX™, the Cyber Observable eXpression

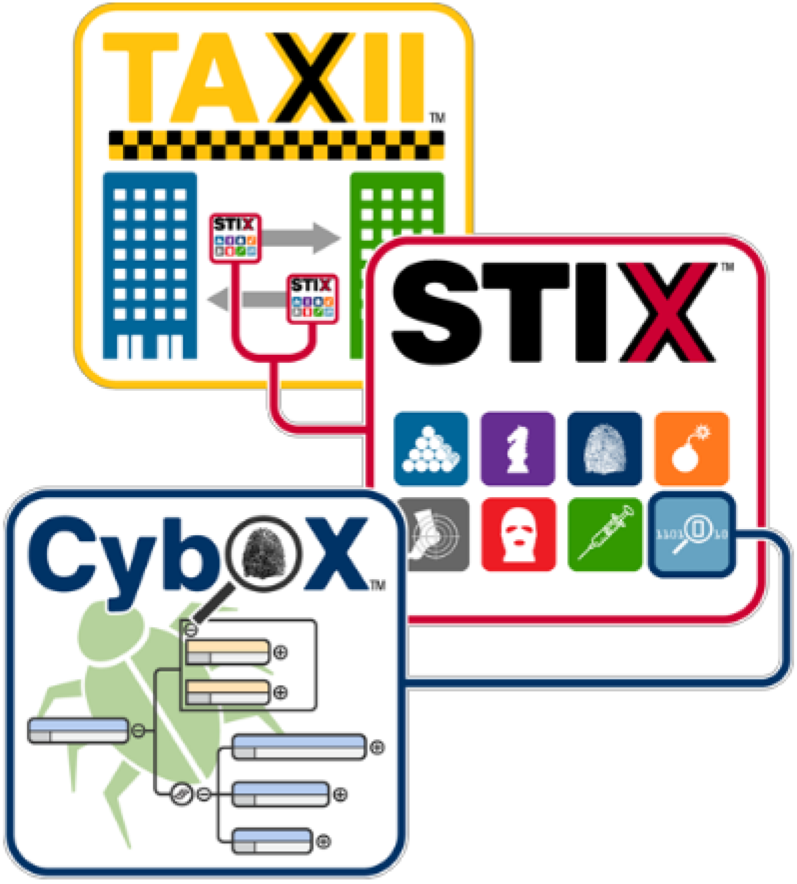


Figure 2. TAXII, STIX and CybOX logos[12]

[11] Part of this introduction is taken from this original source https://www.us-cert.gov/Information-Sharing-Specifications-Cybersecurity

[12] Picture from https://www.us-cert.gov/Information-Sharing-Specifications-Cybersecurity

1.2.3.1 Structured Threat Information Expression (STIX)

Structured Threat Information Expression - STIX[13] is a relatively recent collaborative community-driven effort to define and develop a standardised language to represent structured cyber threat information. The STIX Language is intended to convey the full range of potential cyber threat information and strives to be fully expressive, flexible, extensible, automatable, and as human-readable as possible. Any interested party can participate in evolving STIX as part of its open and collaborative community.

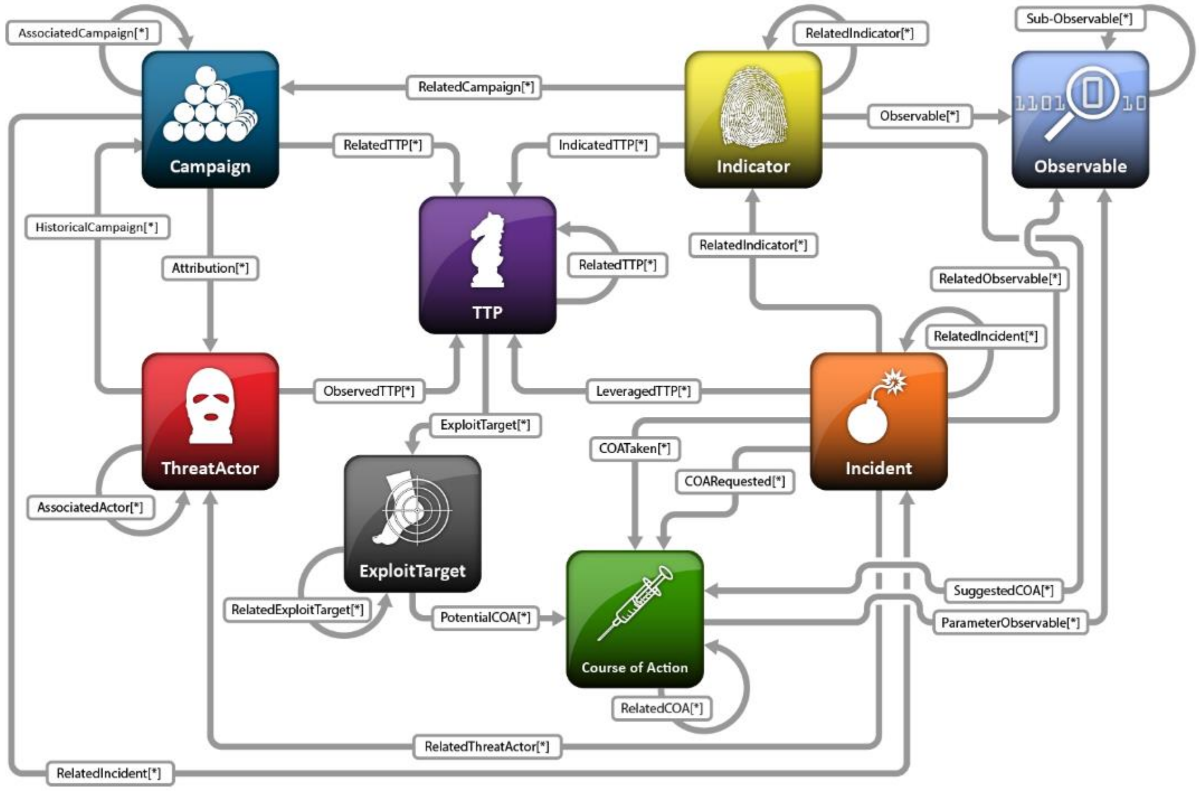


Figure 3. STIX v1.1 Architecture[14]

1.2.3.2 Cyber Observable Expression (CybOX)

The Cyber Observable Expression CybOX™[15] is a standardised schema for the specification, capture, characterisation, and communication of event properties that are observable in the operational domain. A wide variety of high-level cyber security use cases rely on such information, including event management/logging, malware characterisation, intrusion detection, incident response/management, and attack pattern characterisation. CybOX provides a common mechanism (structure and content) for addressing cyber observables across and among this full range of use cases, improving consistency, efficiency, interoperability, and overall situational awareness.

1.2.3.3 Incident Object Description Exchange Format (IODEF)

The Incident Object Description Exchange Format (IODEF) specification (RFC 5070[16]) defines a data representation that provides a framework for sharing information commonly exchanged by CERTs

[13] http://stix.mitre.org
[14] https://stix.mitre.org/about/documents/STIX_v1.1_Introduction_Briefing.pdf
[15] http://cybox.mitre.org
[16] http://www.ietf.org/rfc/rfc5070.txt

about computer security incidents. It provides an XML representation for conveying incident information across administrative domains between parties that have an operational responsibility for remediation or watch-and-warning over defined constituencies. The data model encodes information about hosts, networks, and the services running on these systems; attack methodology and associated forensic evidence; the impact of the activity; and limited approaches for documenting workflow.

2 MANTIS

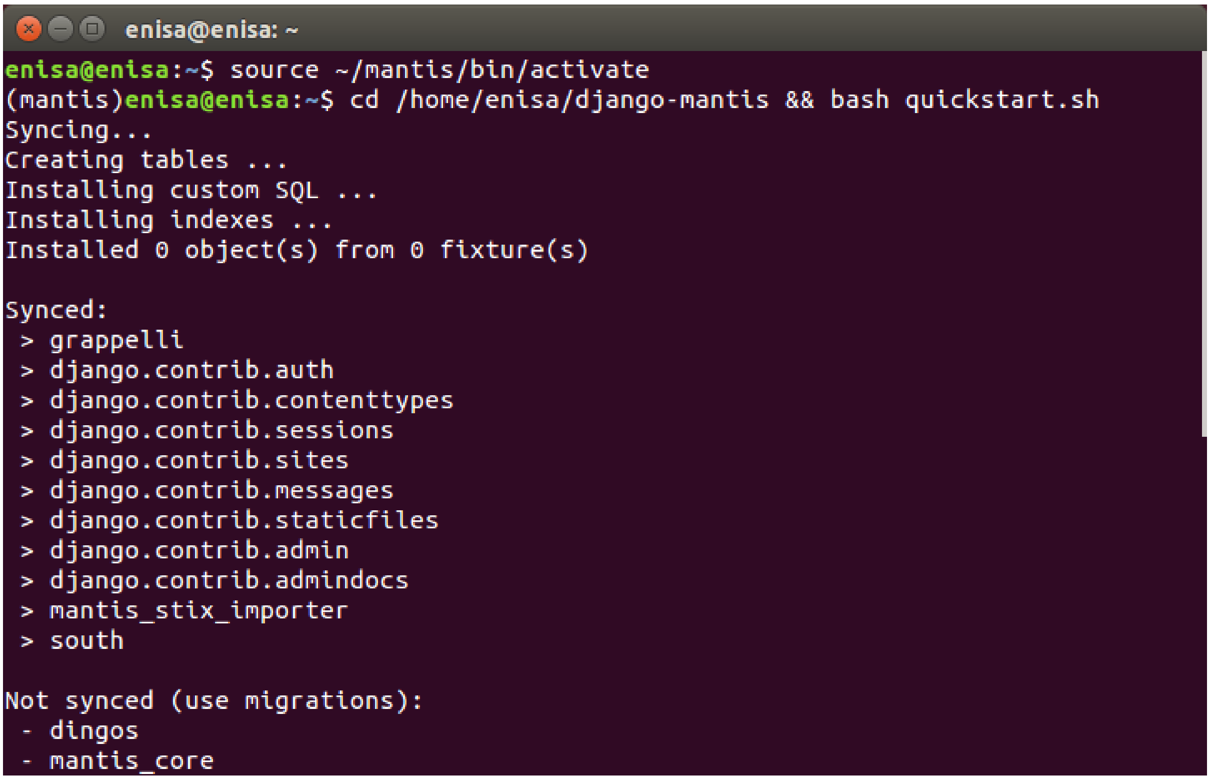
The MANTIS (Model-based Analysis of Threat Intelligence Sources) framework consists of several Django[17] apps that, in combination, support the management of cyber threat intelligence expressed in standards such as STIX, CybOX, OpenIOC, IODEF (RFC 5070), etc.

Unlike previous exercises, MANTIS is already installed in our virtual machine. Installation instructions can be found in appendices at the end of this document.

2.1 Run MANTIS

To start MANTIS type the following commands in a terminal:

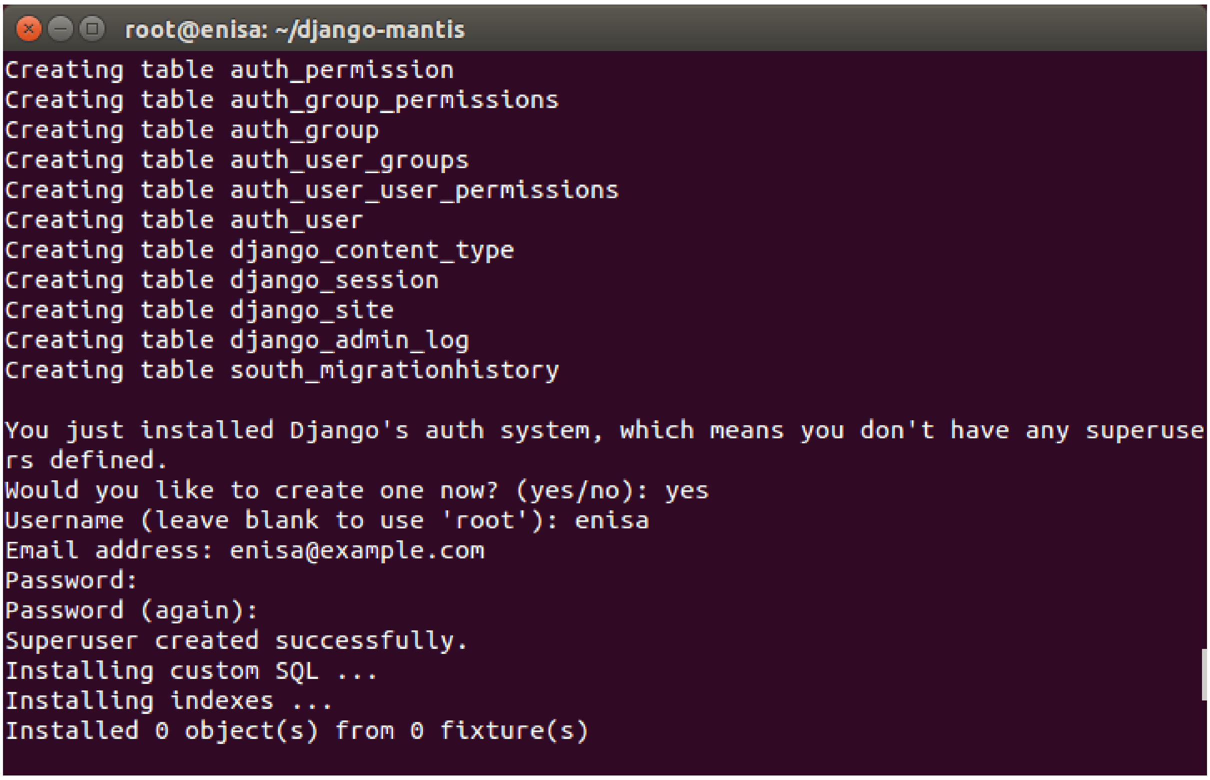
```
enisa@enisa:~/django-mantis$ source /home/enisa/mantis/bin/activate

(mantis)enisa@enisa:~/django-mantis$ cd /home/enisa/django-mantis && bash quickstart.sh
```



```
enisa@enisa:~$ source ~/mantis/bin/activate
(mantis)enisa@enisa:~$ cd /home/enisa/django-mantis && bash quickstart.sh
Syncing...
Creating tables ...
Installing custom SQL ...
Installing indexes ...
Installed 0 object(s) from 0 fixture(s)

Synced:
 > grappelli
 > django.contrib.auth
 > django.contrib.contenttypes
 > django.contrib.sessions
 > django.contrib.sites
 > django.contrib.messages
 > django.contrib.staticfiles
 > django.contrib.admin
 > django.contrib.admindocs
 > mantis_stix_importer
 > south

Not synced (use migrations):
 - dingos
 - mantis_core
```

Figure 3. MANTIS first run

[17] https://www.djangoproject.com/



root@enisa: ~/django-mantis

```
Creating table auth_permission
Creating table auth_group_permissions
Creating table auth_group
Creating table auth_user_groups
Creating table auth_user_user_permissions
Creating table auth_user
Creating table django_content_type
Creating table django_session
Creating table django_site
Creating table django_admin_log
Creating table south_migrationhistory

You just installed Django's auth system, which means you don't have any superuse
rs defined.
Would you like to create one now? (yes/no): yes
Username (leave blank to use 'root'): enisa
Email address: enisa@example.com
Password:
Password (again):
Superuser created successfully.
Installing custom SQL ...
Installing indexes ...
Installed 0 object(s) from 0 fixture(s)
```

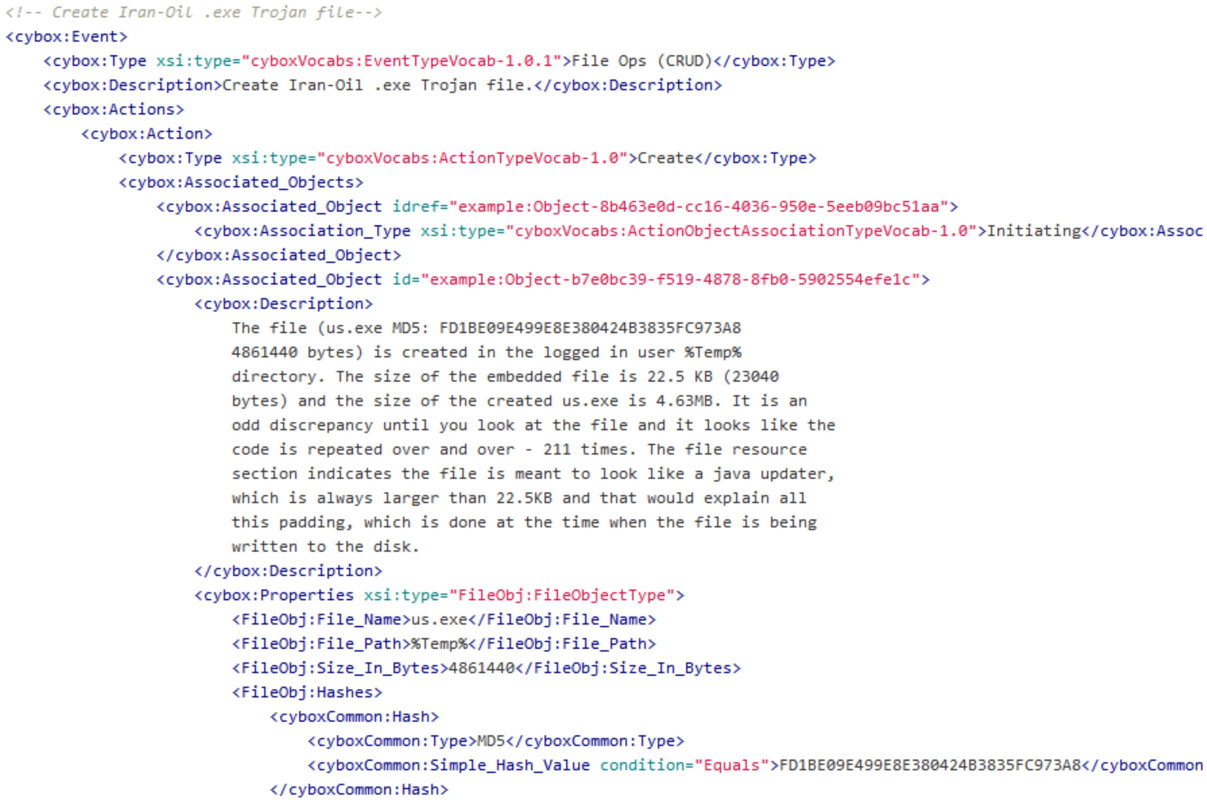
Figure 4. Creation of first MANTIS user

On the first time after installation the '*quickstart.sh*' script will ask if you want to create an administrative user for Django. Type 'yes' and then enter user name (enisa in this case, it will be the default if run as enisa system user), email address (not essential in this installation, enisa@example.com for instance) and a password. We chose password 'toor'. Answer 'yes' to the question about overwriting static files.

Login and password to your VM installation are login 'enisa' and password 'toor' as above.

2.2 Import data to Mantis

Now it is time to import some data to our database to search it through. During this exercise we will use some of the samples provided by CybOX Project at https://github.com/CybOXProject/schemas/tree/master/samples.



```
<!-- Create Iran-Oil .exe Trojan file-->
<cybox:Event>
    <cybox:Type xsi:type="cyboxVocabs:EventTypeVocab-1.0.1">File Ops (CRUD)</cybox:Type>
    <cybox:Description>Create Iran-Oil .exe Trojan file.</cybox:Description>
    <cybox:Actions>
        <cybox:Action>
            <cybox:Type xsi:type="cyboxVocabs:ActionTypeVocab-1.0">Create</cybox:Type>
            <cybox:Associated_Objects>
                <cybox:Associated_Object idref="example:Object-8b463e0d-cc16-4036-950e-5eeb09bc51aa">
                    <cybox:Association_Type xsi:type="cyboxVocabs:ActionObjectAssociationTypeVocab-1.0">Initiating</cybox:Assoc
                </cybox:Associated_Object>
                <cybox:Associated_Object id="example:Object-b7e0bc39-f519-4878-8fb0-5902554efe1c">
                    <cybox:Description>
                        The file (us.exe MD5: FD1BE09E499E8E380424B3835FC973A8
                        4861440 bytes) is created in the logged in user %Temp%
                        directory. The size of the embedded file is 22.5 KB (23040
                        bytes) and the size of the created us.exe is 4.63MB. It is an
                        odd discrepancy until you look at the file and it looks like the
                        code is repeated over and over - 211 times. The file resource
                        section indicates the file is meant to look like a java updater,
                        which is always larger than 22.5KB and that would explain all
                        this padding, which is done at the time when the file is being
                        written to the disk.
                    </cybox:Description>
                    <cybox:Properties xsi:type="FileObj:FileObjectType">
                        <FileObj:File_Name>us.exe</FileObj:File_Name>
                        <FileObj:File_Path>%Temp%</FileObj:File_Path>
                        <FileObj:Size_In_Bytes>4861440</FileObj:Size_In_Bytes>
                        <FileObj:Hashes>
                            <cyboxCommon:Hash>
                                <cyboxCommon:Type>MD5</cyboxCommon:Type>
                                <cyboxCommon:Simple_Hash_Value condition="Equals">FD1BE09E499E8E380424B3835FC973A8</cyboxCommon
                            </cyboxCommon:Hash>
```

Figure 5. "CybOX_Iran-Oil_Dynamic.xml"

We will use the file 'CybOX_Iran-Oil_Dynamic.xml' from:

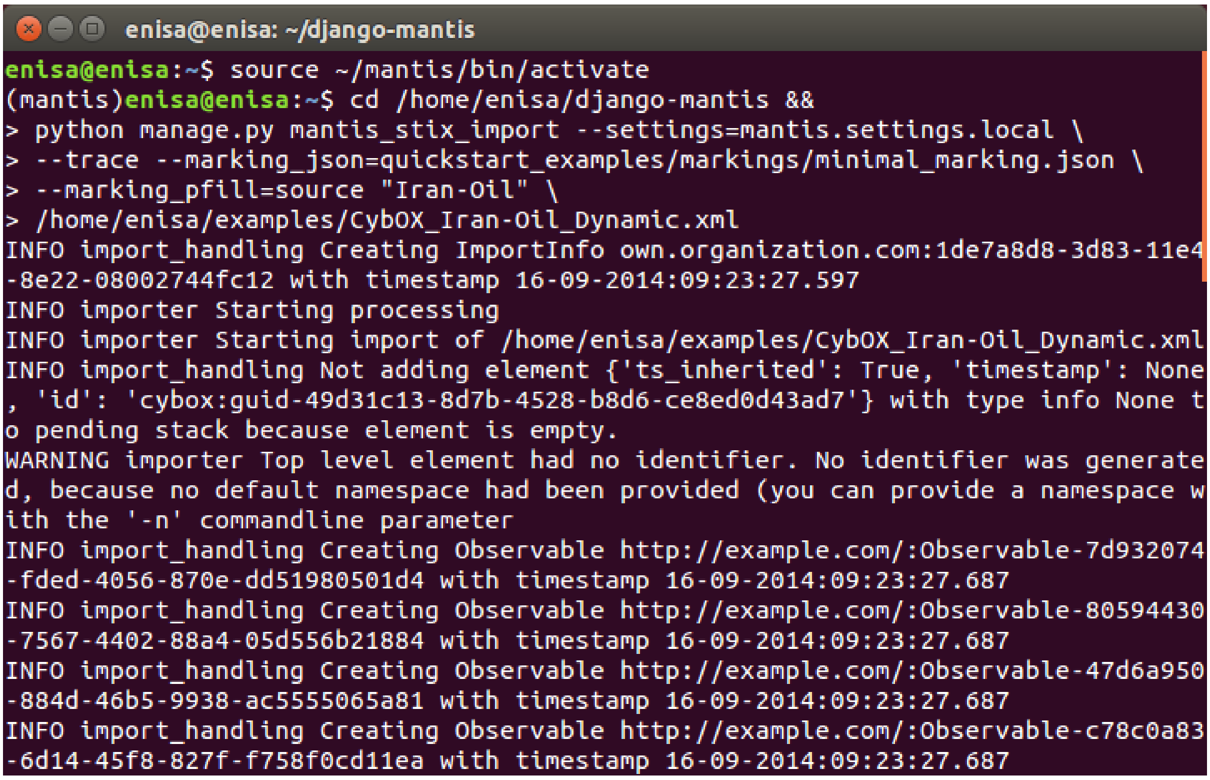
https://raw.githubusercontent.com/CybOXProject/schemas/master/samples/CybOX_Iran-Oil_Dynamic.xml

This file contains information about 'Iran-Oil' (among many other names used) attack campaign from March 2012 written in CybOX format.

This file is located at *'/home/enisa/examples/'* directory for your convenience.

