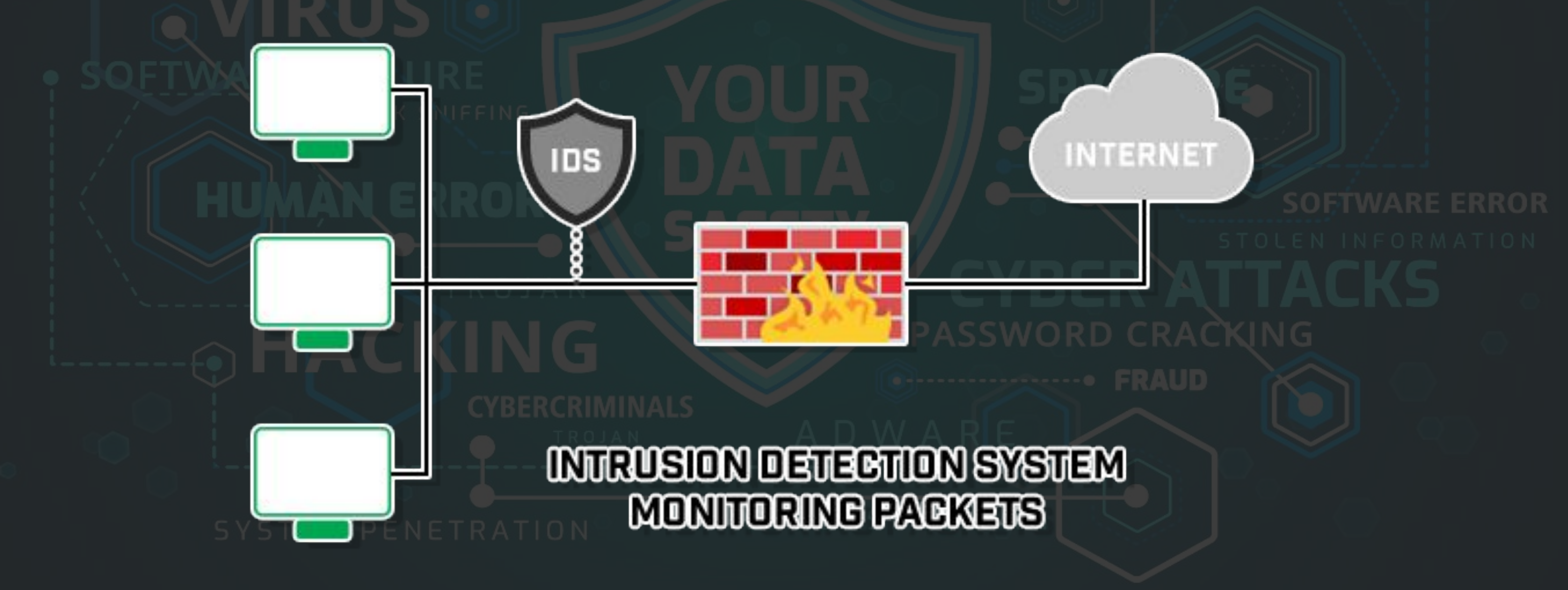
Network Intrusion Detection System

on real time data with Machine Learning

But what is it really a Intrusion Detection System?

An intrusion detection system (IDS) is a device or software application that monitors a network or systems for malicious activity.