To import the data to MANTIS, please write the following commands:

```
enisa@enisa:~/django-mantis$ source ~/mantis/bin/activate

(mantis)enisa@enisa:~/django-mantis$ cd /home/enisa/django-mantis &&

python manage.py mantis_stix_import --settings=mantis.settings.local \

--trace --marking_json=quickstart_examples/markings/minimal_marking.json \

--marking_pfill=source "Iran-Oil" \

/home/enisa/examples/CybOX_Iran-Oil_Dynamic.xml
```



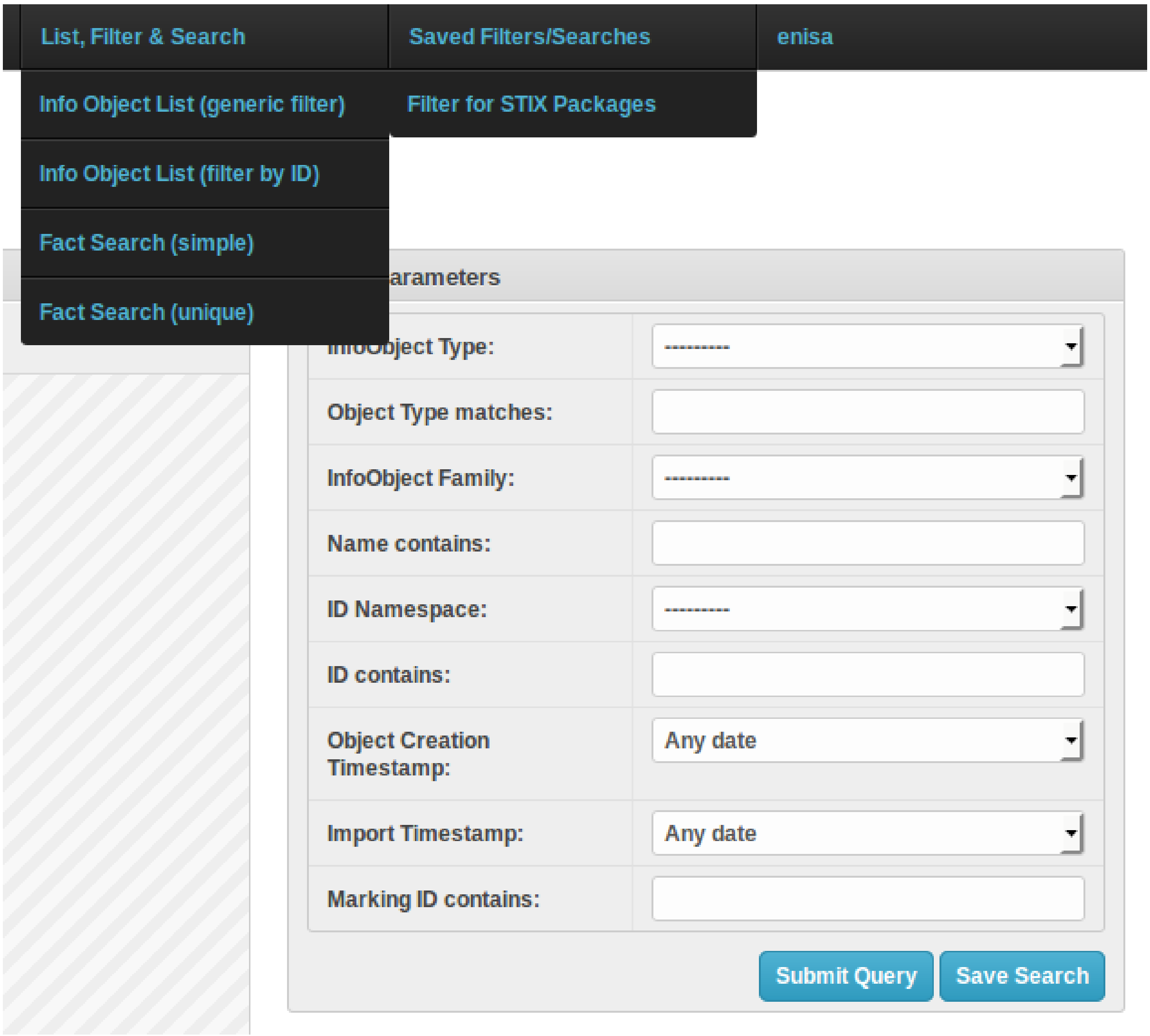
```
enisa@enisa:~$ source ~/mantis/bin/activate
(mantis)enisa@enisa:~$ cd /home/enisa/django-mantis &&
> python manage.py mantis_stix_import --settings=mantis.settings.local \
> --trace --marking_json=quickstart_examples/markings/minimal_marking.json \
> --marking_pfill=source "Iran-Oil" \
> /home/enisa/examples/CybOX_Iran-Oil_Dynamic.xml
INFO import_handling Creating ImportInfo own.organization.com:1de7a8d8-3d83-11e4
-8e22-08002744fc12 with timestamp 16-09-2014:09:23:27.597
INFO importer Starting processing
INFO importer Starting import of /home/enisa/examples/CybOX_Iran-Oil_Dynamic.xml
INFO import_handling Not adding element {'ts_inherited': True, 'timestamp': None
, 'id': 'cybox:guid-49d31c13-8d7b-4528-b8d6-ce8ed0d43ad7'} with type info None t
o pending stack because element is empty.
WARNING importer Top level element had no identifier. No identifier was generate
d, because no default namespace had been provided (you can provide a namespace w
ith the '-n' commandline parameter
INFO import_handling Creating Observable http://example.com/:Observable-7d932074
-fded-4056-870e-dd51980501d4 with timestamp 16-09-2014:09:23:27.687
INFO import_handling Creating Observable http://example.com/:Observable-80594430
-7567-4402-88a4-05d556b21884 with timestamp 16-09-2014:09:23:27.687
INFO import_handling Creating Observable http://example.com/:Observable-47d6a950
-884d-46b5-9938-ac5555065a81 with timestamp 16-09-2014:09:23:27.687
INFO import_handling Creating Observable http://example.com/:Observable-c78c0a83
-6d14-45f8-827f-f758f0cd11ea with timestamp 16-09-2014:09:23:27.687
```

Figure 6. Importing data to MANTIS

Now point your web browser to the web interface of MANTIS running at http://localhost:8000/mantis/View/InfoObject/ .

Login to this interface with username “enisa” and password “toor” (the credentials created in the previous step).

The MANTIS user interface is built around a drop-down menu at the top of the screen. All the following tasks begin with choosing one of the actions from this menu.



InfoObject Type:	----------
Object Type matches:	
InfoObject Family:	----------
Name contains:	
ID Namespace:	----------
ID contains:	
Object Creation Timestamp:	Any date
Import Timestamp:	Any date
Marking ID contains:	

Figure 7. Mantis drop down menu

2.3 Find e-mail addresses

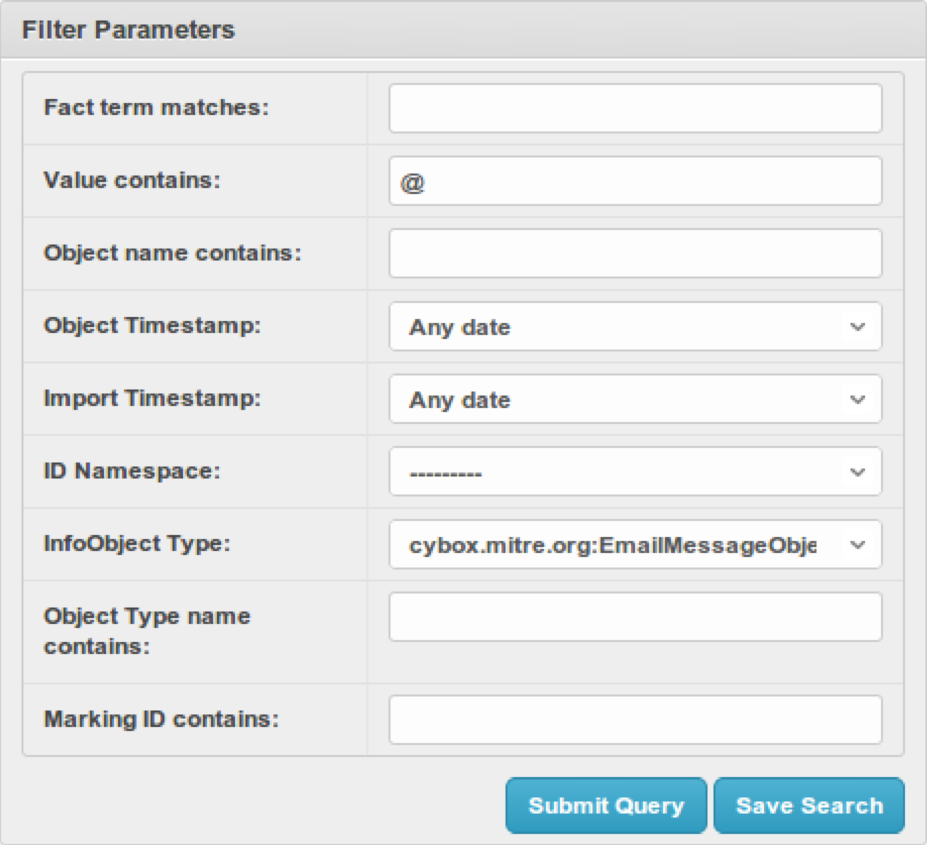
To find e-mail addresses in the MANTIS database we need to find e-mail messages first. Select ‘Fact Search (simple)’ from the drop down menu:

List, Filter & Search → Fact Search (simple)

Now type and select the following values in the form that showed up:

Value contains: @

InfoObject Type: cybox.mitre.org:EmailMessageObject

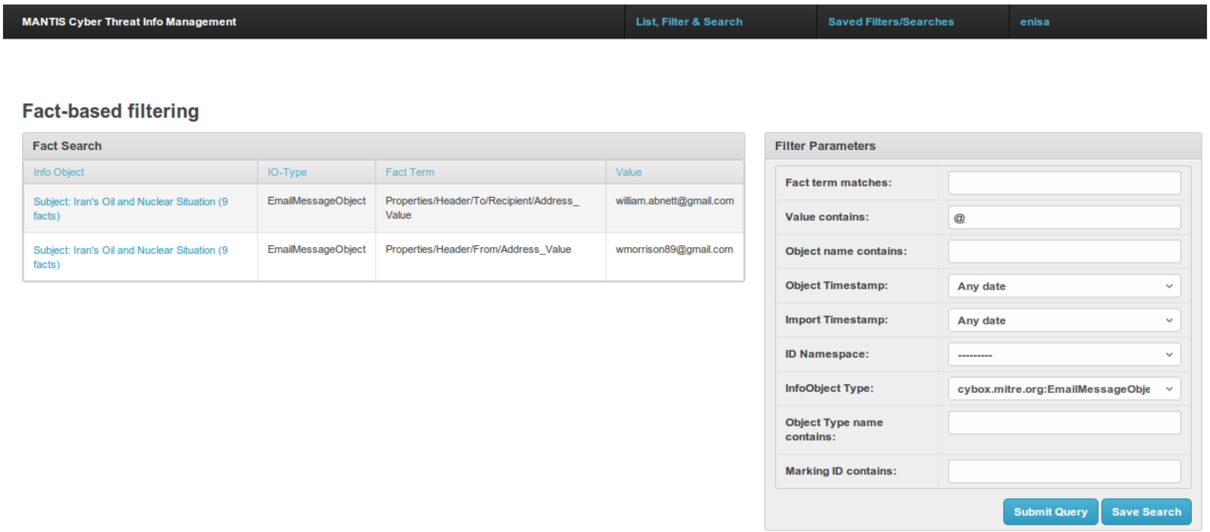


Filter Parameters

Fact term matches:	
Value contains:	@
Object name contains:	
Object Timestamp:	Any date
Import Timestamp:	Any date
ID Namespace:	---------
InfoObject Type:	cybox.mitre.org:EmailMessageObje
Object Type name contains:	
Marking ID contains:	

Figure 8. E-mail addresses Filter Parameters

After following these instructions you will see two messages found:



Fact-based filtering

Fact Search

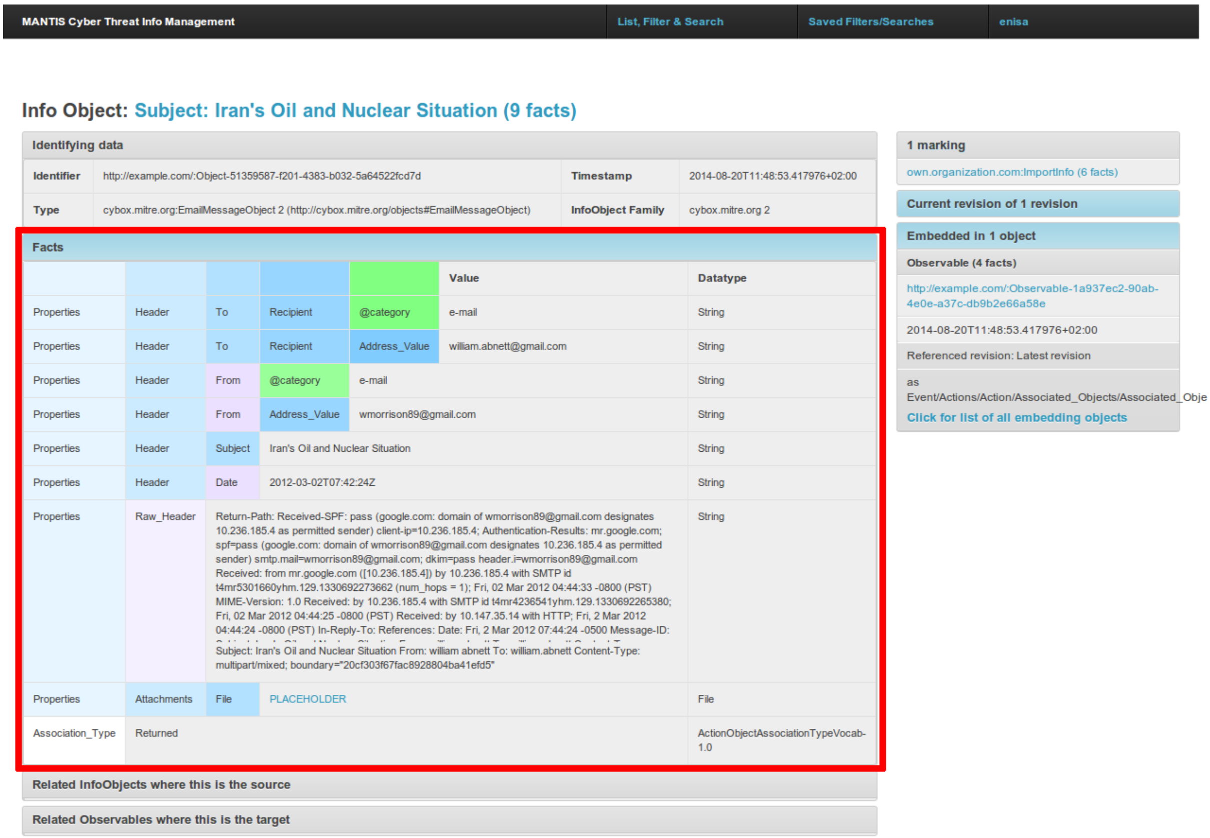
Info Object	IO-Type	Fact Term	Value
Subject: Iran's Oil and Nuclear Situation (9 facts)	EmailMessageObject	Properties/Header/To/Recipient/Address_Value	william.abnett@gmail.com
Subject: Iran's Oil and Nuclear Situation (9 facts)	EmailMessageObject	Properties/Header/From/Address_Value	wmorrison89@gmail.com

Filter Parameters

Fact term matches:	
Value contains:	@
Object name contains:	
Object Timestamp:	Any date
Import Timestamp:	Any date
ID Namespace:	---------
InfoObject Type:	cybox.mitre.org:EmailMessageObje
Object Type name contains:	
Marking ID contains:	

Figure 9. MANTIS Fact-based filtering on e-mail messages

In the 'Fact-based filtering' part of the window you will see the search results, while in the 'Value' column there will be e-mail addresses. Select one of these from the list by clicking on the 'Info Object' element.



MANTIS Cyber Threat Info Management | List, Filter & Search | Saved Filters/Searches | enisa

Info Object: Subject: Iran's Oil and Nuclear Situation (9 facts)

Identifying data

Identifier	http://example.com/:Object-51359587-f201-4383-b032-5a64522fcd7d	**Timestamp**	2014-08-20T11:48:53.417976+02:00
Type	cybox.mitre.org:EmailMessageObject 2 (http://cybox.mitre.org/objects#EmailMessageObject)	**InfoObject Family**	cybox.mitre.org 2

Facts

					Value	Datatype
Properties	Header	To	Recipient	@category	e-mail	String
Properties	Header	To	Recipient	Address_Value	william.abnett@gmail.com	String
Properties	Header	From	@category		e-mail	String
Properties	Header	From	Address_Value		wmorrison89@gmail.com	String
Properties	Header	Subject			Iran's Oil and Nuclear Situation	String
Properties	Header	Date			2012-03-02T07:42:24Z	String
Properties	Raw_Header				Return-Path: Received-SPF: pass (google.com: domain of wmorrison89@gmail.com designates 10.236.185.4 as permitted sender) client-ip=10.236.185.4; Authentication-Results: mr.google.com; spf=pass (google.com: domain of wmorrison89@gmail.com designates 10.236.185.4 as permitted sender) smtp.mail=wmorrison89@gmail.com; dkim=pass header.i=wmorrison89@gmail.com Received: from mr.google.com ([10.236.185.4]) by 10.236.185.4 with SMTP id t4mr5301660yhm.129.1330692273662 (num_hops = 1); Fri, 02 Mar 2012 04:44:33 -0800 (PST) MIME-Version: 1.0 Received: by 10.236.185.4 with SMTP id t4mr4236541yhm.129.1330692265380; Fri, 02 Mar 2012 04:44:25 -0800 (PST) Received: by 10.147.35.14 with HTTP; Fri, 2 Mar 2012 04:44:24 -0800 (PST) In-Reply-To: References: Date: Fri, 2 Mar 2012 07:44:24 -0500 Message-ID: [illegible] Subject: Iran's Oil and Nuclear Situation From: william abnett To: william.abnett Content-Type: multipart/mixed; boundary="20cf303f67fac8928804ba41efd5"	String
Properties	Attachments	File			PLACEHOLDER	File
Association_Type	Returned					ActionObjectAssociationTypeVocab-1.0

Related InfoObjects where this is the source

Related Observables where this is the target

1 marking

own.organization.com:ImportInfo (6 facts)

Current revision of 1 revision

Embedded in 1 object

Observable (4 facts)

http://example.com/:Observable-1a937ec2-90ab-4e0e-a37c-db9b2e66a58e

2014-08-20T11:48:53.417976+02:00

Referenced revision: Latest revision

as Event/Actions/Action/Associated_Objects/Associated_Obje

Click for list of all embedding objects

Figure 10. E-mail details

In the last window you can see standard e-mail details such as e-mail addresses, subject, attachments etc.

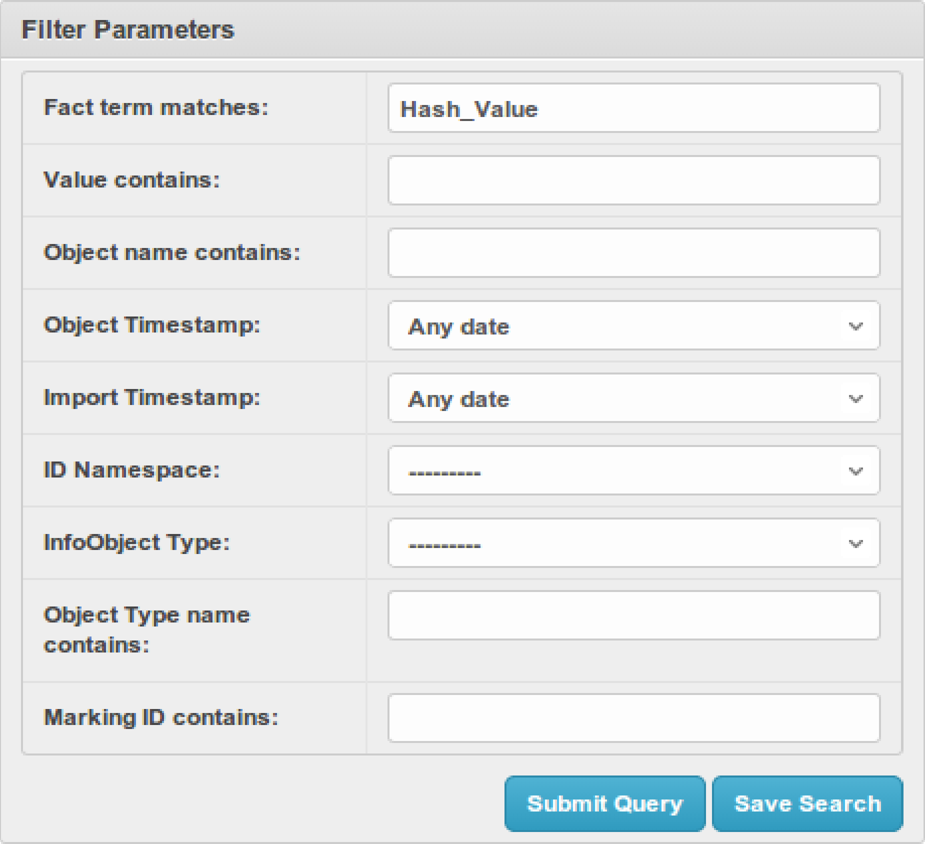
2.4 Find hashes

Another useful feature of MANTIS is the ability to search for file hashes. Select the following from the drop down menu:

List, Filter & Search → Fact Search (simple)

Type ‘Hash_Value’ in the window:

Fact term matches: Hash_Value

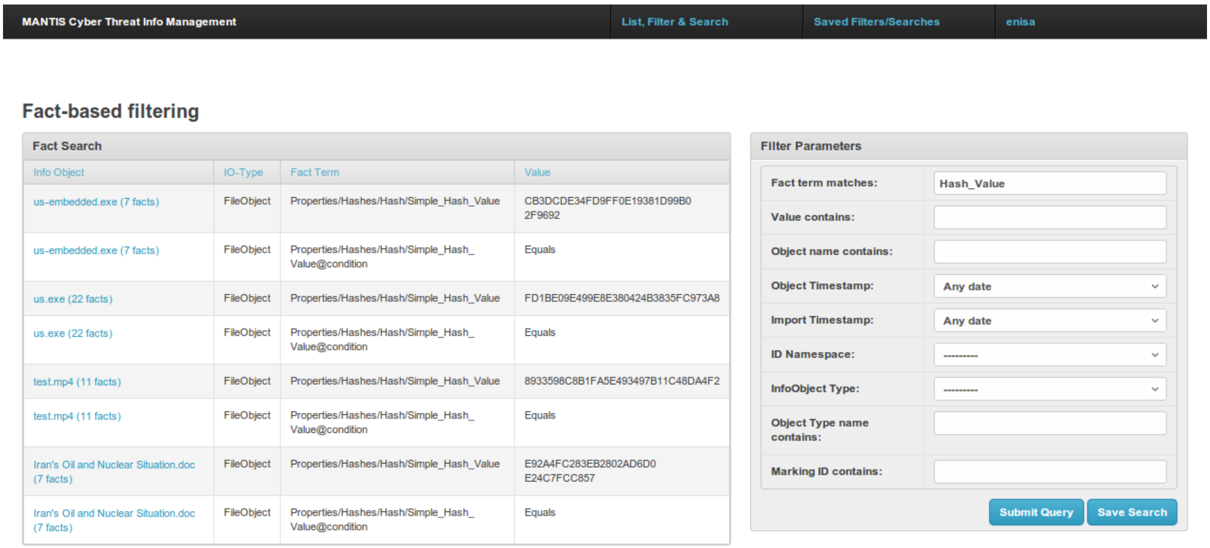


Filter Parameters

Fact term matches:	Hash_Value
Value contains:	
Object name contains:	
Object Timestamp:	Any date
Import Timestamp:	Any date
ID Namespace:	---------
InfoObject Type:	---------
Object Type name contains:	
Marking ID contains:	

Figure 11. Looking for file hashes

After submitting the query you see a list of info objects that contain a file hash:



Fact-based filtering

Fact Search

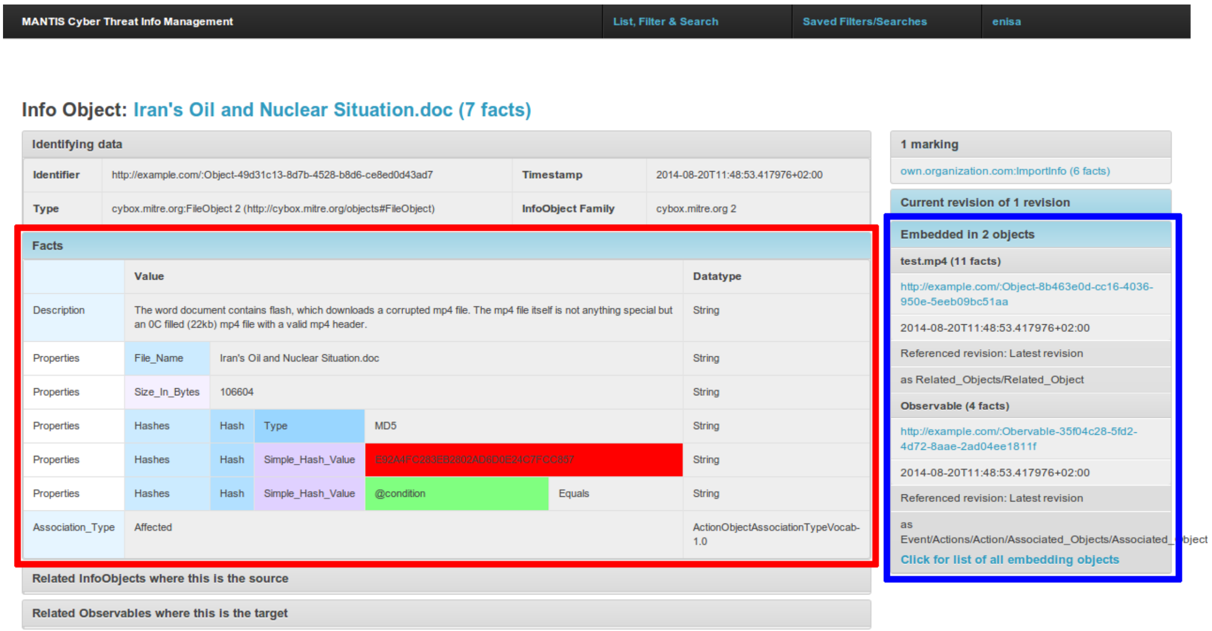
Info Object	IO-Type	Fact Term	Value
us-embedded.exe (7 facts)	FileObject	Properties/Hashes/Hash/Simple_Hash_Value	CB3DCDE34FD9FF0E19381D99B02F9692
us-embedded.exe (7 facts)	FileObject	Properties/Hashes/Hash/Simple_Hash_Value@condition	Equals
us.exe (22 facts)	FileObject	Properties/Hashes/Hash/Simple_Hash_Value	FD1BE09E499E8E380424B3835FC973A8
us.exe (22 facts)	FileObject	Properties/Hashes/Hash/Simple_Hash_Value@condition	Equals
test.mp4 (11 facts)	FileObject	Properties/Hashes/Hash/Simple_Hash_Value	8933598C8B1FA5E493497B11C48DA4F2
test.mp4 (11 facts)	FileObject	Properties/Hashes/Hash/Simple_Hash_Value@condition	Equals
Iran's Oil and Nuclear Situation.doc (7 facts)	FileObject	Properties/Hashes/Hash/Simple_Hash_Value	E92A4FC283EB2802AD6D0E24C7FCC857
Iran's Oil and Nuclear Situation.doc (7 facts)	FileObject	Properties/Hashes/Hash/Simple_Hash_Value@condition	Equals

Filter Parameters

Fact term matches:	Hash_Value
Value contains:	
Object name contains:	
Object Timestamp:	Any date
Import Timestamp:	Any date
ID Namespace:	---------
InfoObject Type:	---------
Object Type name contains:	
Marking ID contains:	

Figure 12. List of Info Objects containing hashes

Again the ‘Fact-based filtering’ part of the window presents the search results, hashes along with search conditions. The first column contains the filename for each hash. Select one of them by clicking on one of the hyperlinks in the ‘Info Object’ column.



Info Object: Iran's Oil and Nuclear Situation.doc (7 facts)

Identifying data

Identifier	http://example.com/:Object-49d31c13-8d7b-4528-b8d6-ce8ed0d43ad7	Timestamp	2014-08-20T11:48:53.417976+02:00
Type	cybox.mitre.org:FileObject 2 (http://cybox.mitre.org/objects#FileObject)	InfoObject Family	cybox.mitre.org 2

Facts

	Value					Datatype
Description	The word document contains flash, which downloads a corrupted mp4 file. The mp4 file itself is not anything special but an 0C filled (22kb) mp4 file with a valid mp4 header.					String
Properties	File_Name	Iran's Oil and Nuclear Situation.doc				String
Properties	Size_In_Bytes	106604				String
Properties	Hashes	Hash	Type	MD5		String
Properties	Hashes	Hash	Simple_Hash_Value	E92A4FC283EB2802AD6D0E24C7FCC857		String
Properties	Hashes	Hash	Simple_Hash_Value	@condition	Equals	String
Association_Type	Affected					ActionObjectAssociationTypeVocab-1.0

Related InfoObjects where this is the source

Related Observables where this is the target

1 marking

own.organization.com:ImportInfo (6 facts)

Current revision of 1 revision

Embedded in 2 objects

test.mp4 (11 facts)

http://example.com/:Object-8b463e0d-cc16-4036-950e-5eeb09bc51aa

2014-08-20T11:48:53.417976+02:00

Referenced revision: Latest revision

as Related_Objects/Related_Object

Observable (4 facts)

http://example.com/:Obervable-35f04c28-5fd2-4d72-8aae-2ad04ee1811f

2014-08-20T11:48:53.417976+02:00

Referenced revision: Latest revision

as Event/Actions/Action/Associated_Objects/Associated_Object

Click for list of all embedding objects

Figure 13. File details about “Iran’s Oil and Nuclear Situation.doc” file

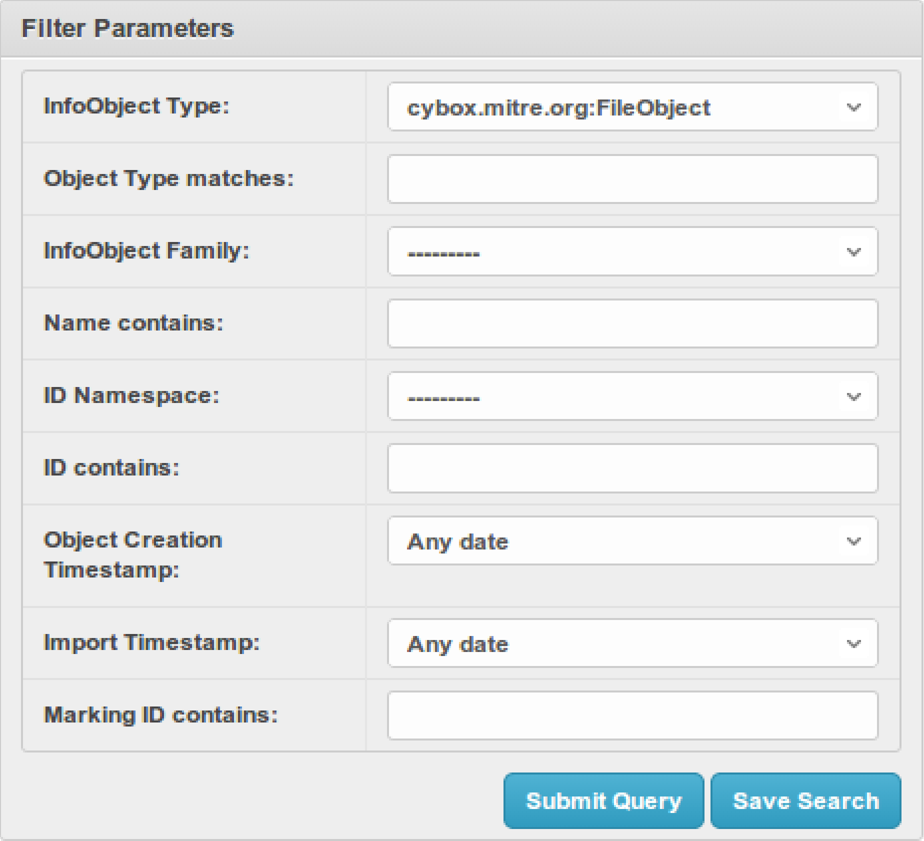
Now you can see the file details. The ‘Facts’ section contains information like a description, file name, hash and size. On the right-hand side of the window there is information about related objects.

2.5 List files

In order to get the list of files, select the following from the drop-down menu and select corresponding Info Object type in the window:

Saved Filters/Searches → Filter for STIX Packages

InfoObject Type: cybox.mitre.org:FileObject

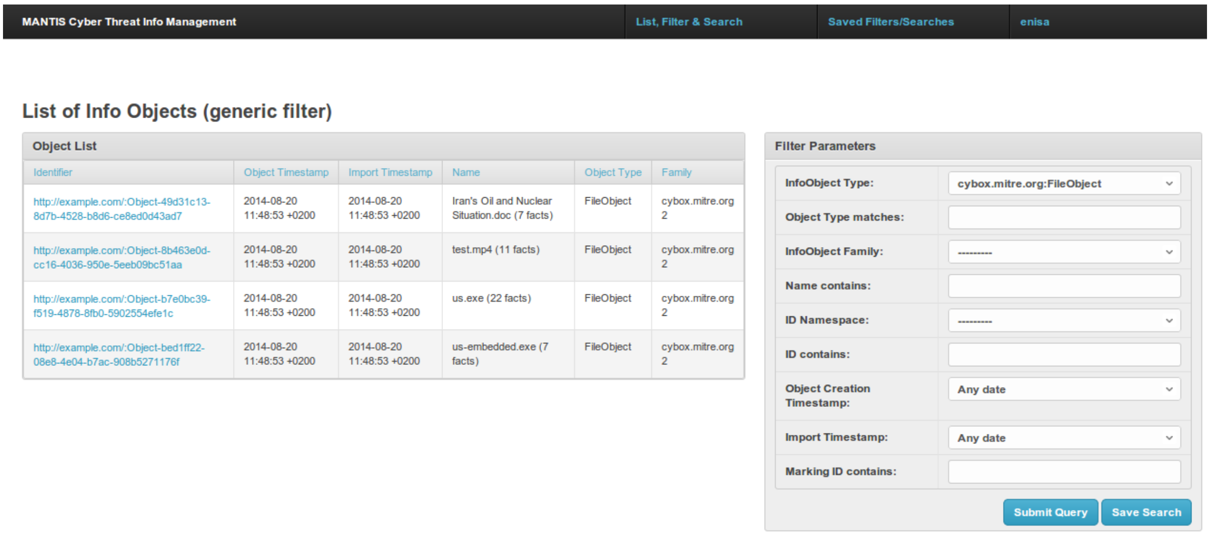


Filter Parameters

InfoObject Type:	cybox.mitre.org:FileObject
Object Type matches:	
InfoObject Family:	---------
Name contains:	
ID Namespace:	---------
ID contains:	
Object Creation Timestamp:	Any date
Import Timestamp:	Any date
Marking ID contains:	

Figure 14. Filtering for files

After submitting the query you will see a list of file object:



List of Info Objects (generic filter)

Object List

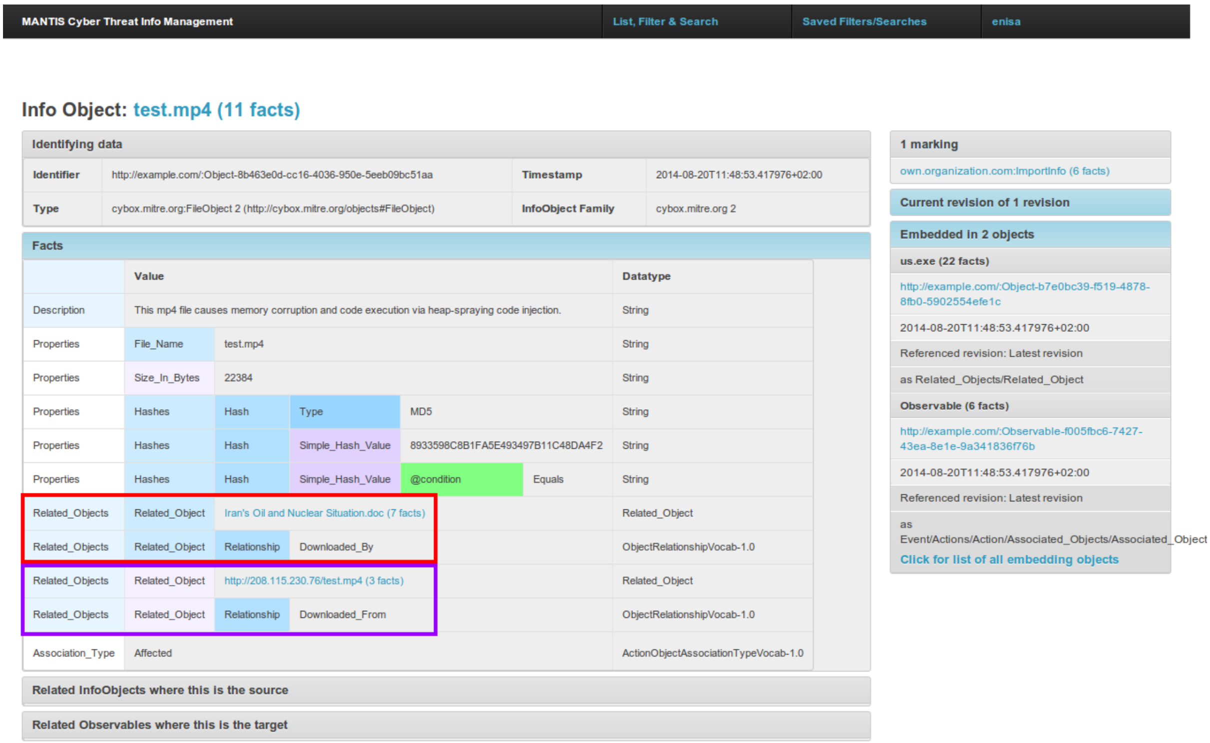
Identifier	Object Timestamp	Import Timestamp	Name	Object Type	Family
http://example.com/:Object-49d31c13-8d7b-4528-b8d6-ce8ed0d43ad7	2014-08-20 11:48:53 +0200	2014-08-20 11:48:53 +0200	Iran's Oil and Nuclear Situation.doc (7 facts)	FileObject	cybox.mitre.org 2
http://example.com/:Object-8b463e0d-cc16-4036-950e-5eeb09bc51aa	2014-08-20 11:48:53 +0200	2014-08-20 11:48:53 +0200	test.mp4 (11 facts)	FileObject	cybox.mitre.org 2
http://example.com/:Object-b7e0bc39-f519-4878-8fb0-5902554efe1c	2014-08-20 11:48:53 +0200	2014-08-20 11:48:53 +0200	us.exe (22 facts)	FileObject	cybox.mitre.org 2
http://example.com/:Object-bed1ff22-08e8-4e04-b7ac-908b5271176f	2014-08-20 11:48:53 +0200	2014-08-20 11:48:53 +0200	us-embedded.exe (7 facts)	FileObject	cybox.mitre.org 2

Filter Parameters

InfoObject Type:	cybox.mitre.org:FileObject
Object Type matches:	
InfoObject Family:	---------
Name contains:	
ID Namespace:	---------
ID contains:	
Object Creation Timestamp:	Any date
Import Timestamp:	Any date
Marking ID contains:	

Figure 15. List of Info Objects

In the 'List of Info Objects' section you can find the list of all files, in the 'Name' column there are file names and the number of facts related to each of the files. Select the 'test.mp4' file from the list by clicking its 'Identifier' element.



MANTIS Cyber Threat Info Management | List, Filter & Search | Saved Filters/Searches | enisa

Info Object: test.mp4 (11 facts)

Identifying data

Identifier	http://example.com/:Object-8b463e0d-cc16-4036-950e-5eeb09bc51aa	**Timestamp**	2014-08-20T11:48:53.417976+02:00
Type	cybox.mitre.org:FileObject 2 (http://cybox.mitre.org/objects#FileObject)	**InfoObject Family**	cybox.mitre.org 2

Facts

	Value					Datatype
Description	This mp4 file causes memory corruption and code execution via heap-spraying code injection.					String
Properties	File_Name	test.mp4				String
Properties	Size_In_Bytes	22384				String
Properties	Hashes	Hash	Type	MD5		String
Properties	Hashes	Hash	Simple_Hash_Value	8933598C8B1FA5E493497B11C48DA4F2		String
Properties	Hashes	Hash	Simple_Hash_Value	@condition	Equals	String
Related_Objects	Related_Object	Iran's Oil and Nuclear Situation.doc (7 facts)				Related_Object
Related_Objects	Related_Object	Relationship	Downloaded_By			ObjectRelationshipVocab-1.0
Related_Objects	Related_Object	http://208.115.230.76/test.mp4 (3 facts)				Related_Object
Related_Objects	Related_Object	Relationship	Downloaded_From			ObjectRelationshipVocab-1.0
Association_Type	Affected					ActionObjectAssociationTypeVocab-1.0

Related InfoObjects where this is the source

Related Observables where this is the target

1 marking

own.organization.com:ImportInfo (6 facts)

Current revision of 1 revision

Embedded in 2 objects

us.exe (22 facts)

http://example.com/:Object-b7e0bc39-f519-4878-8fb0-5902554efe1c

2014-08-20T11:48:53.417976+02:00

Referenced revision: Latest revision

as Related_Objects/Related_Object

Observable (6 facts)

http://example.com/:Observable-f005fbc6-7427-43ea-8e1e-9a341836f76b

2014-08-20T11:48:53.417976+02:00

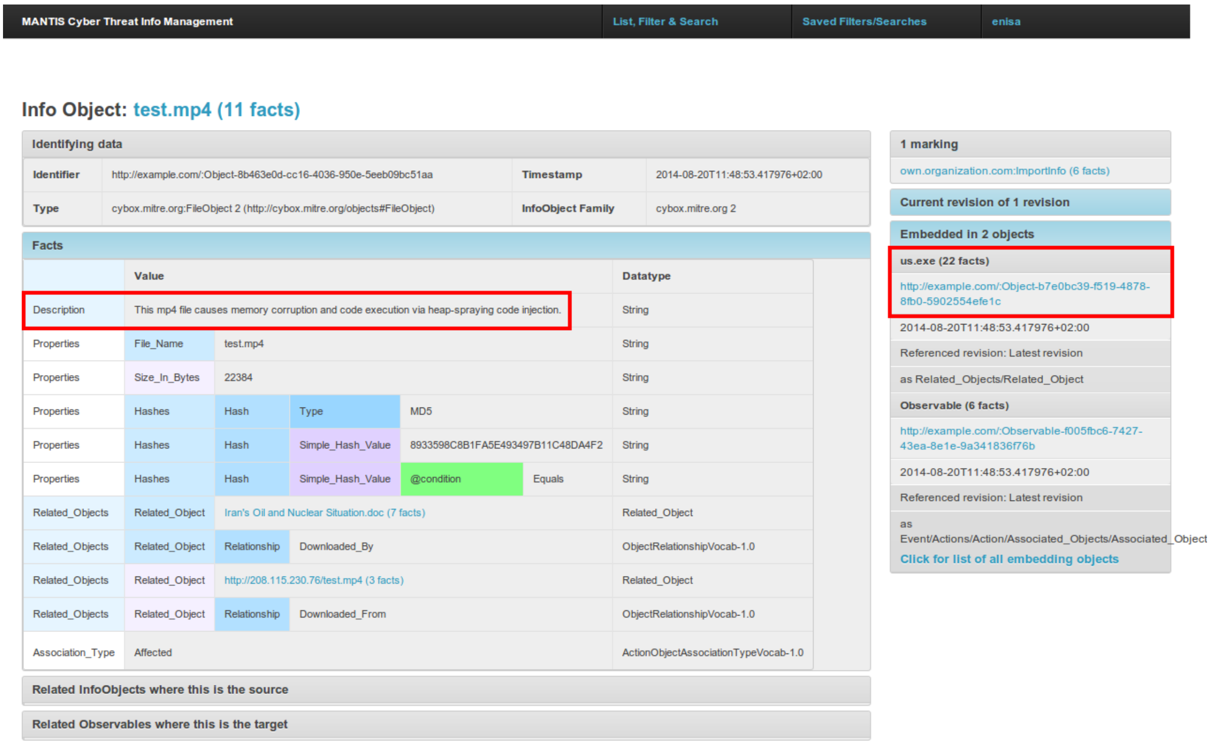
Referenced revision: Latest revision

as Event/Actions/Action/Associated_Objects/Associated_Object

Click for list of all embedding objects

Figure 15. Details about "test.mp4" file

Among the facts you can find the information that this file was downloaded by ‘Iran's Oil and Nuclear Situation.doc’ from ‘http://208.115.230.76/test.mp4’.



MANTIS Cyber Threat Info Management | List, Filter & Search | Saved Filters/Searches | enisa

Info Object: test.mp4 (11 facts)

Identifying data

Identifier	http://example.com/:Object-8b463e0d-cc16-4036-950e-5eeb09bc51aa	**Timestamp**	2014-08-20T11:48:53.417976+02:00
Type	cybox.mitre.org:FileObject 2 (http://cybox.mitre.org/objects#FileObject)	**InfoObject Family**	cybox.mitre.org 2

Facts

	Value					Datatype
Description	This mp4 file causes memory corruption and code execution via heap-spraying code injection.					String
Properties	File_Name	test.mp4				String
Properties	Size_In_Bytes	22384				String
Properties	Hashes	Hash	Type	MD5		String
Properties	Hashes	Hash	Simple_Hash_Value	8933598C8B1FA5E493497B11C48DA4F2		String
Properties	Hashes	Hash	Simple_Hash_Value	@condition	Equals	String
Related_Objects	Related_Object	Iran's Oil and Nuclear Situation.doc (7 facts)				Related_Object
Related_Objects	Related_Object	Relationship	Downloaded_By			ObjectRelationshipVocab-1.0
Related_Objects	Related_Object	http://208.115.230.76/test.mp4 (3 facts)				Related_Object
Related_Objects	Related_Object	Relationship	Downloaded_From			ObjectRelationshipVocab-1.0
Association_Type	Affected					ActionObjectAssociationTypeVocab-1.0

Related InfoObjects where this is the source

Related Observables where this is the target

1 marking

own.organization.com:ImportInfo (6 facts)

Current revision of 1 revision

Embedded in 2 objects

us.exe (22 facts)

http://example.com/:Object-b7e0bc39-f519-4878-8fb0-5902554efe1c

2014-08-20T11:48:53.417976+02:00

Referenced revision: Latest revision

as Related_Objects/Related_Object

Observable (6 facts)

http://example.com/:Observable-f005fbc6-7427-43ea-8e1e-9a341836f76b

2014-08-20T11:48:53.417976+02:00

Referenced revision: Latest revision

as Event/Actions/Action/Associated_Objects/Associated_Object

Click for list of all embedding objects

Figure 16. File "test.mp4" details

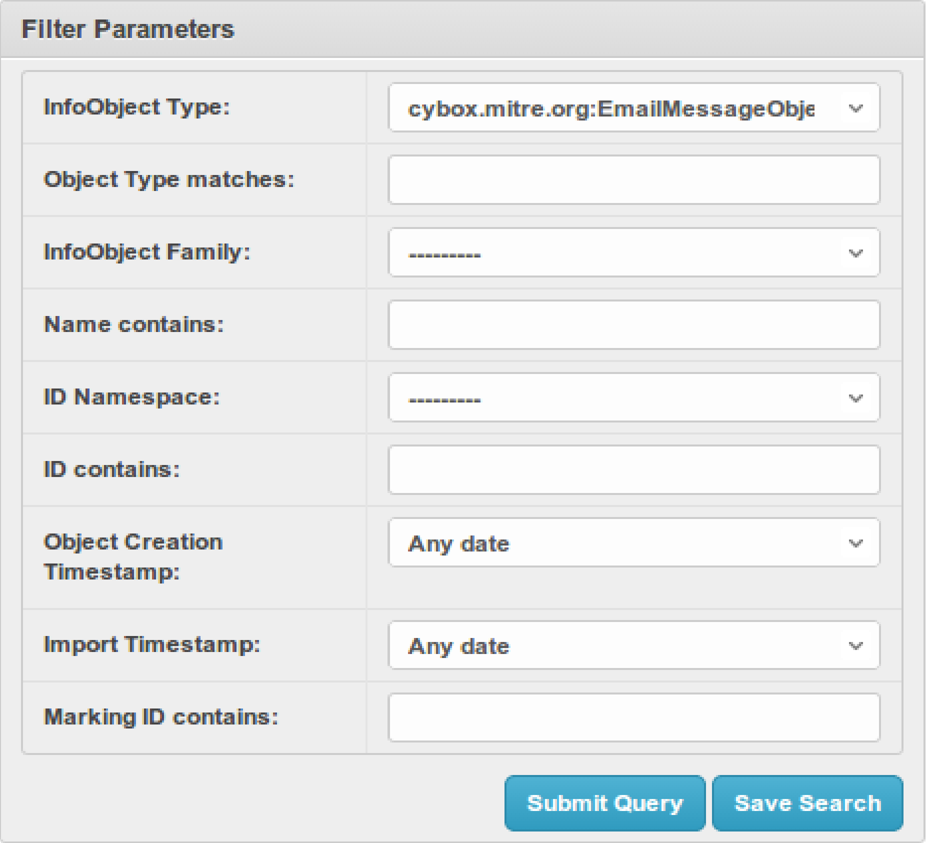
The description of this file reads ‘This mp4 file causes memory corruption and code execution via heap-spraying code injection’ and you can infer from the information in the right-hand side box that this file was included in an exploit running the payload ‘us.exe’.