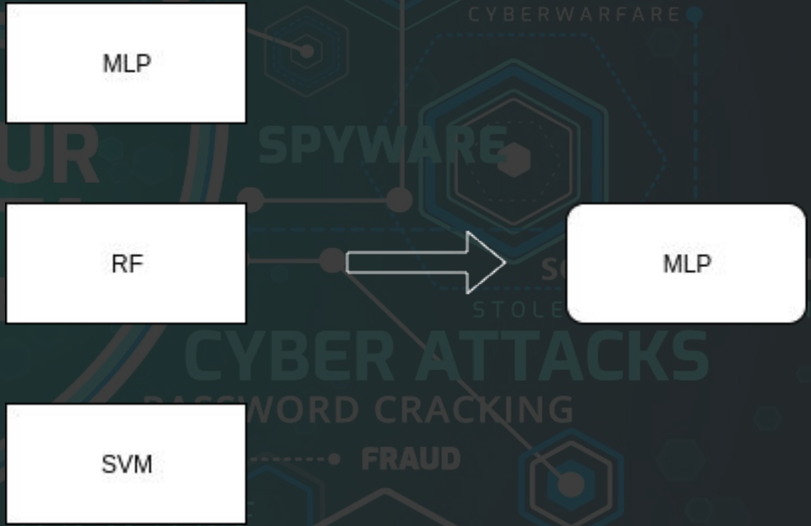
The basic idea - Implementation

- Create a machine learning model that can make decisions and validate if the current traffic is related to an attack or a normal flow.
- We conducted our own research on papers regarding the machine learning algorithms that are related and finally we used the below:

Tests	Normal/Abnormal Classification	Attack Type Classification
Multilayer Perceptron	83.96%	82.81%
Random Forest	81.33%	68.08%
Support Vector Machines	76.10%	68.08%

Which model should we choose ?

It is obvious that MLP produces the better results of the three.We can use the current model for evaluation at the data feeding phase.