2.6 List e-mails

To list the e-mails stored in the database, select the following from the drop-down menu and select the e-mail message object type:

Saved Filters/Searches → Filter for STIX Packages

InfoObject Type: cybox.mitre.org:EmailMessageObject

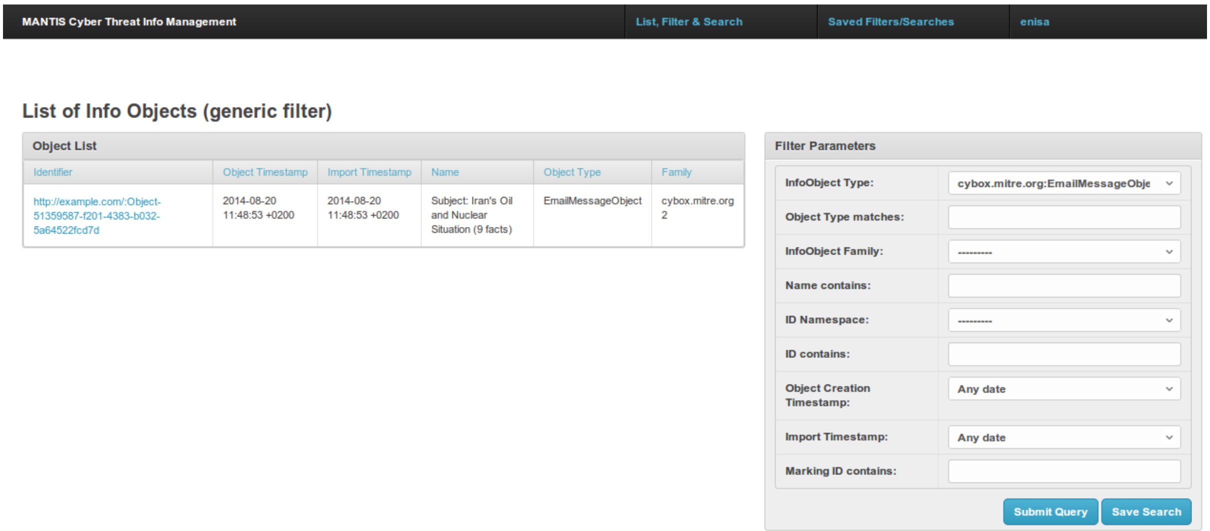


Filter Parameters

InfoObject Type:	cybox.mitre.org:EmailMessageObje
Object Type matches:	
InfoObject Family:	---------
Name contains:	
ID Namespace:	---------
ID contains:	
Object Creation Timestamp:	Any date
Import Timestamp:	Any date
Marking ID contains:	

Figure 17. Filter Parameters for e-mail messages

After submitting the query you will see list of e-mails shown in the ‘List of Info Objects’ section:



List of Info Objects (generic filter)

Object List

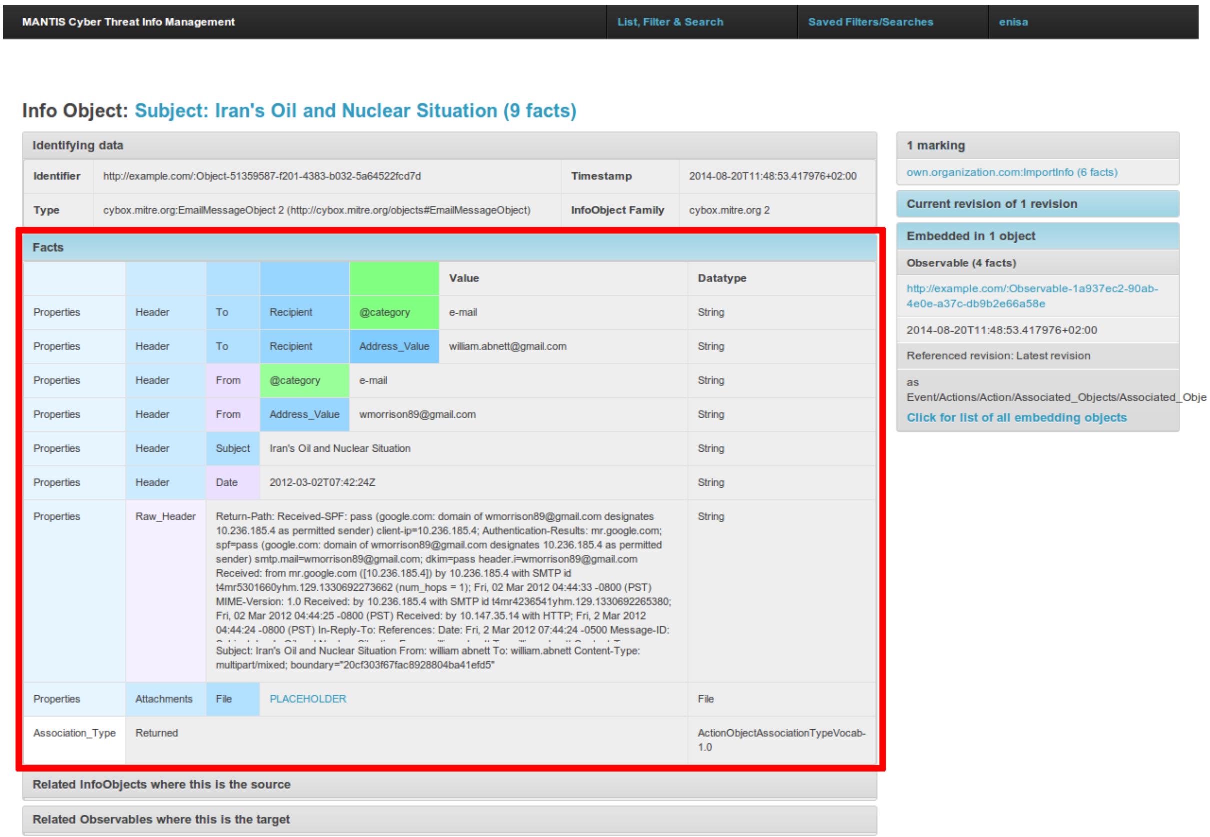
Identifier	Object Timestamp	Import Timestamp	Name	Object Type	Family
http://example.com/:Object-51359587-f201-4383-b032-5a64522fcd7d	2014-08-20 11:48:53 +0200	2014-08-20 11:48:53 +0200	Subject: Iran's Oil and Nuclear Situation (9 facts)	EmailMessageObject	cybox.mitre.org 2

Filter Parameters

InfoObject Type:	cybox.mitre.org:EmailMessageObje
Object Type matches:	
InfoObject Family:	---------
Name contains:	
ID Namespace:	---------
ID contains:	
Object Creation Timestamp:	Any date
Import Timestamp:	Any date
Marking ID contains:	

Figure 18. List of Info Objects

Select the first (and only) one from the list by clicking the element in the 'Identifier' column.



Info Object: Subject: Iran's Oil and Nuclear Situation (9 facts)

Identifying data

Identifier	http://example.com/:Object-51359587-f201-4383-b032-5a64522fcd7d	Timestamp	2014-08-20T11:48:53.417976+02:00
Type	cybox.mitre.org:EmailMessageObject 2 (http://cybox.mitre.org/objects#EmailMessageObject)	InfoObject Family	cybox.mitre.org 2

Facts

					Value	Datatype
Properties	Header	To	Recipient	@category	e-mail	String
Properties	Header	To	Recipient	Address_Value	william.abnett@gmail.com	String
Properties	Header	From	@category	e-mail		String
Properties	Header	From	Address_Value	wmorrison89@gmail.com		String
Properties	Header	Subject	Iran's Oil and Nuclear Situation			String
Properties	Header	Date	2012-03-02T07:42:24Z			String
Properties	Raw_Header	Return-Path: Received-SPF: pass (google.com: domain of wmorrison89@gmail.com designates 10.236.185.4 as permitted sender) client-ip=10.236.185.4; Authentication-Results: mr.google.com; spf=pass (google.com: domain of wmorrison89@gmail.com designates 10.236.185.4 as permitted sender) smtp.mail=wmorrison89@gmail.com; dkim=pass header.i=wmorrison89@gmail.com Received: from mr.google.com ([10.236.185.4]) by 10.236.185.4 with SMTP id t4mr5301660yhm.129.1330692273662 (num_hops = 1); Fri, 02 Mar 2012 04:44:33 -0800 (PST) MIME-Version: 1.0 Received: by 10.236.185.4 with SMTP id t4mr4236541yhm.129.1330692265380; Fri, 02 Mar 2012 04:44:25 -0800 (PST) Received: by 10.147.35.14 with HTTP; Fri, 2 Mar 2012 04:44:24 -0800 (PST) In-Reply-To: References: Date: Fri, 2 Mar 2012 07:44:24 -0500 Message-ID: Subject: Iran's Oil and Nuclear Situation From: william abnett To: william.abnett Content-Type: multipart/mixed; boundary="20cf303f67fac8928804ba41efd5"				String
Properties	Attachments	File	PLACEHOLDER			File
Association_Type	Returned					ActionObjectAssociationTypeVocab-1.0

Related InfoObjects where this is the source

Related Observables where this is the target

1 marking

own.organization.com:ImportInfo (6 facts)

Current revision of 1 revision

Embedded in 1 object

Observable (4 facts)

http://example.com/:Observable-1a937ec2-90ab-4e0e-a37c-db9b2e66a58e

2014-08-20T11:48:53.417976+02:00

Referenced revision: Latest revision

as Event/Actions/Action/Associated_Objects/Associated_Obje

Click for list of all embedding objects

Figure 19. E-mail "Iran's Oil and Nuclear Situation" details

On the left-hand side of the window you will see standard e-mail details like e-mail addresses, subject, attachments etc.

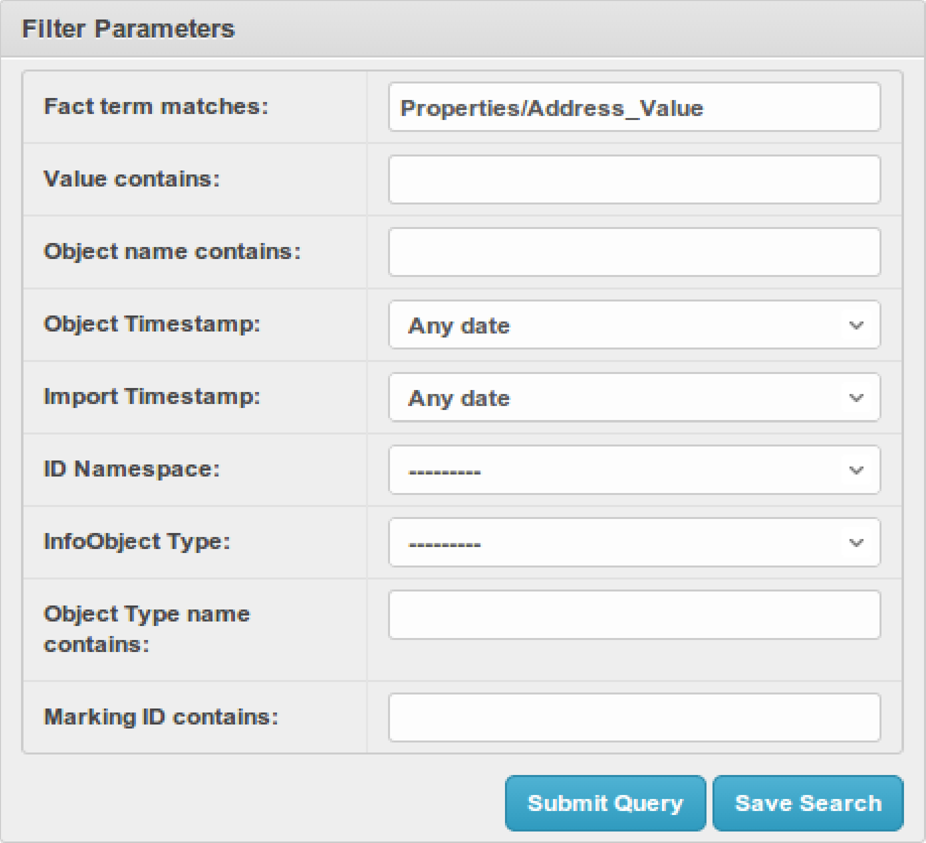
2.7 Find IP addresses

To find IP addresses in the database you need to select item from drop down menu in the right hand corner of the page:

List, Filter & Search → Fact Search (simple)

Then you need to type the following value in the form on the right side of the window:

Fact term matches: Properties/Address_Value

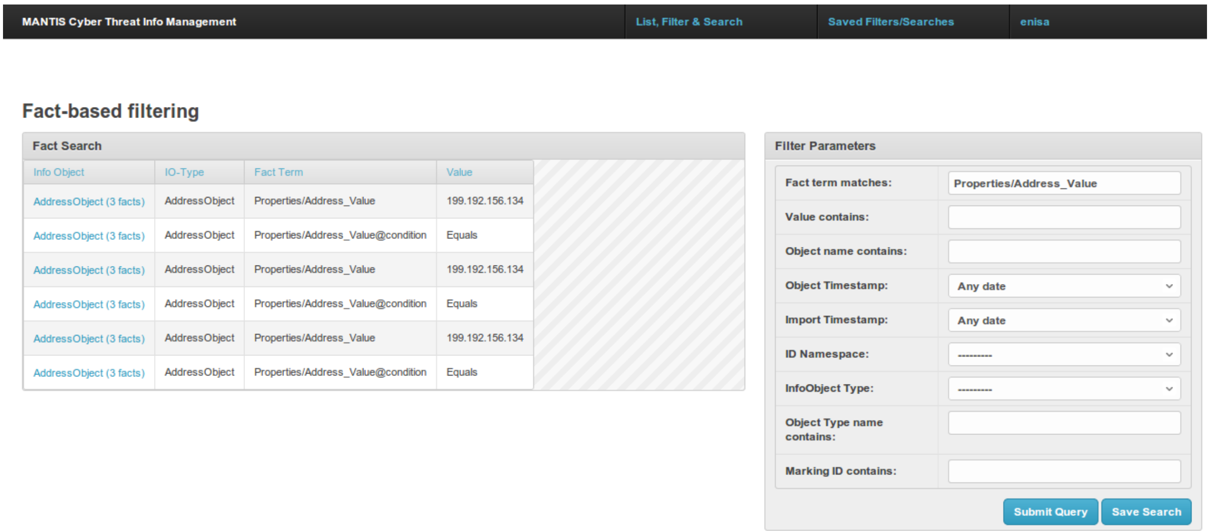


Filter Parameters

Fact term matches:	Properties/Address_Value
Value contains:	
Object name contains:	
Object Timestamp:	Any date
Import Timestamp:	Any date
ID Namespace:	---------
InfoObject Type:	---------
Object Type name contains:	
Marking ID contains:	

Figure 20. Filter Parameters

After following these instructions you will get IP addresses along with more information (type of dependency between the property and its value – 'Equals' in this example):



Fact-based filtering

Fact Search

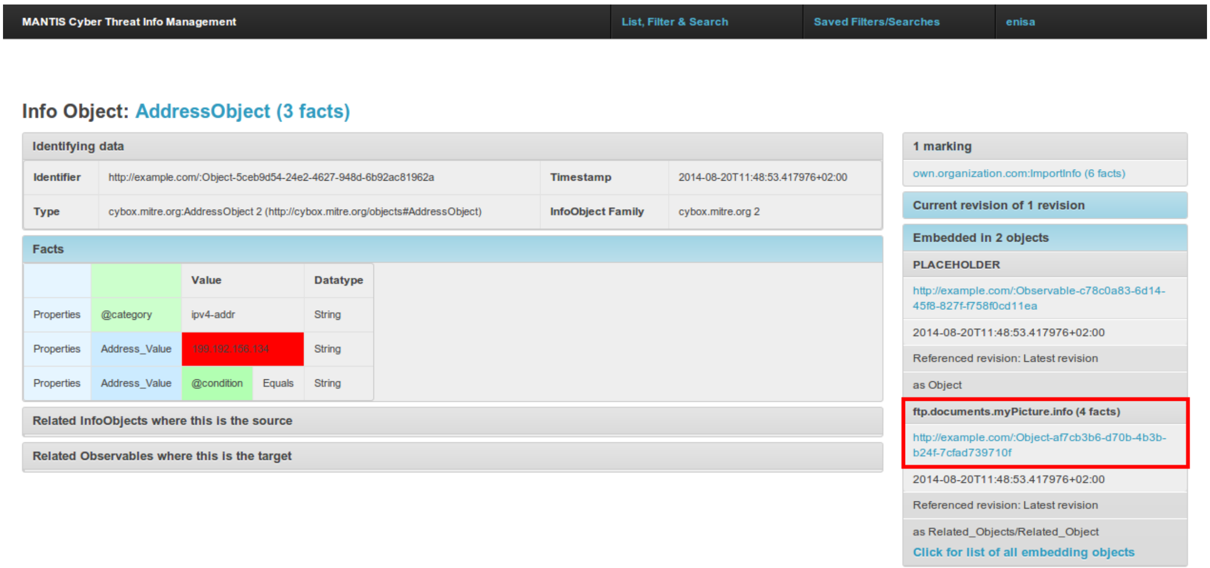
Info Object	IO-Type	Fact Term	Value
AddressObject (3 facts)	AddressObject	Properties/Address_Value	199.192.156.134
AddressObject (3 facts)	AddressObject	Properties/Address_Value@condition	Equals
AddressObject (3 facts)	AddressObject	Properties/Address_Value	199.192.156.134
AddressObject (3 facts)	AddressObject	Properties/Address_Value@condition	Equals
AddressObject (3 facts)	AddressObject	Properties/Address_Value	199.192.156.134
AddressObject (3 facts)	AddressObject	Properties/Address_Value@condition	Equals

Filter Parameters

Fact term matches:	Properties/Address_Value
Value contains:	
Object name contains:	
Object Timestamp:	Any date
Import Timestamp:	Any date
ID Namespace:	---------
InfoObject Type:	---------
Object Type name contains:	
Marking ID contains:	

Figure 21. Fact-based filtering

Select one of the address values from the list by clicking the 'Info Object' element in the first row:



Info Object: AddressObject (3 facts)

Identifying data

Identifier	http://example.com/:Object-5ceb9d54-24e2-4627-948d-6b92ac81962a	Timestamp	2014-08-20T11:48:53.417976+02:00
Type	cybox.mitre.org:AddressObject 2 (http://cybox.mitre.org/objects#AddressObject)	InfoObject Family	cybox.mitre.org 2

Facts

		Value		Datatype
Properties	@category	ipv4-addr		String
Properties	Address_Value	199.192.156.134		String
Properties	Address_Value	@condition	Equals	String

Related InfoObjects where this is the source

Related Observables where this is the target

1 marking

own.organization.com:ImportInfo (6 facts)

Current revision of 1 revision

Embedded in 2 objects

PLACEHOLDER

http://example.com/:Observable-c78c0a83-6d14-45f8-827f-f758f0cd11ea

2014-08-20T11:48:53.417976+02:00

Referenced revision: Latest revision

as Object

ftp.documents.myPicture.info (4 facts)

http://example.com/:Object-af7cb3b6-d70b-4b3b-b24f-7cfad739710f

2014-08-20T11:48:53.417976+02:00

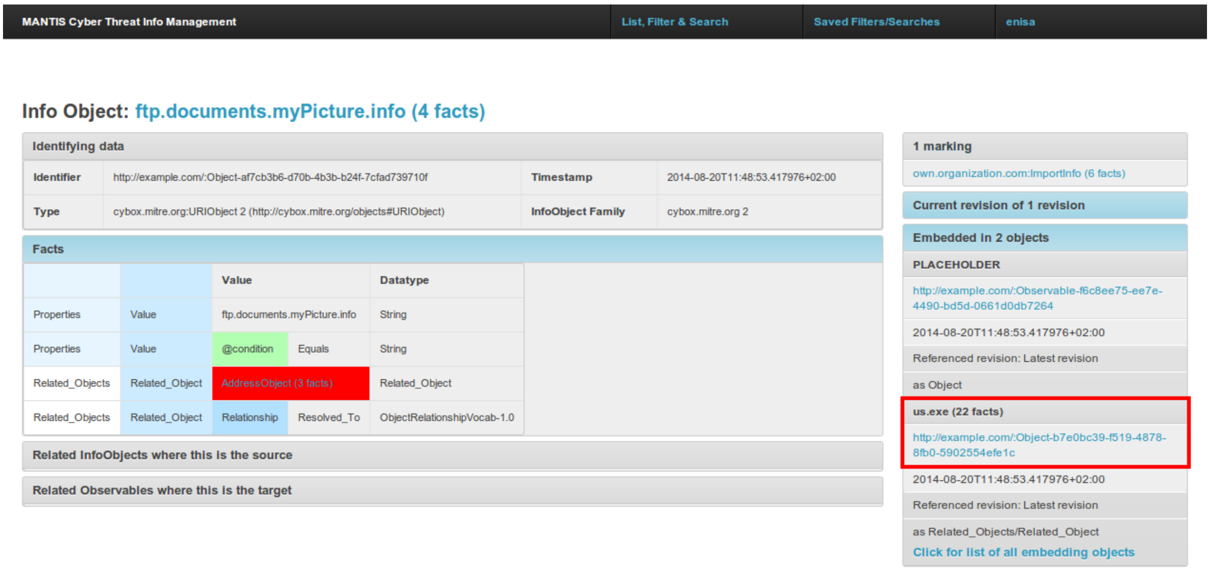
Referenced revision: Latest revision

as Related_Objects/Related_Object

Click for list of all embedding objects

Figure 22. Info Object

The right-hand side of the window presents objects related to this address. This IP address is related to the domain 'ftp.documents.myPicture.info'. Click on the hyperlink inside the red rectangle to see more facts about this domain.



Info Object: ftp.documents.myPicture.info (4 facts)

Identifying data

Identifier	http://example.com/:Object-af7cb3b6-d70b-4b3b-b24f-7cfad739710f	Timestamp	2014-08-20T11:48:53.417976+02:00
Type	cybox.mitre.org:URIObject 2 (http://cybox.mitre.org/objects#URIObject)	InfoObject Family	cybox.mitre.org 2

Facts

		Value		Datatype
Properties	Value	ftp.documents.myPicture.info		String
Properties	Value	@condition	Equals	String
Related_Objects	Related_Object	AddressObject (3 facts)		Related_Object
Related_Objects	Related_Object	Relationship	Resolved_To	ObjectRelationshipVocab-1.0

Related InfoObjects where this is the source

Related Observables where this is the target

1 marking

own.organization.com:ImportInfo (6 facts)

Current revision of 1 revision

Embedded in 2 objects

PLACEHOLDER

http://example.com/:Observable-f6c8ee75-ee7e-4490-bd5d-0661d0db7264

2014-08-20T11:48:53.417976+02:00

Referenced revision: Latest revision

as Object

us.exe (22 facts)

http://example.com/:Object-b7e0bc39-f519-4878-8fb0-5902554efe1c

2014-08-20T11:48:53.417976+02:00

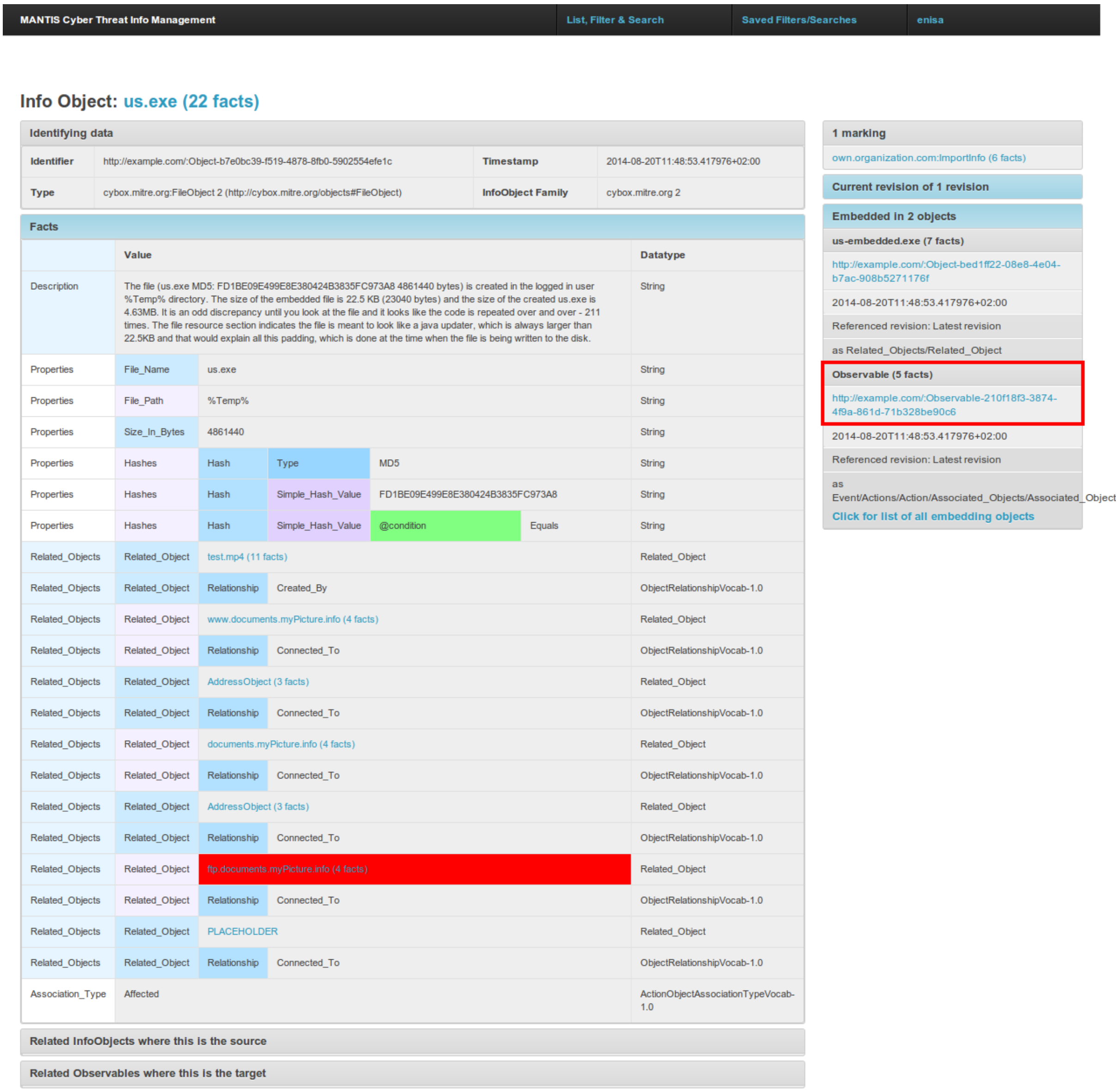
Referenced revision: Latest revision

as Related_Objects/Related_Object

Click for list of all embedding objects

Figure 23. Facts about object

As you can see the ‘ftp.documents.myPicture.info’ domain name is related to the file ‘us.exe’. Click on the hyperlink under that file name.



Info Object: us.exe (22 facts)

Identifying data

Identifier	http://example.com/:Object-b7e0bc39-f519-4878-8fb0-5902554efe1c	Timestamp	2014-08-20T11:48:53.417976+02:00
Type	cybox.mitre.org:FileObject 2 (http://cybox.mitre.org/objects#FileObject)	InfoObject Family	cybox.mitre.org 2

Facts

	Value					Datatype
Description	The file (us.exe MD5: FD1BE09E499E8E380424B3835FC973A8 4861440 bytes) is created in the logged in user %Temp% directory. The size of the embedded file is 22.5 KB (23040 bytes) and the size of the created us.exe is 4.63MB. It is an odd discrepancy until you look at the file and it looks like the code is repeated over and over - 211 times. The file resource section indicates the file is meant to look like a java updater, which is always larger than 22.5KB and that would explain all this padding, which is done at the time when the file is being written to the disk.					String
Properties	File_Name	us.exe				String
Properties	File_Path	%Temp%				String
Properties	Size_In_Bytes	4861440				String
Properties	Hashes	Hash	Type	MD5		String
Properties	Hashes	Hash	Simple_Hash_Value	FD1BE09E499E8E380424B3835FC973A8		String
Properties	Hashes	Hash	Simple_Hash_Value	@condition	Equals	String
Related_Objects	Related_Object	test.mp4 (11 facts)				Related_Object
Related_Objects	Related_Object	Relationship	Created_By			ObjectRelationshipVocab-1.0
Related_Objects	Related_Object	www.documents.myPicture.info (4 facts)				Related_Object
Related_Objects	Related_Object	Relationship	Connected_To			ObjectRelationshipVocab-1.0
Related_Objects	Related_Object	AddressObject (3 facts)				Related_Object
Related_Objects	Related_Object	Relationship	Connected_To			ObjectRelationshipVocab-1.0
Related_Objects	Related_Object	documents.myPicture.info (4 facts)				Related_Object
Related_Objects	Related_Object	Relationship	Connected_To			ObjectRelationshipVocab-1.0
Related_Objects	Related_Object	AddressObject (3 facts)				Related_Object
Related_Objects	Related_Object	Relationship	Connected_To			ObjectRelationshipVocab-1.0
Related_Objects	Related_Object	ftp.documents.myPicture.info (4 facts)				Related_Object
Related_Objects	Related_Object	Relationship	Connected_To			ObjectRelationshipVocab-1.0
Related_Objects	Related_Object	PLACEHOLDER				Related_Object
Related_Objects	Related_Object	Relationship	Connected_To			ObjectRelationshipVocab-1.0
Association_Type	Affected					ActionObjectAssociationTypeVocab-1.0

Related InfoObjects where this is the source

Related Observables where this is the target

1 marking

own.organization.com:ImportInfo (6 facts)

Current revision of 1 revision

Embedded in 2 objects

us-embedded.exe (7 facts)

http://example.com/:Object-bed1ff22-08e8-4e04-b7ac-908b5271176f

2014-08-20T11:48:53.417976+02:00

Referenced revision: Latest revision

as Related_Objects/Related_Object

Observable (5 facts)

http://example.com/:Observable-210f18f3-3874-4f9a-861d-71b328be90c6

2014-08-20T11:48:53.417976+02:00

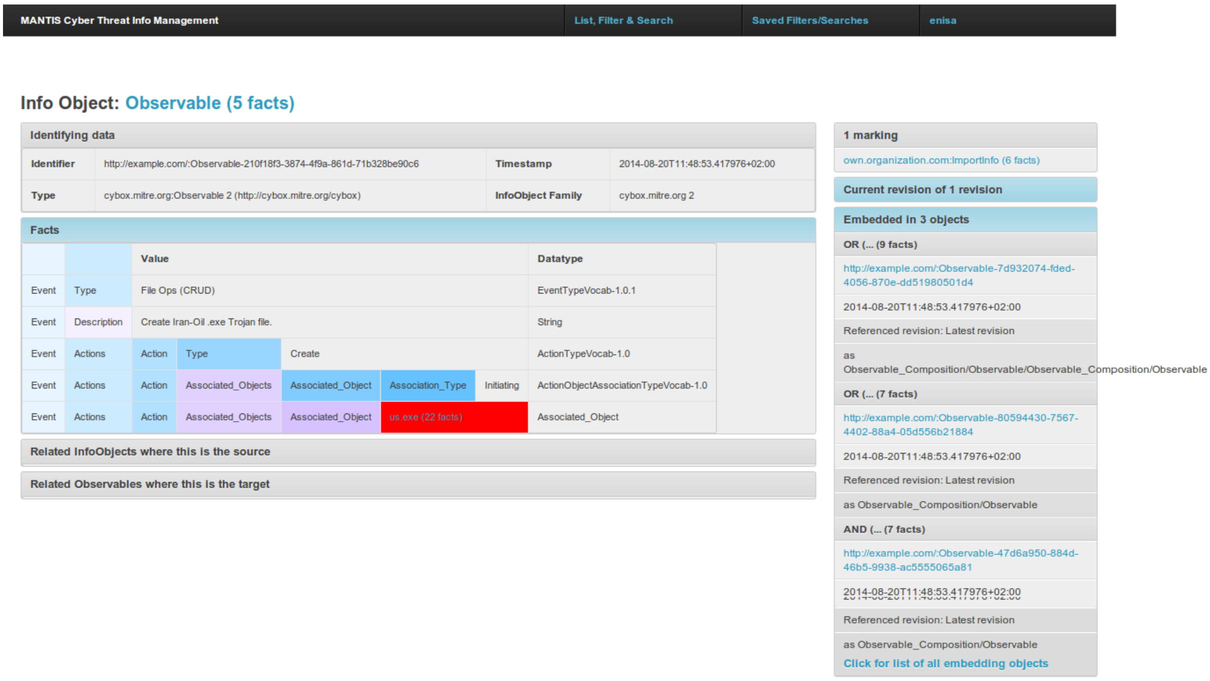
Referenced revision: Latest revision

as Event/Actions/Action/Associated_Objects/Associated_Object

Click for list of all embedding objects

Figure 24. Details of ‘us.exe’ file

You can see all the details about the ‘us.exe’ file stored in the database. Along with file description you can find related object that possibly contained this file – other files (‘test.mp4’ for instance), domain names and e-mail document. Now, click the ‘Observable’ link:



MANTIS Cyber Threat Info Management | List, Filter & Search | Saved Filters/Searches | enisa

Info Object: Observable (5 facts)

Identifying data

Identifier	http://example.com/:Observable-210f18f3-3874-4f9a-861d-71b328be90c6	**Timestamp**	2014-08-20T11:48:53.417976+02:00
Type	cybox.mitre.org:Observable 2 (http://cybox.mitre.org/cybox)	**InfoObject Family**	cybox.mitre.org 2

Facts

		Value					Datatype
Event	Type	File Ops (CRUD)					EventTypeVocab-1.0.1
Event	Description	Create Iran-Oil .exe Trojan file.					String
Event	Actions	Action	Type	Create			ActionTypeVocab-1.0
Event	Actions	Action	Associated_Objects	Associated_Object	Association_Type	Initiating	ActionObjectAssociationTypeVocab-1.0
Event	Actions	Action	Associated_Objects	Associated_Object	us.exe (22 facts)		Associated_Object

Related InfoObjects where this is the source

Related Observables where this is the target

1 marking

own.organization.com:ImportInfo (6 facts)

Current revision of 1 revision

Embedded in 3 objects

OR (... (9 facts)

http://example.com/:Observable-7d932074-fded-4056-870e-dd51980501d4

2014-08-20T11:48:53.417976+02:00

Referenced revision: Latest revision

as Observable_Composition/Observable/Observable_Composition/Observable

OR (... (7 facts)

http://example.com/:Observable-80594430-7567-4402-88a4-05d556b21884

2014-08-20T11:48:53.417976+02:00

Referenced revision: Latest revision

as Observable_Composition/Observable

AND (... (7 facts)

http://example.com/:Observable-47d6a950-884d-46b5-9938-ac5555065a81

2014-08-20T11:48:53.417976+02:00

Referenced revision: Latest revision

as Observable_Composition/Observable

Click for list of all embedding objects

Figure 25. ‘us.exe’ observables

From the description part we get the information that file “us.exe” is apparently a piece of malicious code creating the ‘Iran-Oil.exe’ Trojan file, and from the related objects we deduce the domain analysed previously served as its C&C server address.

3 CRITs

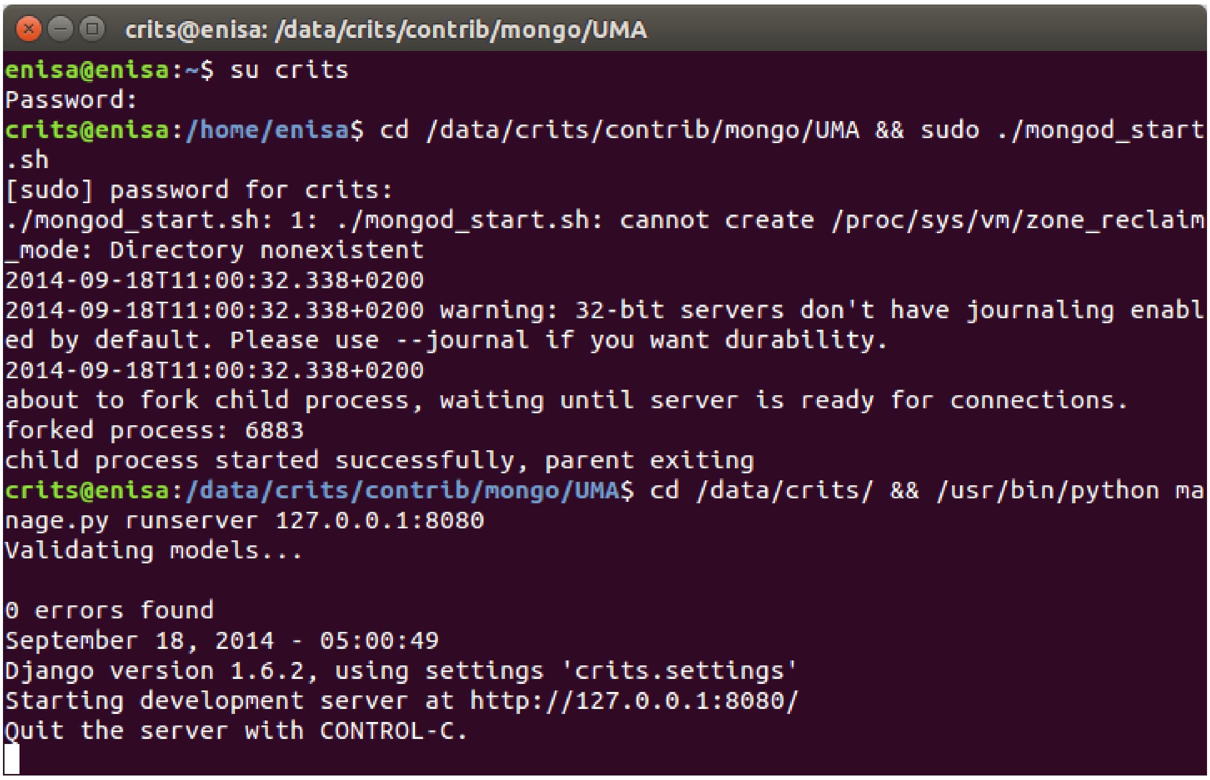
CRITs[18] is a web-based tool which combines an analytic engine with a cyber-threat database that not only serves as a repository for attack data and malware, but it also provides analysts with a powerful platform for conducting malware analyses, correlating malware, and for targeting data. These analyses and correlations can also be saved and exploited within CRITs. CRITs employs a simple but very useful hierarchy to structure cyber threat information. This structure gives analyst the power to 'pivot' on metadata to discover previously unknown related content.

CRITs software has been already installed in the VM for your convenience, you can find installation instructions in the appendices at the end of this document.

3.1 Run CRITs

To run CRITs type the following commands in the terminal:

```
su crits
cd /data/crits/contrib/mongo/UMA && sudo ./mongod_start.sh
cd /data/crits/ && /usr/bin/python manage.py runserver 127.0.0.1:8080
```



```
enisa@enisa:~$ su crits
Password:
crits@enisa:/home/enisa$ cd /data/crits/contrib/mongo/UMA && sudo ./mongod_start
.sh
[sudo] password for crits:
./mongod_start.sh: 1: ./mongod_start.sh: cannot create /proc/sys/vm/zone_reclaim
_mode: Directory nonexistent
2014-09-18T11:00:32.338+0200
2014-09-18T11:00:32.338+0200 warning: 32-bit servers don't have journaling enabl
ed by default. Please use --journal if you want durability.
2014-09-18T11:00:32.338+0200
about to fork child process, waiting until server is ready for connections.
forked process: 6883
child process started successfully, parent exiting
crits@enisa:/data/crits/contrib/mongo/UMA$ cd /data/crits/ && /usr/bin/python ma
nage.py runserver 127.0.0.1:8080
Validating models...

0 errors found
September 18, 2014 - 05:00:49
Django version 1.6.2, using settings 'crits.settings'
Starting development server at http://127.0.0.1:8080/
Quit the server with CONTROL-C.
```

Figure 26. CRITs server running

VM password to “crits” user is “toor”.

CRITs web interface is available at http://127.0.0.1:8080 . Log into this interface using username: ‘enisa’ and password: ‘Enisa!11’.

[18] http://crits.github.io/

3.2 Upload binary sample to CRITs

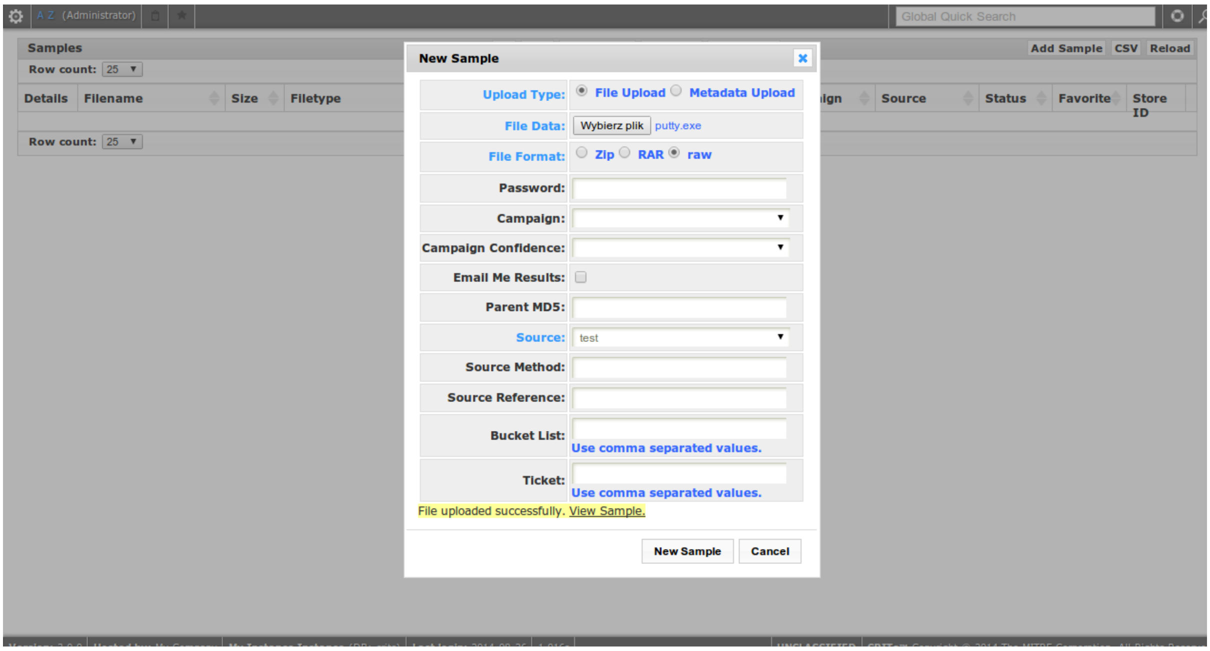
As an example we will use the "putty.exe" binary from Putty[19] (which is not malware).

This file is located '/home/enisa/examples/' directory.

To upload this sample select from the menu on to the left of the screen:

Samples → Add Sample → View Sample

Choose the 'raw' file format just below file selection button.



New Sample

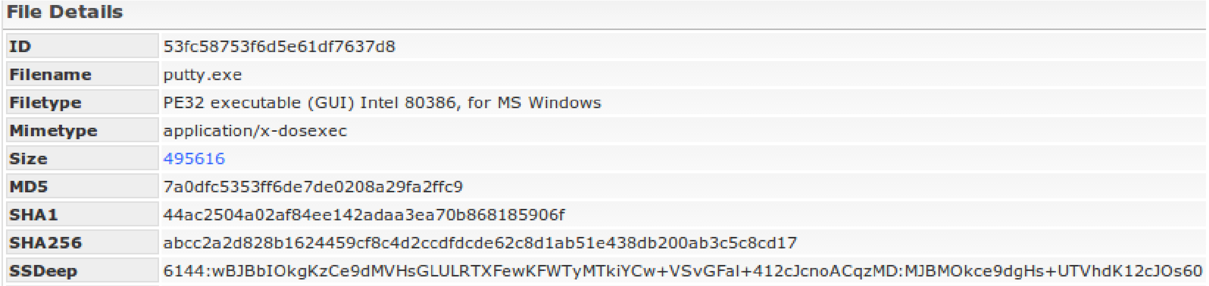
Upload Type:	● File Upload ○ Metadata Upload
File Data:	Wybierz plik putty.exe
File Format:	○ Zip ○ RAR ● raw
Password:	
Campaign:	
Campaign Confidence:	
Email Me Results:	□
Parent MD5:	
Source:	test
Source Method:	
Source Reference:	
Bucket List:	Use comma separated values.
Ticket:	Use comma separated values.

File uploaded successfully. View Sample.

New Sample | Cancel

Figure 27. CRITs New Sample

After submitting new sample you can see the file details:



File Details

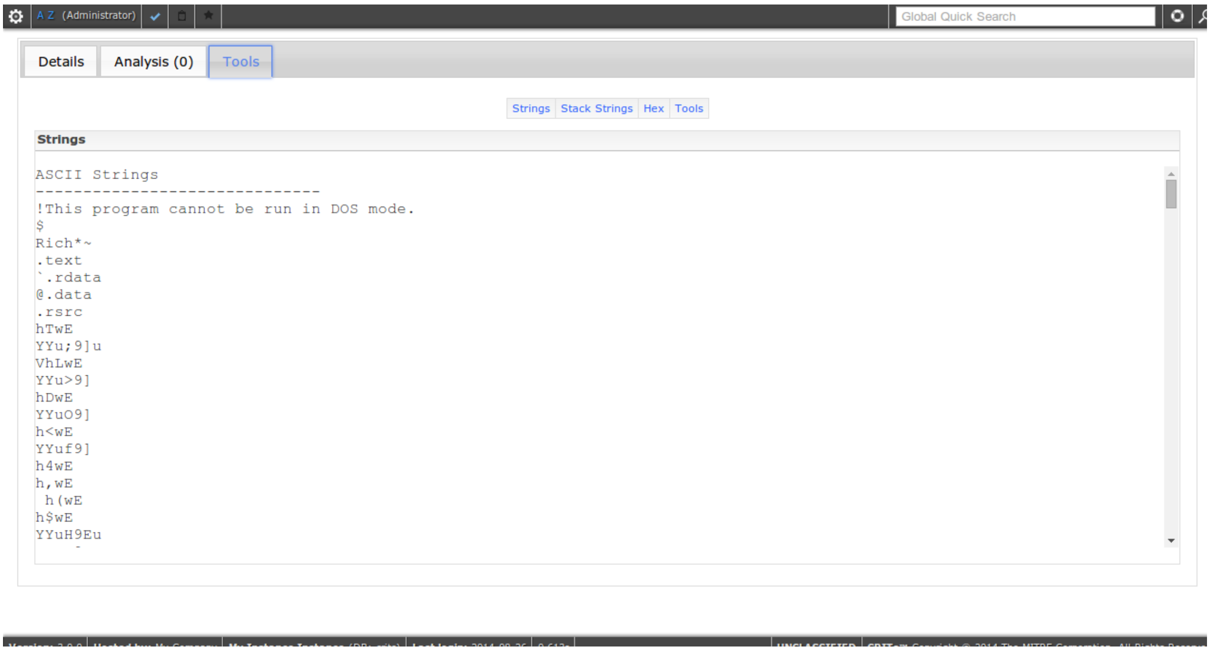
ID	53fc58753f6d5e61df7637d8
Filename	putty.exe
Filetype	PE32 executable (GUI) Intel 80386, for MS Windows
Mimetype	application/x-dosexec
Size	495616
MD5	7a0dfc5353ff6de7de0208a29fa2ffc9
SHA1	44ac2504a02af84ee142adaa3ea70b868185906f
SHA256	abcc2a2d828b1624459cf8c4d2ccdfdcde62c8d1ab51e438db200ab3c5c8cd17
SSDeep	6144:wBJBbIOkgKzCe9dMVHsGLULRTXFewKFWTyMTkiYCw+VSvGFal+412cJcnoACqzMD:MJBMOkce9dgHs+UTVhdK12cJOs60

Figure 28. CRITs File Details

From the top menu select:

Tools → Strings

[19] http://the.earth.li/~sgtatham/putty/latest/x86/putty.exe



Strings

```
ASCII Strings
------------------------------
!This program cannot be run in DOS mode.
$
Rich*~
.text
`.rdata
@.data
.rsrc
hTwE
YYu;9]u
VhLwE
YYu>9]
hDwE
YYuO9]
h<wE
YYuf9]
h4wE
h,wE
 h(wE
h$wE
YYuH9Eu
```

Figure 29. Strings present in putty.exe

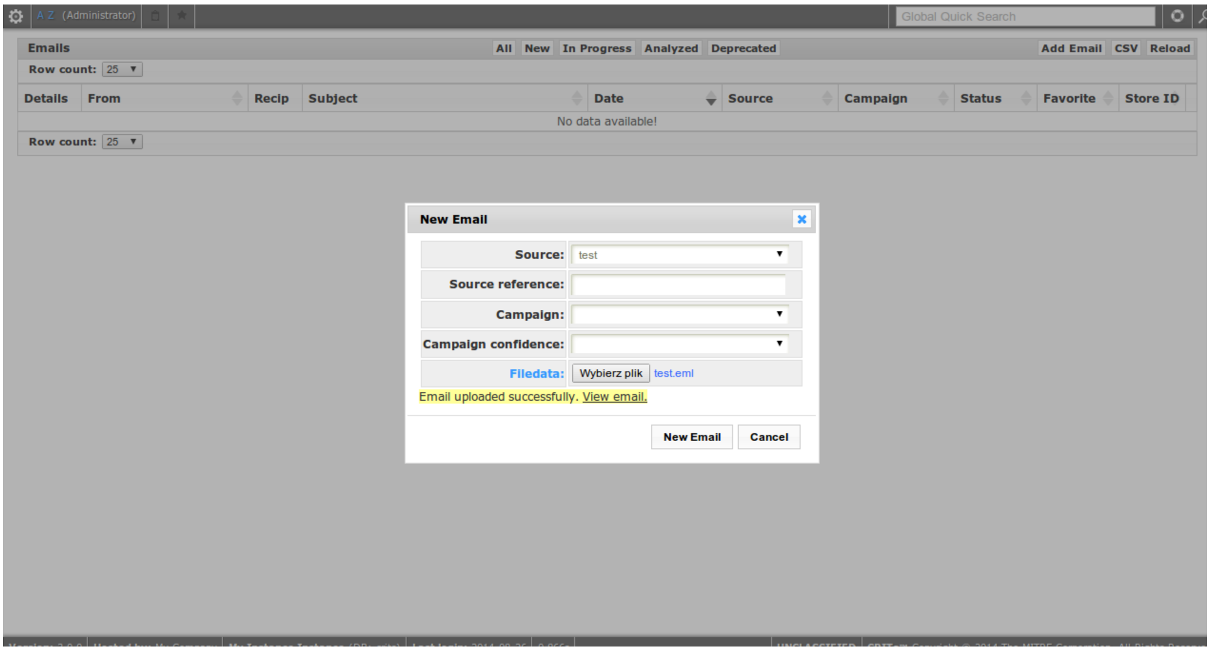
This is the equivalent to the standard Unix ‘strings’ tool. Tools like ‘strings’ are commonly used in first and fast parts of binary files analyses.

3.3 Upload E-mail files

To upload an e-mail file, for example in EML format (you can also use Outlook, YAML, Raw) select from the menu:

Emails → New Email (EML) → View email

A sample EML file has been prepared on this VM: ‘/home/enisa/examples/test.eml’



Row count: 25

Details	From	Recip	Subject	Date	Source	Campaign	Status	Favorite	Store ID
No data available!									

Row count: 25

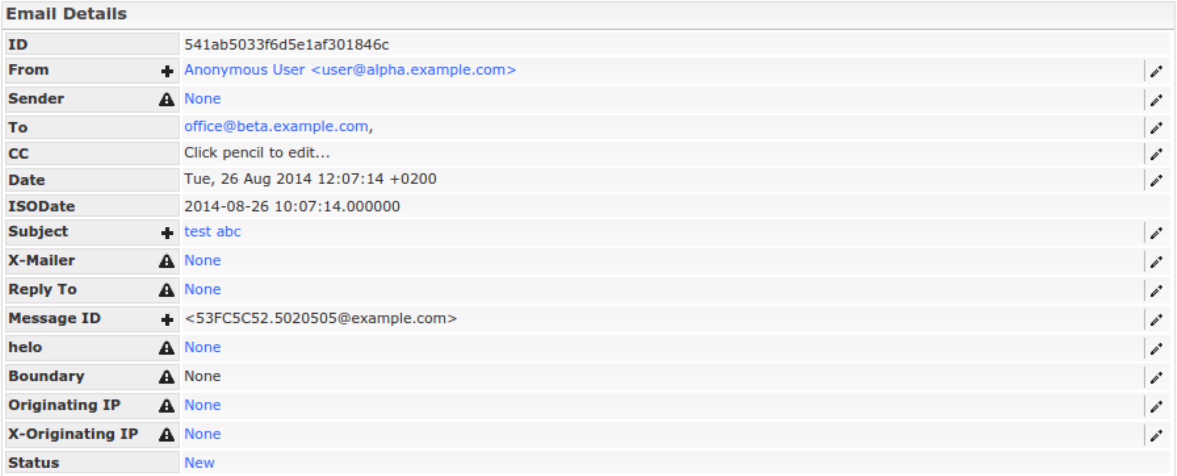
New Email

Source: test
Source reference:
Campaign:
Campaign confidence:
Filedata: Wybierz plik test.eml

Email uploaded successfully. View email.

Figure 30. CRITs new e-mail

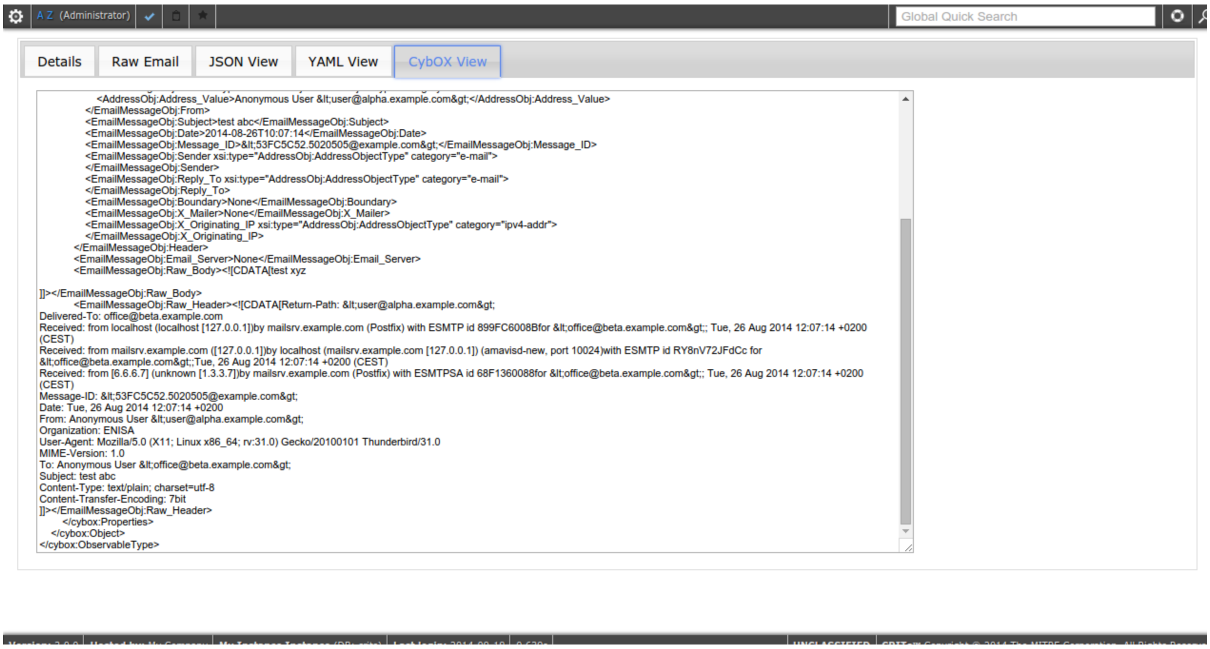
After uploading you can see e-mail details:



Email Details		
ID		541ab5033f6d5e1af301846c
From	✚	Anonymous User <user@alpha.example.com>
Sender	⚠	None
To		office@beta.example.com,
CC		Click pencil to edit...
Date		Tue, 26 Aug 2014 12:07:14 +0200
ISODate		2014-08-26 10:07:14.000000
Subject	✚	test abc
X-Mailer	⚠	None
Reply To	⚠	None
Message ID	✚	<53FC5C52.5020505@example.com>
helo	⚠	None
Boundary	⚠	None
Originating IP	⚠	None
X-Originating IP	⚠	None
Status		New

Figure 32. CRITs e-mail details

Now you can view the imported EML file also in CybOX format after select "CybOX View" from the top menu.



```
                <AddressObj:Address_Value>Anonymous User &lt;user@alpha.example.com&gt;</AddressObj:Address_Value>
            </EmailMessageObj:From>
            <EmailMessageObj:Subject>test abc</EmailMessageObj:Subject>
            <EmailMessageObj:Date>2014-08-26T10:07:14</EmailMessageObj:Date>
            <EmailMessageObj:Message_ID>&lt;53FC5C52.5020505@example.com&gt;</EmailMessageObj:Message_ID>
            <EmailMessageObj:Sender xsi:type="AddressObj:AddressObjectType" category="e-mail">
            </EmailMessageObj:Sender>
            <EmailMessageObj:Reply_To xsi:type="AddressObj:AddressObjectType" category="e-mail">
            </EmailMessageObj:Reply_To>
            <EmailMessageObj:Boundary>None</EmailMessageObj:Boundary>
            <EmailMessageObj:X_Mailer>None</EmailMessageObj:X_Mailer>
            <EmailMessageObj:X_Originating_IP xsi:type="AddressObj:AddressObjectType" category="ipv4-addr">
            </EmailMessageObj:X_Originating_IP>
        </EmailMessageObj:Header>
        <EmailMessageObj:Email_Server>None</EmailMessageObj:Email_Server>
        <EmailMessageObj:Raw_Body><![CDATA[test xyz

]]></EmailMessageObj:Raw_Body>
        <EmailMessageObj:Raw_Header><![CDATA[Return-Path: &lt;user@alpha.example.com&gt;
Delivered-To: office@beta.example.com
Received: from localhost (localhost [127.0.0.1])by mailsrv.example.com (Postfix) with ESMTP id 899FC6008Bfor &lt;office@beta.example.com&gt;; Tue, 26 Aug 2014 12:07:14 +0200
(CEST)
Received: from mailsrv.example.com ([127.0.0.1])by localhost (mailsrv.example.com [127.0.0.1]) (amavisd-new, port 10024)with ESMTP id RY8nV72JFdCc for
&lt;office@beta.example.com&gt;;Tue, 26 Aug 2014 12:07:14 +0200 (CEST)
Received: from [6.6.6.7] (unknown [1.3.3.7])by mailsrv.example.com (Postfix) with ESMTPSA id 68F1360088for &lt;office@beta.example.com&gt;; Tue, 26 Aug 2014 12:07:14 +0200
(CEST)
Message-ID: &lt;53FC5C52.5020505@example.com&gt;
Date: Tue, 26 Aug 2014 12:07:14 +0200
From: Anonymous User &lt;user@alpha.example.com&gt;
Organization: ENISA
User-Agent: Mozilla/5.0 (X11; Linux x86_64; rv:31.0) Gecko/20100101 Thunderbird/31.0
MIME-Version: 1.0
To: Anonymous User &lt;office@beta.example.com&gt;
Subject: test abc
Content-Type: text/plain; charset=utf-8
Content-Transfer-Encoding: 7bit
]]></EmailMessageObj:Raw_Header>
      </cybox:Properties>
    </cybox:Object>
</cybox:ObservableType>
```

Figure 32. CRITs e-mail details in CybOX format

You can now easily use the contents from the 'CybOX View' in any other tool supporting the CybOX format.

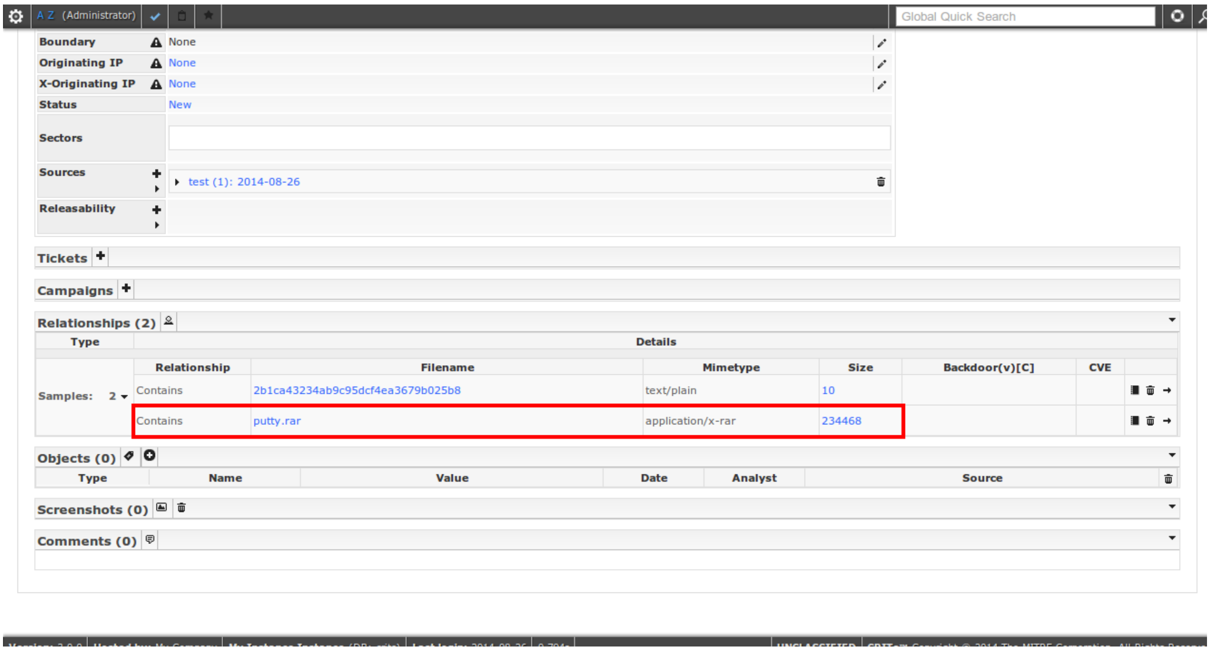
3.4 Upload E-mail with an attachment

To upload an e-mail with an attachment in the EML format use the same menu item as for a plain e-mail in previous task:

Emails → New Email (EML) → View email

Again, a sample EML file has been prepared on this VM: "/home/enisa/examples/test123.eml".

After uploading it you will see e-mail details:



Boundary	None
Originating IP	None
X-Originating IP	None
Status	New
Sectors	
Sources	test (1): 2014-08-26
Releasability	

Tickets

Campaigns

Relationships (2)

Type	Relationship	Filename	Mimetype	Size	Backdoor(v)[C]	CVE
Samples: 2	Contains	2b1ca43234ab9c95dcf4ea3679b025b8	text/plain	10		
	Contains	putty.rar	application/x-rar	234468		

Objects (0)

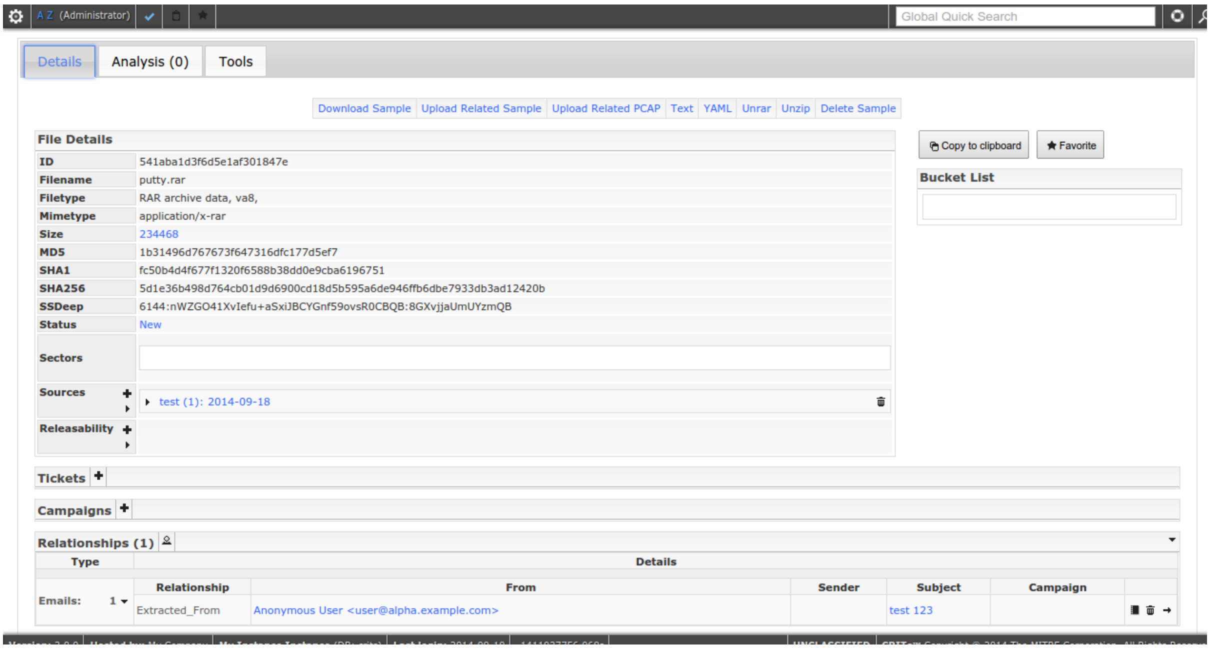
Type	Name	Value	Date	Analyst	Source

Screenshots (0)

Comments (0)

Figure 33. CRITs e-mail with attachment

Click the filename in the relationships box of this e-mail to get details about this attachment:



File Details

ID	541aba1d3f6d5e1af301847e
Filename	putty.rar
Filetype	RAR archive data, va8,
Mimetype	application/x-rar
Size	234468
MD5	1b31496d767673f647316dfc177d5ef7
SHA1	fc50b4d4f677f1320f6588b38dd0e9cba6196751
SHA256	5d1e36b498d764cb01d9d6900cd18d5b595a6de946ffb6dbe7933db3ad12420b
SSDeep	6144:nWZGO41XvIefu+aSxiJBCYGnf59ovsR0CBQB:8GXvjjaUmUYzmQB
Status	New
Sectors	
Sources	test (1): 2014-09-18
Releasability	

Tickets

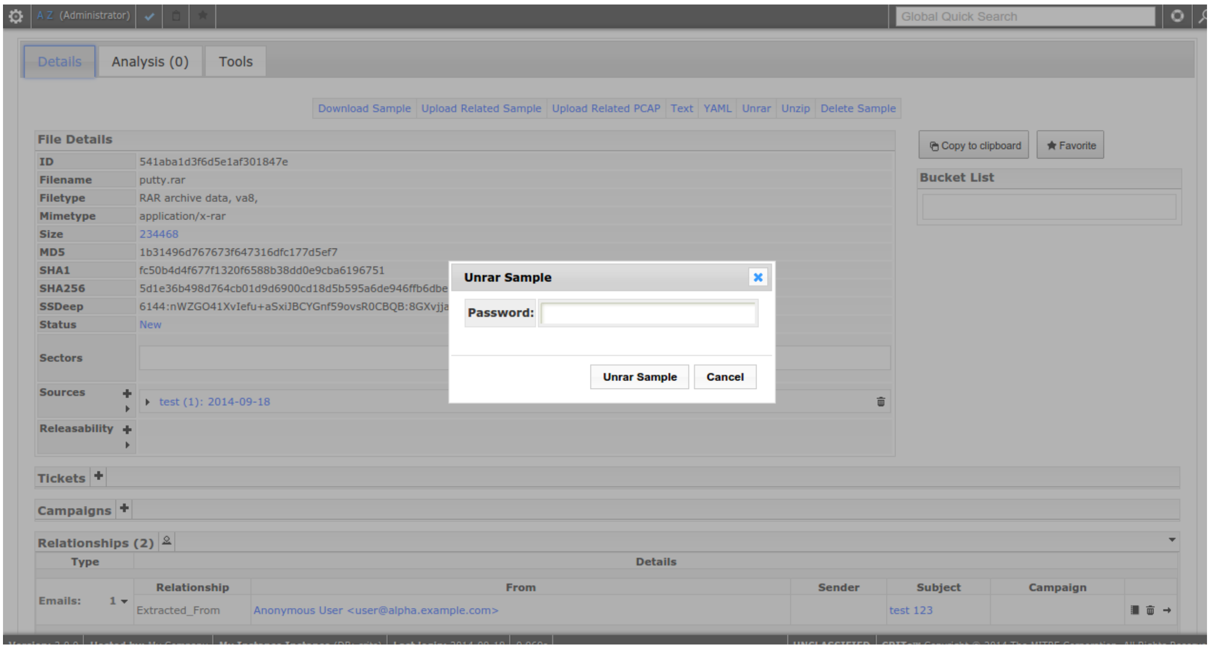
Campaigns

Relationships (1)

Type	Relationship	From	Sender	Subject	Campaign
Emails: 1	Extracted_From	Anonymous User <user@alpha.example.com>		test 123	

Figure 34. CRITs attachment details

This attachment is a RAR archive, to unpack it you can use a tool built into CRITs – just select ‘Unrar’ tab.



File Details

ID	541aba1d3f6d5e1af301847e
Filename	putty.rar
Filetype	RAR archive data, va8,
Mimetype	application/x-rar
Size	234468
MD5	1b31496d767673f647316dfc177d5ef7
SHA1	fc50b4d4f677f1320f6588b38dd0e9cba6196751
SHA256	5d1e36b498d764cb01d9d6900cd18d5b595a6de946ffb6dbe
SSDeep	6144:nWZGO41XvIefu+aSxiJBCYGnf59ovsR0CBQB:8GXvjja
Status	New
Sectors	
Sources	test (1): 2014-09-18
Releasability	

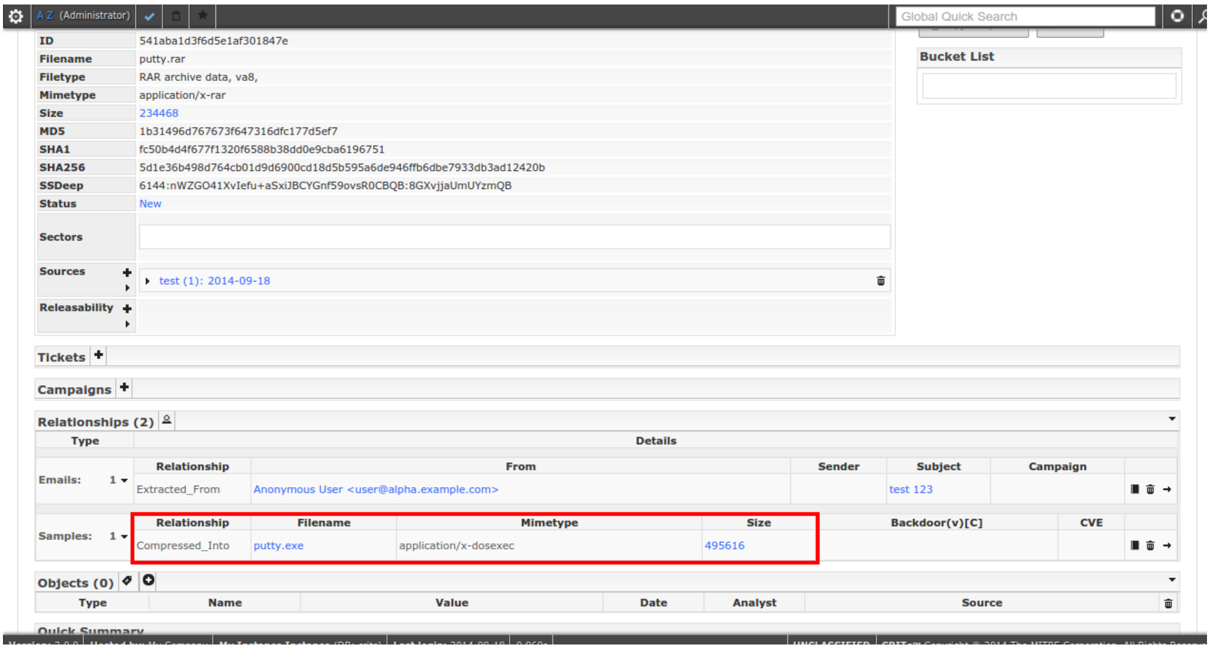
Password:

Relationships (2)

Type	Relationship	From	Sender	Subject	Campaign
Emails: 1	Extracted_From	Anonymous User <user@alpha.example.com>		test 123	

Figure 35. CRITs unrar sample

Our sample archive is protected with password, and the password is ‘infected’ (the archive is clean however).



ID	541aba1d3f6d5e1af301847e
Filename	putty.rar
Filetype	RAR archive data, va8,
Mimetype	application/x-rar
Size	234468
MD5	1b31496d767673f647316dfc177d5ef7
SHA1	fc50b4d4f677f1320f6588b38dd0e9cba6196751
SHA256	5d1e36b498d764cb01d9d6900cd18d5b595a6de946ffb6dbe7933db3ad12420b
SSDeep	6144:nWZGO41XvIefu+aSxiJBCYGnf59ovsR0CBQB:8GXvjjaUmUYzmQB
Status	New
Sectors	
Sources	test (1): 2014-09-18
Releasability	

Relationships (2)

Type	Relationship	From	Sender	Subject	Campaign
Emails: 1	Extracted_From	Anonymous User <user@alpha.example.com>		test 123	

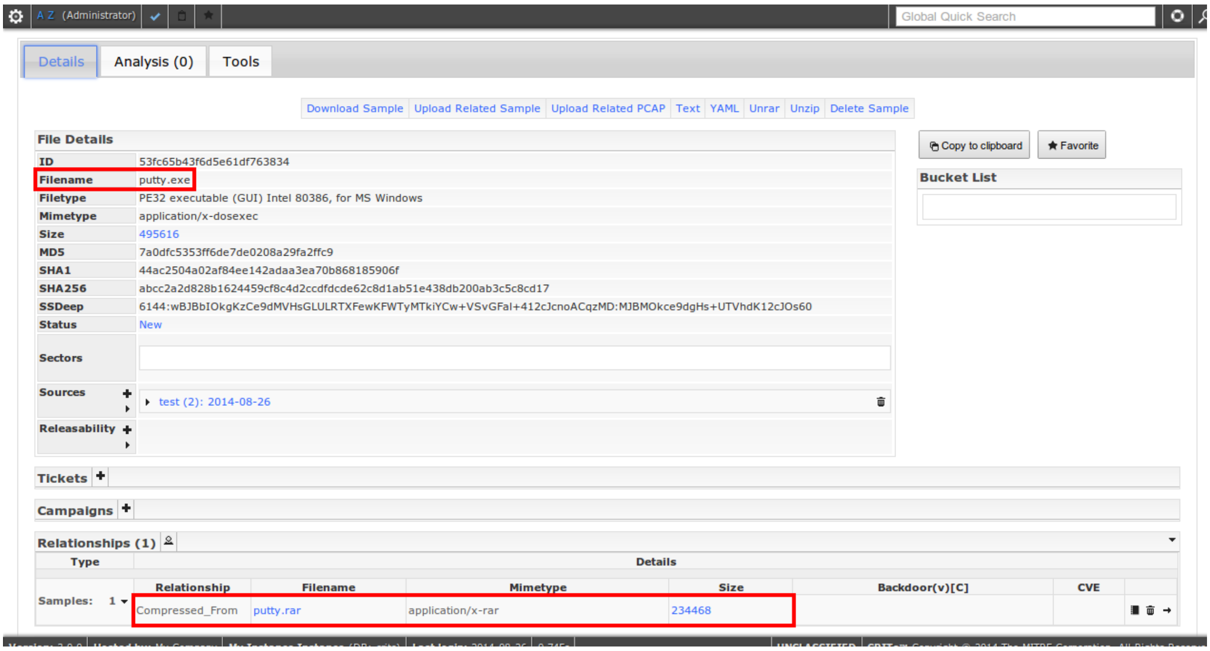
Type	Relationship	Filename	Mimetype	Size	Backdoor(v)[C]	CVE
Samples: 1	Compressed_Into	putty.exe	application/x-dosexec	495616		

Objects (0)

Type	Name	Value	Date	Analyst	Source

Figure 36. RAR archive

After unpacking the RAR archive you will see relationships like the file origin (extracted from mail message).



File Details

ID	53fc65b43f6d5e61df763834
Filename	putty.exe
Filetype	PE32 executable (GUI) Intel 80386, for MS Windows
Mimetype	application/x-dosexec
Size	495616
MD5	7a0dfc5353ff6de7de0208a29fa2ffc9
SHA1	44ac2504a02af84ee142adaa3ea70b868185906f
SHA256	abcc2a2d828b1624459cf8c4d2ccdfdcde62c8d1ab51e438db200ab3c5c8cd17
SSDeep	6144:wBJBbIOkgKzCe9dMVHsGLULRTXFewKFWTyMTkiYCw+VSvGFal+412cJcnoACqzMD:MJBMOkce9dgHs+UTVhdK12cJOs60
Status	New
Sectors	
Sources	test (2): 2014-08-26
Releasability	

Tickets

Campaigns

Relationships (1)

Type	Relationship	Filename	Mimetype	Size	Backdoor(v)[C]	CVE
Samples: 1	Compressed_From	putty.rar	application/x-rar	234468		

Figure 37. CRITs File Details

After selecting the binary you will see also relationship to the archive it was extracted from.

4 Python and common data formats

The formats we are discussing here are based on the XML (eXtensible Markup Language), today's standard in defining structured documents. Because of this simple fact you can easily play with these formats using standard XML libraries available for virtually all modern programming languages. As an example we will use one of the most popular - Python.

All these examples are stored on the VM in '/home/enisa/examples/' directory.

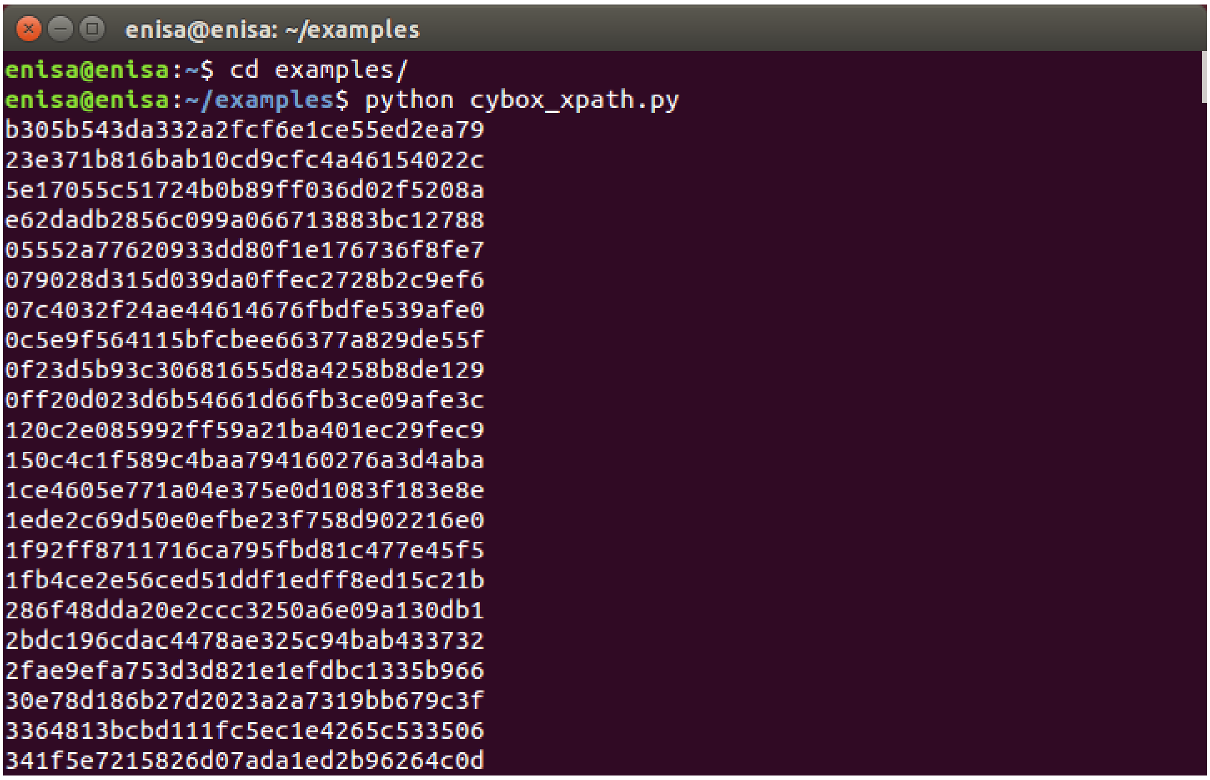
```
#!/usr/bin/env python
# -*- coding: utf-8 -*-s
from lxml import etree # http://lxml.de/xpathxslt.html#the-xpath-method
namespaces = {
        'xsi': 'http://www.w3.org/2001/XMLSchema-instance',
        'stix': 'http://stix.mitre.org/stix-1',
        'stixVocabs': 'http://stix.mitre.org/default_vocabularies-1',
        'stixCommon': 'http://stix.mitre.org/common-1',
        'cybox': 'http://cybox.mitre.org/cybox-2',
        'cyboxCommon': 'http://cybox.mitre.org/common-2',
        'cyboxVocabs': 'http://cybox.mitre.org/default_vocabularies-2',
        'indicator': 'http://stix.mitre.org/Indicator-2',
        'ttp': 'http://stix.mitre.org/TTP-1',
        'marking': 'http://data-marking.mitre.org/Marking-1',
        'simpleMarking': 'http://data-marking.mitre.org/extensions/MarkingStructure#Simple-1',
        'openiocTM': 'http://stix.mitre.org/extensions/TestMechanism#OpenIOC2010-1',
        'mandiant': 'http://www.mandiant.com',
        'FileObj': 'http://cybox.mitre.org/objects#FileObject-2',
        'WinServiceObj': 'http://cybox.mitre.org/objects#WinServiceObject-2',
        'WinProcessObj': 'http://cybox.mitre.org/objects#WinProcessObject-2',
        'WinExecutableFileObj': 'http://cybox.mitre.org/objects#WinExecutableFileObject-2',
        'WinRegistryKeyObj': 'http://cybox.mitre.org/objects#WinRegistryKeyObject-2',
        'WinHandleObj': 'http://cybox.mitre.org/objects#WinHandleObject-2',
        'ProcessObj': 'http://cybox.mitre.org/objects#ProcessObject-2',
        'WinDriverObj': 'http://cybox.mitre.org/objects#WinDriverObject-2'
}

f = 'Appendix_G_IOCs_Full.xml' # http://stix.mitre.org/downloads/APT1-STIX.zip
doc = etree.parse(f)
for r in doc.xpath('/stix:STIX_Package/stix:Observables/cybox:Observable/cybox:Object/cybox:Properties/FileObj:Hashes/cyboxCommon:Hash/cyboxCommon:Simple_Hash_Value', namespaces=namespaces):
        print r.text
```

This sample script opens “Appendix_G_IOCs_Full.xml” file from the STIX examples http://stix.mitre.org/downloads/APT1-STIX.zip.

After parsing it with namespaces and XPATH it prints all hashes from this file on the screen in a loop.

```
$ python cybox_xpath.py
b305b543da332a2fcf6e1ce55ed2ea79
23e371b816bab10cd9cfc4a46154022c
5e17055c51724b0b89ff036d02f5208a
e62dadb2856c099a066713883bc12788
05552a77620933dd80f1e176736f8fe7
079028d315d039da0ffec2728b2c9ef6
07c4032f24ae44614676fbdfe539afe0
0c5e9f564115bfcbee66377a829de55f
0f23d5b93c30681655d8a4258b8de129
0ff20d023d6b54661d66fb3ce09afe3c
120c2e085992ff59a21ba401ec29fec9
150c4c1f589c4baa794160276a3d4aba
1ce4605e771a04e375e0d1083f183e8e
1ede2c69d50e0efbe23f758d902216e0
1f92ff8711716ca795fbd81c477e45f5
1fb4ce2e56ced51ddf1edff8ed15c21b
286f48dda20e2ccc3250a6e09a130db1
2bdc196cdac4478ae325c94bab433732
```

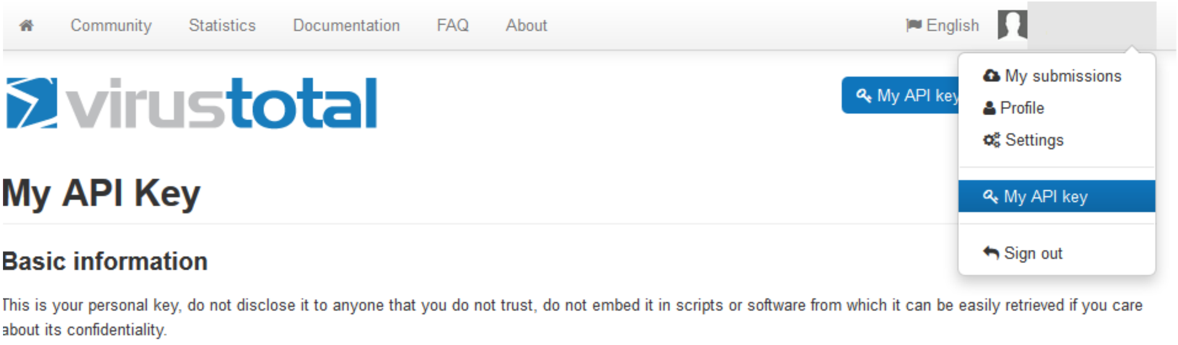
```
2fae9efa753d3d821e1efdbc1335b966
30e78d186b27d2023a2a7319bb679c3f
[...]
```



```
enisa@enisa: ~/examples
enisa@enisa:~$ cd examples/
enisa@enisa:~/examples$ python cybox_xpath.py
b305b543da332a2fcf6e1ce55ed2ea79
23e371b816bab10cd9cfc4a46154022c
5e17055c51724b0b89ff036d02f5208a
e62dadb2856c099a066713883bc12788
05552a77620933dd80f1e176736f8fe7
079028d315d039da0ffec2728b2c9ef6
07c4032f24ae44614676fbdfe539afe0
0c5e9f564115bfcbee66377a829de55f
0f23d5b93c30681655d8a4258b8de129
0ff20d023d6b54661d66fb3ce09afe3c
120c2e085992ff59a21ba401ec29fec9
150c4c1f589c4baa794160276a3d4aba
1ce4605e771a04e375e0d1083f183e8e
1ede2c69d50e0efbe23f758d902216e0
1f92ff8711716ca795fbd81c477e45f5
1fb4ce2e56ced51ddf1edff8ed15c21b
286f48dda20e2ccc3250a6e09a130db1
2bdc196cdac4478ae325c94bab433732
2fae9efa753d3d821e1efdbc1335b966
30e78d186b27d2023a2a7319bb679c3f
3364813bcbd111fc5ec1e4265c533506
341f5e7215826d07ada1ed2b96264c0d
```

Figure 38. Hashes extracted from the APT1 source

You can also query services like VirusTotal with these hashes. You will need VirusTotal API key. To request this key login to the VirusTotal service and select 'My API key' from the menu as shown below:



My API Key

Basic information

This is your personal key, do not disclose it to anyone that you do not trust, do not embed it in scripts or software from which it can be easily retrieved if you care about its confidentiality.

Figure 39. VirustTotal.com API key

Sample python script sending hashes to the VT:

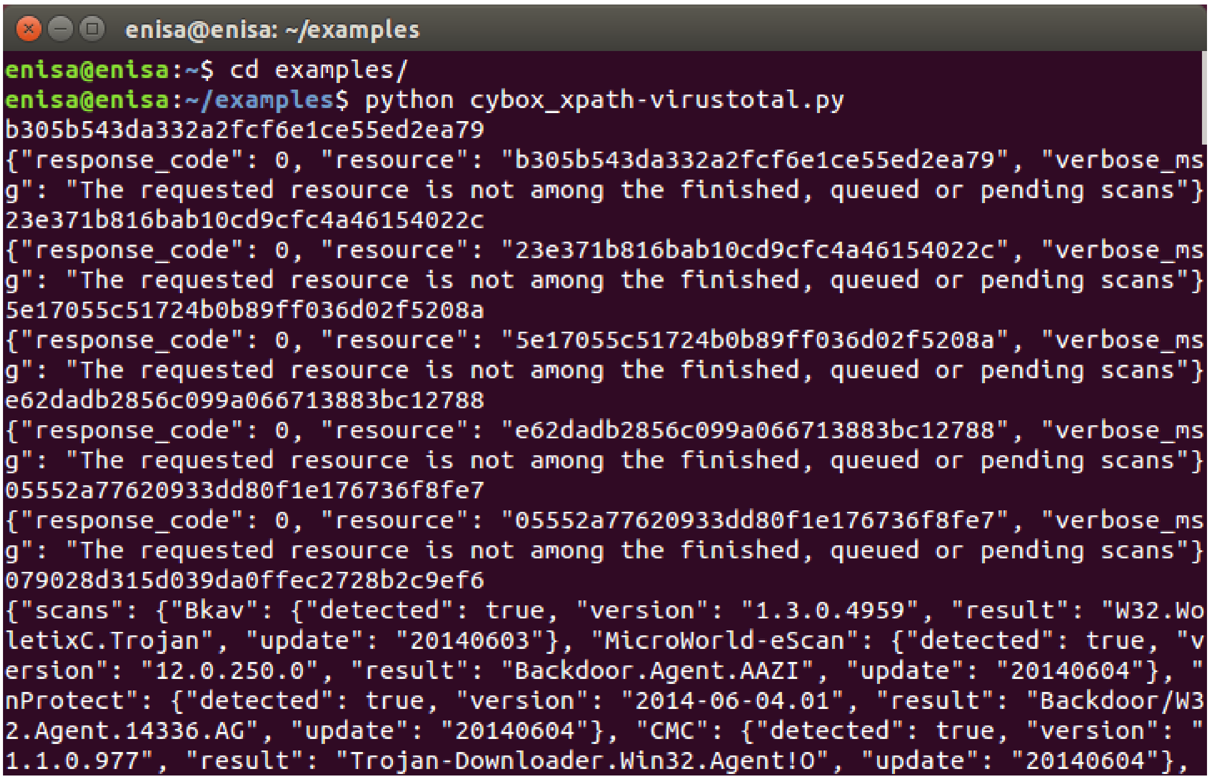
```
#!/usr/bin/env python
# -*- coding: utf-8 -*-


from lxml import etree # http://lxml.de/xpathxslt.html#the-xpath-method
```

```
import simplejson
import urllib
import urllib2
import time

namespaces = {
        'xsi': 'http://www.w3.org/2001/XMLSchema-instance',
        'stix': 'http://stix.mitre.org/stix-1',
        'stixVocabs': 'http://stix.mitre.org/default_vocabularies-1',
        'stixCommon': 'http://stix.mitre.org/common-1',
        'cybox': 'http://cybox.mitre.org/cybox-2',
        'cyboxCommon': 'http://cybox.mitre.org/common-2',
        'cyboxVocabs': 'http://cybox.mitre.org/default_vocabularies-2',
        'indicator': 'http://stix.mitre.org/Indicator-2',
        'ttp': 'http://stix.mitre.org/TTP-1',
        'marking': 'http://data-marking.mitre.org/Marking-1',
        'simpleMarking': 'http://data-marking.mitre.org/extensions/MarkingStructure#Simple-1',
        'openiocTM': 'http://stix.mitre.org/extensions/TestMechanism#OpenIOC2010-1',
        'mandiant': 'http://www.mandiant.com',
        'FileObj': 'http://cybox.mitre.org/objects#FileObject-2',
        'WinServiceObj': 'http://cybox.mitre.org/objects#WinServiceObject-2',
        'WinProcessObj': 'http://cybox.mitre.org/objects#WinProcessObject-2',
        'WinExecutableFileObj': 'http://cybox.mitre.org/objects#WinExecutableFileObject-2',
        'WinRegistryKeyObj': 'http://cybox.mitre.org/objects#WinRegistryKeyObject-2',
        'WinHandleObj': 'http://cybox.mitre.org/objects#WinHandleObject-2',
        'ProcessObj': 'http://cybox.mitre.org/objects#ProcessObject-2',
        'WinDriverObj': 'http://cybox.mitre.org/objects#WinDriverObject-2'
}

url = "https://www.virustotal.com/vtapi/v2/file/report"
f = 'Appendix_G_IOCs_Full.xml' # http://stix.mitre.org/downloads/APT1-STIX.zip

doc = etree.parse(f)
for r in doc.xpath('/stix:STIX_Package/stix:Observables/cybox:Observable/cybox:Object/cybox:Properties/FileObj:Hashes/cyboxCommon:Hash/cyboxCommon:Simple_Hash_Value', namespaces=namespaces):
        print r.text
        parameters = {"resource": r.text, "apikey": "XXXXXXXXXX"} # VirusTotal API Key
        data = urllib.urlencode(parameters)
        req = urllib2.Request(url, data)

        response = urllib2.urlopen(req)

        json = response.read()

        print json

        time.sleep(15) # VirusTotal API request rate - 4 requests/minute
```

After running the above script you will get output like (without colour distinctions):

```
$ python cybox_xpath-virustotal.py

b305b543da332a2fcf6e1ce55ed2ea79

{"response_code": 0, "resource": "b305b543da332a2fcf6e1ce55ed2ea79", "verbose_msg": "The requested resource is not
among the finished, queued or pending scans"}

23e371b816bab10cd9cfc4a46154022c

{"response_code": 0, "resource": "23e371b816bab10cd9cfc4a46154022c", "verbose_msg": "The requested resource is not
among the finished, queued or pending scans"}

5e17055c51724b0b89ff036d02f5208a

{"response_code": 0, "resource": "5e17055c51724b0b89ff036d02f5208a", "verbose_msg": "The requested resource is not
among the finished, queued or pending scans"}

e62dadb2856c099a066713883bc12788

{"response_code": 0, "resource": "e62dadb2856c099a066713883bc12788", "verbose_msg": "The requested resource is not
among the finished, queued or pending scans"}

05552a77620933dd80f1e176736f8fe7

{"response_code": 0, "resource": "05552a77620933dd80f1e176736f8fe7", "verbose_msg": "The requested resource is not
among the finished, queued or pending scans"}

079028d315d039da0ffec2728b2c9ef6

{"scans": {"Bkav": {"detected": true, "version": "1.3.0.4959", "result": "W32.WoletixC.Trojan", "update": "20140603"},
"MicroWorld-eScan": {"detected": true, "version": "12.0.250.0", "result": "Backdoor.Agent.AAZI", "update": "20140604"},
"nProtect": {"detected": true, "version": "2014-06-04.01", "result": "Backdoor/W32.Agent.14336.AG", "update":
"20140604"}, "CMC": {"detected": true, "version": "1.1.0.977", "result": "Trojan-Downloader.Win32.Agent!O", "update":
"20140604"}, "CAT-QuickHeal": {"detected": true, "version": "14.00", "result": "Backdoor.Likseput.B3", "update":
"20140604"}, "McAfee": {"detected": true, "version": "6.0.4.564", "result": "BackDoor-FALR!079028D315D0", "update":
"20140604"}, "Malwarebytes": {"detected": false, "version": "1.75.0001", "result": null, "update": "20140604"},
"SUPERAntiSpyware": {"detected": false, "version": "5.6.0.1032", "result": null, "update": "20140604"}, "TheHacker":
{"detected": true, "version": "6.8.0.5.463", "result": "Trojan/Downloader.Agent.tmyh", "update": "20140602"}, "K7GW":
{"detected": true, "version": "9.178.12292", "result": "Backdoor ( 04c525311 )", "update": "20140603"}, "K7AntiVirus":
{"detected": true, "version": "9.178.12292", "result": "Backdoor ( 04c525311 )", "update": "20140603"}, "Agnitum":
{"detected": true, "version": "5.5.1.3", "result": "Trojan.DL.Agent!oelAAZ4vip8", "update": "20140602"}, "F-Prot":
{"detected": true, "version": "4.7.1.166", "result": "W32/Trojan-Dlr-SysWrt-based!Max", "update": "20140604"},
"Symantec": {"detected": true, "version": "20131.1.5.61", "result": "Backdoor.Trojan", "update": "20140604"}, "Norman":
{"detected": true, "version": "7.04.04", "result": "Agent.AOLSS", "update": "20140604"}, "TotalDefense": {"detected": false,
"version": "37.0.10977", "result": null, "update": "20140603"}, "TrendMicro-HouseCall": {"detected": true, "version":
"9.700-1001", "result": "BKDR_LIKSPUT.SMR", "update": "20140604"}, "Avast": {"detected": true, "version": "8.0.1489.320",
"result": "Win32:Malware-gen", "update": "20140604"}, "ClamAV": {"detected": false, "version": "0.98.3", "result": null,
"update": "20140603"}, "Kaspersky": {"detected": true, "version": "12.0.0.1225", "result": "Trojan-
Downloader.Win32.Agent.xumu", "update": "20140604"}, "BitDefender": {"detected": true, "version": "7.2", "result":
"Backdoor.Agent.AAZI", "update": "20140604"}, "NANO-Antivirus": {"detected": true, "version": "0.28.0.60100", "result":
"Trojan.Win32.Agent.cpgsvj", "update": "20140604"}, "AegisLab": {"detected": false, "version": "1.5", "result": null,
"update": "20140604"}, "ByteHero": {"detected": false, "version": "1.0.0.1", "result": null, "update": "20140604"},
"Tencent": {"detected": false, "version": "1.0.0.1", "result": null, "update": "20140604"}, "Ad-Aware": {"detected": true,
"version": "12.0.163.0", "result": "Backdoor.Agent.AAZI", "update": "20140604"}, "Sophos": {"detected": true, "version":
"4.98.0", "result": "Troj/Agent-UCB", "update": "20140604"}, "Comodo": {"detected": true, "version": "18430", "result":
```

```
"UnclassifiedMalware", "update": "20140604"}, "F-Secure": {"detected": true, "version": "11.0.19100.45", "result":
"Backdoor.Agent.AAZI", "update": "20140604"}, "DrWeb": {"detected": true, "version": "7.00.9.04080", "result":
"Trojan.DownLoad2.44669", "update": "20140604"}, "VIPRE": {"detected": true, "version": "29924", "result":
"Trojan.Win32.Generic!BT", "update": "20140604"}, "AntiVir": {"detected": true, "version": "7.11.152.224", "result":
"TR/Spy.Gen", "update": "20140604"}, "TrendMicro": {"detected": true, "version": "9.740-1012", "result":
"TROJ_GEN.F0C2C00L413", "update": "20140604"}, "McAfee-GW-Edition": {"detected": true, "version": "2013", "result":
"BackDoor-FALR!079028D315D0", "update": "20140603"}, "Emsisoft": {"detected": true, "version": "3.0.0.599", "result":
"Backdoor.Agent.AAZI (B)", "update": "20140604"}, "Antiy-AVL": {"detected": true, "version": "0.1.0.1", "result":
"Trojan[Downloader]/Win32.Agent", "update": "20140603"}, "Kingsoft": {"detected": true, "version": "2013.04.09.267",
"result": "Win32.TrojDownloader.Agent.(kcloud)", "update": "20140604"}, "Microsoft": {"detected": true, "version":
"1.10600", "result": "Backdoor:Win32/Likseput.B", "update": "20140604"}, "ViRobot": {"detected": true, "version":
"2011.4.7.4223", "result": "Trojan.Win32.A.Downloader.14336.AV", "update": "20140604"}, "AhnLab-V3": {"detected":
true, "version": "2014.06.04.00", "result": "Downloader/Win32.Agent", "update": "20140603"}, "GData": {"detected": true,
"version": "24", "result": "Backdoor.Agent.AAZI", "update": "20140604"}, "Commtouch": {"detected": true, "version":
"5.4.1.7", "result": "W32/Trojan-Dlr-SysWrt-based!Max", "update": "20140604"}, "ESET-NOD32": {"detected": true,
"version": "9891", "result": "a variant of Win32/Agent.PNC", "update": "20140604"}, "VBA32": {"detected": true, "version":
"3.12.26.0", "result": "TrojanDownloader.Agent", "update": "20140604"}, "Baidu-International": {"detected": true,
"version": "3.5.1.41473", "result": "Trojan.Win32.Downloader.AYy", "update": "20140604"}, "Rising": {"detected": false,
"version": "25.0.0.11", "result": null, "update": "20140603"}, "Ikarus": {"detected": true, "version": "T3.1.6.1.0", "result":
"Backdoor.Win32.Likseput", "update": "20140604"}, "Fortinet": {"detected": true, "version": "4", "result":
"W32/Agent.OIG!tr", "update": "20140604"}, "AVG": {"detected": true, "version": "14.0.0.3955", "result":
"Downloader.Agent2.AVNR", "update": "20140604"}, "Panda": {"detected": true, "version": "10.0.3.5", "result": "Generic
Backdoor", "update": "20140603"}, "Qihoo-360": {"detected": true, "version": "1.0.0.1015", "result":
"HEUR/Malware.QVM07.Gen", "update": "20140604"}}, "scan_id":
"4123011354d8259e919fbdf605be1973a79100074959dca9d0cd1955667b8e93-1401874699", "sha1":
"565a1b0b23f7c8f8e89030bc13b51e80df264a13", "resource": "079028d315d039da0ffec2728b2c9ef6", "response_code":
1, "scan_date": "2014-06-04 09:38:19", "permalink":
"https://www.virustotal.com/file/4123011354d8259e919fbdf605be1973a79100074959dca9d0cd1955667b8e93/analysis/1
401874699/", "verbose_msg": "Scan finished, scan information embedded in this object", "total": 51, "positives": 43,
"sha256": "4123011354d8259e919fbdf605be1973a79100074959dca9d0cd1955667b8e93", "md5":
"079028d315d039da0ffec2728b2c9ef6"}

[…]
```



```
enisa@enisa:~$ cd examples/
enisa@enisa:~/examples$ python cybox_xpath-virustotal.py
b305b543da332a2fcf6e1ce55ed2ea79
{"response_code": 0, "resource": "b305b543da332a2fcf6e1ce55ed2ea79", "verbose_ms
g": "The requested resource is not among the finished, queued or pending scans"}
23e371b816bab10cd9cfc4a46154022c
{"response_code": 0, "resource": "23e371b816bab10cd9cfc4a46154022c", "verbose_ms
g": "The requested resource is not among the finished, queued or pending scans"}
5e17055c51724b0b89ff036d02f5208a
{"response_code": 0, "resource": "5e17055c51724b0b89ff036d02f5208a", "verbose_ms
g": "The requested resource is not among the finished, queued or pending scans"}
e62dadb2856c099a066713883bc12788
{"response_code": 0, "resource": "e62dadb2856c099a066713883bc12788", "verbose_ms
g": "The requested resource is not among the finished, queued or pending scans"}
05552a77620933dd80f1e176736f8fe7
{"response_code": 0, "resource": "05552a77620933dd80f1e176736f8fe7", "verbose_ms
g": "The requested resource is not among the finished, queued or pending scans"}
079028d315d039da0ffec2728b2c9ef6
{"scans": {"Bkav": {"detected": true, "version": "1.3.0.4959", "result": "W32.Wo
letixC.Trojan", "update": "20140603"}, "MicroWorld-eScan": {"detected": true, "v
ersion": "12.0.250.0", "result": "Backdoor.Agent.AAZI", "update": "20140604"}, "
nProtect": {"detected": true, "version": "2014-06-04.01", "result": "Backdoor/W3
2.Agent.14336.AG", "update": "20140604"}, "CMC": {"detected": true, "version": "
1.1.0.977", "result": "Trojan-Downloader.Win32.Agent!O", "update": "20140604"},
```

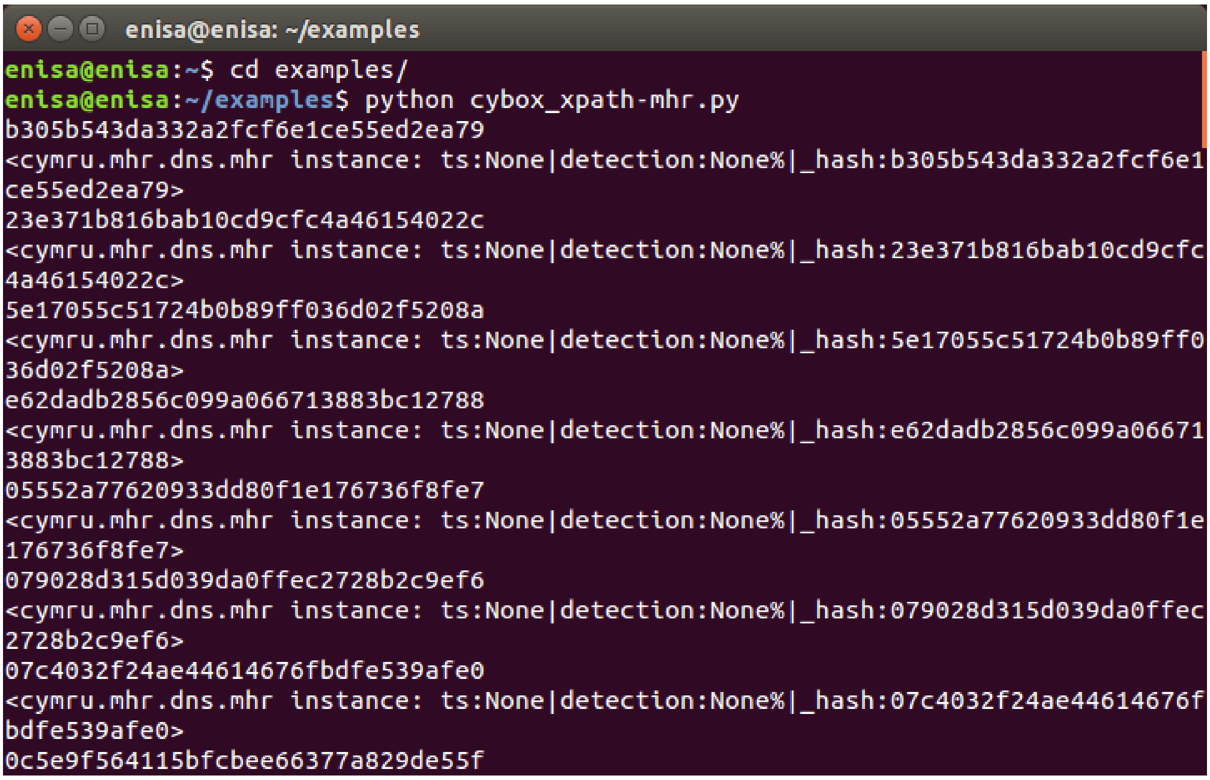
Figure 40. VirusTotal queries with Python

The same, easy way you can query other malware databases such as Malware Hash Registry (MHR) from Team Cymru and a sample script for doing that is shown below:

```
#!/usr/bin/env python
# -*- coding: utf-8 -*-

from lxml import etree # http://lxml.de/xpathxslt.html#the-xpath-method
import hashlib
from cymru.mhr.dns import DNSClient as mhr

namespaces = {
        'xsi': 'http://www.w3.org/2001/XMLSchema-instance',
        'stix': 'http://stix.mitre.org/stix-1',
        'stixVocabs': 'http://stix.mitre.org/default_vocabularies-1',
        'stixCommon': 'http://stix.mitre.org/common-1',
        'cybox': 'http://cybox.mitre.org/cybox-2',
        'cyboxCommon': 'http://cybox.mitre.org/common-2',
        'cyboxVocabs': 'http://cybox.mitre.org/default_vocabularies-2',
        'indicator': 'http://stix.mitre.org/Indicator-2',
        'ttp': 'http://stix.mitre.org/TTP-1',
        'marking': 'http://data-marking.mitre.org/Marking-1',
        'simpleMarking': 'http://data-marking.mitre.org/extensions/MarkingStructure#Simple-1',
        'openiocTM': 'http://stix.mitre.org/extensions/TestMechanism#OpenIOC2010-1',
        'mandiant': 'http://www.mandiant.com',
        'FileObj': 'http://cybox.mitre.org/objects#FileObject-2',
        'WinServiceObj': 'http://cybox.mitre.org/objects#WinServiceObject-2',
        'WinProcessObj': 'http://cybox.mitre.org/objects#WinProcessObject-2',
        'WinExecutableFileObj': 'http://cybox.mitre.org/objects#WinExecutableFileObject-2',
        'WinRegistryKeyObj': 'http://cybox.mitre.org/objects#WinRegistryKeyObject-2',
        'WinHandleObj': 'http://cybox.mitre.org/objects#WinHandleObject-2',
        'ProcessObj': 'http://cybox.mitre.org/objects#ProcessObject-2',
        'WinDriverObj': 'http://cybox.mitre.org/objects#WinDriverObject-2'
}

client=mhr()
f = 'Appendix_G_IOCs_Full.xml' # http://stix.mitre.org/downloads/APT1-STIX.zip
doc = etree.parse(f)
for r in
doc.xpath('/stix:STIX_Package/stix:Observables/cybox:Observable/cybox:Object/cybox:Properties/FileObj:Hashes/cyboxCo
mmon:Hash/cyboxCommon:Simple_Hash_Value', namespaces=namespaces):
        print r.text
        print client.lookup(r.text)
```

After running it you will get an output like (without colour distinctions):

```
$ python cybox_xpath-mhr.py
[…]
0c5e9f564115bfcbee66377a829de55f
<cymru.mhr.dns.mhr instance: ts:1361642853|detection:41%|_hash:0c5e9f564115bfcbee66377a829de55f>
0f23d5b93c30681655d8a4258b8de129
<cymru.mhr.dns.mhr instance: ts:None|detection:None%|_hash:0f23d5b93c30681655d8a4258b8de129>
0ff20d023d6b54661d66fb3ce09afe3c
<cymru.mhr.dns.mhr instance: ts:None|detection:None%|_hash:0ff20d023d6b54661d66fb3ce09afe3c>
120c2e085992ff59a21ba401ec29fec9
<cymru.mhr.dns.mhr instance: ts:1367288162|detection:64%|_hash:120c2e085992ff59a21ba401ec29fec9>
150c4c1f589c4baa794160276a3d4aba
<cymru.mhr.dns.mhr instance: ts:None|detection:None%|_hash:150c4c1f589c4baa794160276a3d4aba>
1ce4605e771a04e375e0d1083f183e8e
<cymru.mhr.dns.mhr instance: ts:1255088157|detection:60%|_hash:1ce4605e771a04e375e0d1083f183e8e>
1ede2c69d50e0efbe23f758d902216e0
<cymru.mhr.dns.mhr instance: ts:None|detection:None%|_hash:1ede2c69d50e0efbe23f758d902216e0>
1f92ff8711716ca795fbd81c477e45f5
<cymru.mhr.dns.mhr instance: ts:1361643138|detection:55%|_hash:1f92ff8711716ca795fbd81c477e45f5>
1fb4ce2e56ced51ddf1edff8ed15c21b
<cymru.mhr.dns.mhr instance: ts:1386799871|detection:61%|_hash:1fb4ce2e56ced51ddf1edff8ed15c21b>
```



```
enisa@enisa:~$ cd examples/
enisa@enisa:~/examples$ python cybox_xpath-mhr.py
b305b543da332a2fcf6e1ce55ed2ea79
<cymru.mhr.dns.mhr instance: ts:None|detection:None%|_hash:b305b543da332a2fcf6e1
ce55ed2ea79>
23e371b816bab10cd9cfc4a46154022c
<cymru.mhr.dns.mhr instance: ts:None|detection:None%|_hash:23e371b816bab10cd9cfc
4a46154022c>
5e17055c51724b0b89ff036d02f5208a
<cymru.mhr.dns.mhr instance: ts:None|detection:None%|_hash:5e17055c51724b0b89ff0
36d02f5208a>
e62dadb2856c099a066713883bc12788
<cymru.mhr.dns.mhr instance: ts:None|detection:None%|_hash:e62dadb2856c099a06671
3883bc12788>
05552a77620933dd80f1e176736f8fe7
<cymru.mhr.dns.mhr instance: ts:None|detection:None%|_hash:05552a77620933dd80f1e
176736f8fe7>
079028d315d039da0ffec2728b2c9ef6
<cymru.mhr.dns.mhr instance: ts:None|detection:None%|_hash:079028d315d039da0ffec
2728b2c9ef6>
07c4032f24ae44614676fbdfe539afe0
<cymru.mhr.dns.mhr instance: ts:None|detection:None%|_hash:07c4032f24ae44614676f
bdfe539afe0>
0c5e9f564115bfcbee66377a829de55f
```

Figure 41. MHR lookup

With contemporary programming languages and their libraries the artifact analysis laboratory can be extended with many useful capabilities. It also allows user to make easy and fast mass verifications of artifacts in large databases like VirusTotal or MHR using their API.

With XPATH one can read any value from STIX, CybOX etc XML formats, so that creating many useful utilities like ‘format aware grep’ – a pattern matching utility becomes possible.

Annex A: Installation instructions

A.1 Mantis installation[20]

The installation instructions below have been tested on an out-of-the-box installation of Ubuntu Linux 14.04 LTS.

Attention: If you are setting up a virtual machine, make sure to give it at least 3GB of memory if you want to import really large XML structures such as MITRE's STIX conversion of the Mandiant APT-1 report (http://stix.mitre.org/downloads/APT1-STIX.zip) – importing large files currently takes a lot of memory – there seems to be a memory leak which we still have to track down.

Make sure that you have the required dependencies on OS level for building the XML-related packages. For example, on an Ubuntu system, execute the following commands:

```
$ sudo apt-get update && sudo apt-get install libxml2 libxml2-dev python-dev libxslt1-dev libz-dev
```

Also, while you are at it, install git, if you do not have it already:

```
$ sudo apt-get install git
```

If you are behind a proxy, you can configure a proxy for apt-get by putting a file 95proxy into /etc/apt/apt.conf.d that has the following contents:

```
Acquire::http::proxy "<proxy_url>";

Acquire::ftp::proxy "<proxy_url>";

Acquire::https::proxy "<proxy_url>";
```

It is recommended to use a virtual python environment.

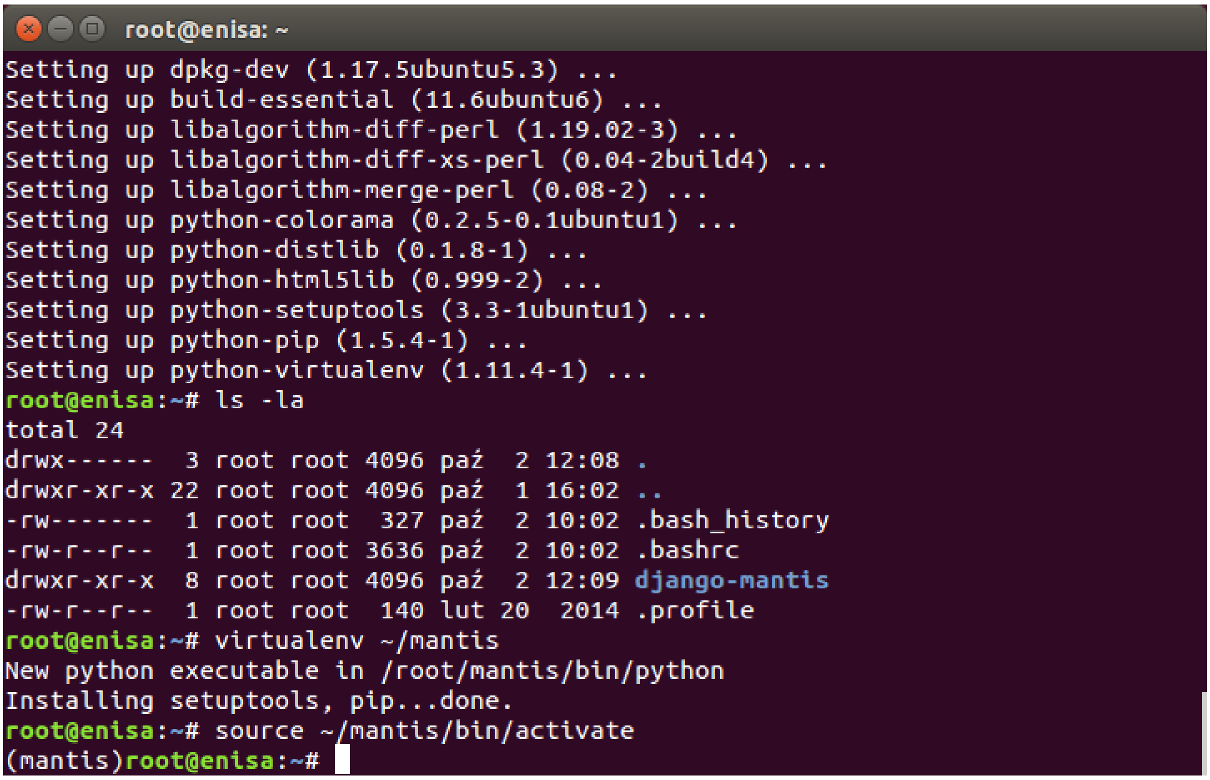
Make sure that virtualenv and pip are installed:

```
$ sudo apt-get install python-virtualenv python-pip
```

Create a virtual environment:

```
$ virtualenv /home/enisa/mantis

$ source /home/enisa/mantis/bin/activate
```

[20] http://django-mantis.readthedocs.org/en/latest/installation.html



```
root@enisa: ~
Setting up dpkg-dev (1.17.5ubuntu5.3) ...
Setting up build-essential (11.6ubuntu6) ...
Setting up libalgorithm-diff-perl (1.19.02-3) ...
Setting up libalgorithm-diff-xs-perl (0.04-2build4) ...
Setting up libalgorithm-merge-perl (0.08-2) ...
Setting up python-colorama (0.2.5-0.1ubuntu1) ...
Setting up python-distlib (0.1.8-1) ...
Setting up python-html5lib (0.999-2) ...
Setting up python-setuptools (3.3-1ubuntu1) ...
Setting up python-pip (1.5.4-1) ...
Setting up python-virtualenv (1.11.4-1) ...
root@enisa:~# ls -la
total 24
drwx------  3 root root 4096 paź  2 12:08 .
drwxr-xr-x 22 root root 4096 paź  1 16:02 ..
-rw-------  1 root root  327 paź  2 10:02 .bash_history
-rw-r--r--  1 root root 3636 paź  2 10:02 .bashrc
drwxr-xr-x  8 root root 4096 paź  2 12:09 django-mantis
-rw-r--r--  1 root root  140 lut 20  2014 .profile
root@enisa:~# virtualenv ~/mantis
New python executable in /root/mantis/bin/python
Installing setuptools, pip...done.
root@enisa:~# source ~/mantis/bin/activate
(mantis)root@enisa:~# 
```

Figure 42. MANTIS activation

Now the virtual environment is activated – you should see a changed prompt that is prefixed with (mantis).

Unfortunately, the process of getting libxml2-python installed using pip varies from OS to OS, because there is no proper library package available. For Ubuntu 14.04, do the following:

Download and unpack the libxml2 sources:

```
(mantis)$ wget http://xmlsoft.org/sources/libxml2-2.9.1.tar.gz
(mantis)$ tar -zxvf libxml2-2.9.1.tar.gz
```

Install via pip:

```
(mantis)$ pip install libxml2-2.9.1/python
```

Go to a location where you want to have the Django Mantis files and check out the git repository:

```
(mantis)$ git clone https://github.com/siemens/django-mantis.git
```

If you are behind a proxy, you can configure a proxy for git via the following:

```
(mantis)$ git config --global http.proxy <proxy_url>
```

Change into the django-mantis directory and do:

```
(mantis)$ cd django-mantis/
(mantis)$ sed -i 's/Django>=1.6/Django==1.6.2/g' requirements/base.txt
(mantis)$ pip install -r requirements/local.txt
(mantis)$ pip install "django-simple-menu>=1.0.6"
```

Last thing to do is to move the database location from /tmp (default) to our home directory:

```
(mantis)$ mkdir /home/enisa/django-mantis/db
(mantis)$ sed -i 's/\/tmp\/django-mantis_test.db/\/home\/enisa\/django-mantis\/db\/django-
mantis_test.db/g' mantis/settings/local.py
```

You are now all set for running MANTIS on top of an SQLite database.

More details about installation (like running MANTIS on top of Postgresql) you can find on http://django-mantis.readthedocs.org/en/latest/installation.html

A.2 CRITs installation[21]

At the beginning you need to install dependencies, depending on the system:

- https://github.com/crits/crits_dependencies – 64-bit dependencies
- https://github.com/adamziaja/crits_dependencies/ – CRITs Ubuntu 14.04.1 LTS 32-bit dependencies

For Install dependencies on Ubuntu 14.04 32-bit type command:

```
wget
https://raw.githubusercontent.com/adamziaja/crits_dependencies/master/install_dependencies_ub
untu_32bit.sh && chmod +x install_dependencies_ubuntu_32bit.sh &&
./install_dependencies_ubuntu_32bit.sh
```

A.2.1 Setting up your single server instance of MongoDB

Create the database directory:

```
sudo mkdir -p /data/db
```

In the 'contrib' directory that came with CRITs, you will find a mongo directory with two directories in it[22]: one for Ubuntu, and one for RHEL. They contain start scripts for your mongo processes. These scripts properly configure reclaim_mode on your server and start the mongod process. cd to the directory for your OS and run the mongod_start.sh script:

```
sudo ./mongod_start.sh
```

Verify this is working by connecting to it with the following command:

```
Mongo
```

This should bring up the mongo shell on localhost.

A.2.2 Installing CRITs using the Django runserver

The Django runserver is our recommended web server for development or test instances of CRITs. It is quick, light, and provides a way for developers and administrators to look at the web server requests/responses in real time. It is also useful for debugging and viewing print statements.

Installing the codebase:

[21] https://github.com/crits/crits

[22] See https://github.com/crits/crits for current CRITS materials

If you are a developer cloning a git repository, we generally recommend you clone to ~/git/crits. If you are using a release tarball, un-tar the tarball in a place of choice.

Edit the database file for your environment:

In the crits/config directory that came with the CRITs codebase, copy database_example.py to database.py:

```
cp database_example.py database.py
```

Edit database.py using the comments to configure your MongoDB connection information and your SECRET_KEY. If you are unsure what S3 is or if you are using it, leave FILE_DB alone.

Create the default collections in MongoDB:

NOTE: at this point you should have MongoDB running!

Run the create_default_collections management command to setup your database:

```
python manage.py create_default_collections
```

Add your first user:

Take a look at the options for the user management command:

```
python manage.py users –h
```

Use that command to setup your first admin user for CRITs. Be sure to use -A to set them as an admin. Make note of the temporary password provided in the output!

Set your allowed hosts:

Django needs to know the host(s) or domain name(s) that you will be serving your CRITs instance from for security purposes. To set this, run the following command:

```
python manage.py setconfig allowed_hosts "foo"
```

Where "foo" is the host/domain name, or a comma separated list of names that will be serving CRITs.

A.2.3 CRITs cronjobs

The main cronjob we recommend is for the script which executes common mapreduce jobs. These jobs do things like collect database statistics, generate Campaign information, and other useful bits of information. If you would like the Counts and stats updated on your Dashboard, you will need to add this.

We also support sending batch email notifications to users of your system. The email provided a non-detailed overview of how many changes have happened to items they are subscribed to. This cronjob also updates the notifications users will see in the interface.

As a user who has access to the codebase and to execute python code, edit their crontab:

```
crontab –e
```

Add the following entries, making adjustments for the folder path and the frequency you want them to run:

```
0 * * * *     cd /data/crits/ && /usr/bin/python manage.py mapreduces
0 * * * *     cd /data/crits/ && /usr/bin/python manage.py generate_notifications
```

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ENISA
European Union Agency for Network and Information Security
Science and Technology Park of Crete (ITE)
Vassilika Vouton, 700 13, Heraklion, Greece

Athens Office
1 Vass. Sofias & Meg. Alexandrou
Marousi 151 24, Athens, Greece

PO Box 1309, 710 01 Heraklion, Greece
Tel: +30 28 14 40 9710
info@enisa.europa.eu
www.enisa.europa.eu