MLP

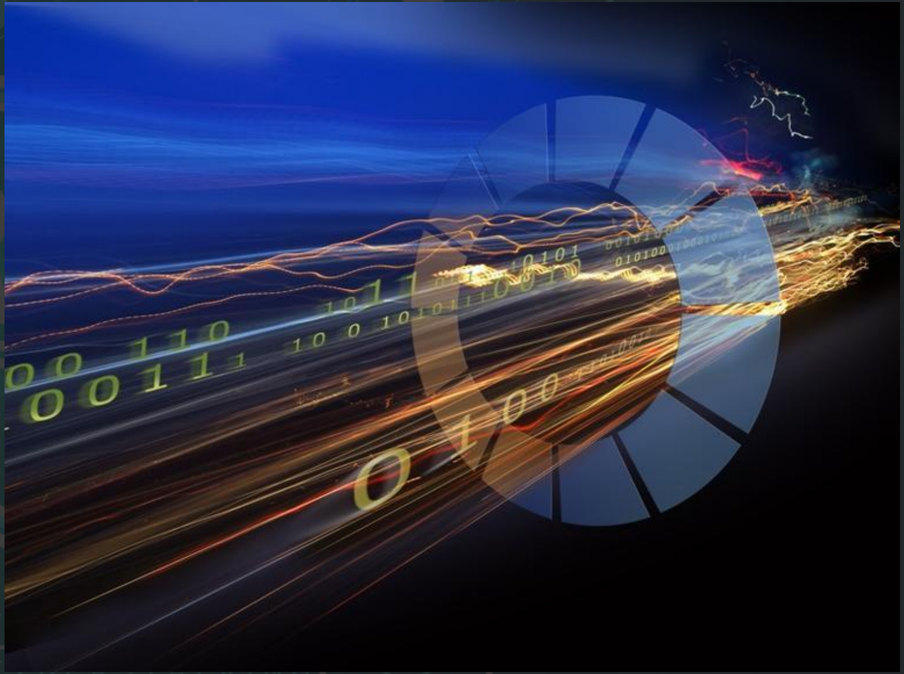
RF

SVM

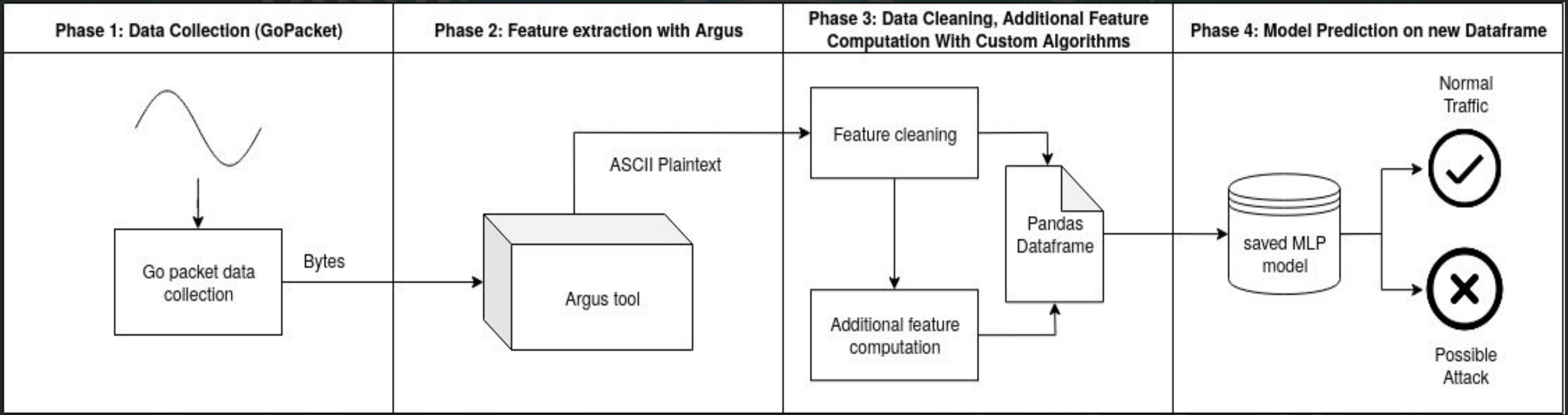
MLP

Real time data stream

Nowadays the data that each network device handles grows exponentially so we must adjust our implementation to real time circumstances.



Data Stream Pipeline - Overview



Phase 1: Data Collection (GoPacket)

Phase 2: Feature extraction with Argus

Phase 3: Data Cleaning, Additional Feature Computation With Custom Algorithms

Phase 4: Model Prediction on new Dataframe

Go packet data collection

Bytes

Argus tool

ASCII Plaintext

Feature cleaning

Additional feature computation

Pandas Dataframe

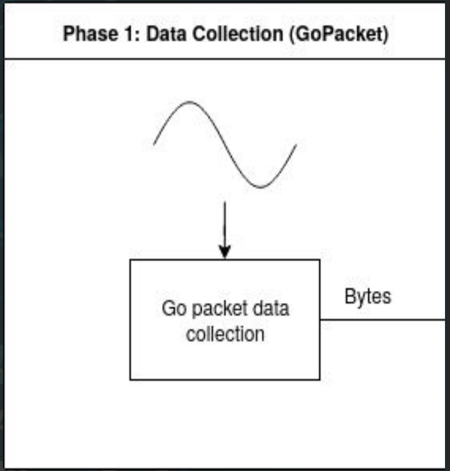
saved MLP model

Normal Traffic

Possible Attack

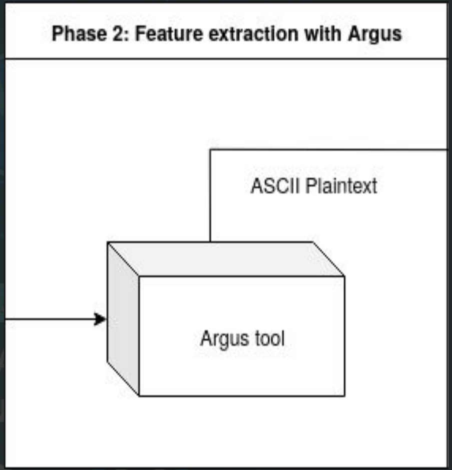
Packet Collection - Steps

- Choose a network interface you want to use.
- Bind to that interface and start listening the traffic.
- Collect each packet.
- Pass the packet byte stream to the next phase of the pipeline.


Phase 1: Data Collection (GoPacket)
Go packet data collection
Bytes

Argus Tool

- Retrieve the byte stream from the previous step.
- Handle the data properly.
- Extract some reports using Argus tool.
- Use ra to read the reports and extract the features we want for our model.
- Pass the above output to the next phase for cleaning and further processing.

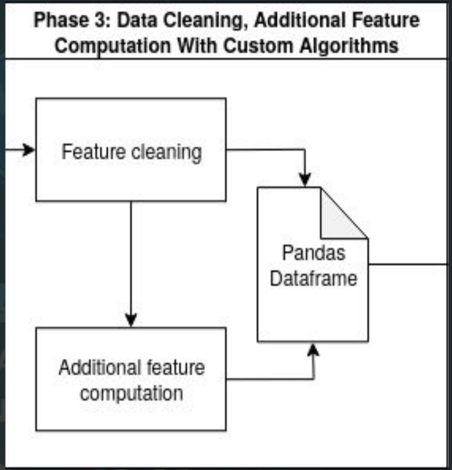


Argus - Features

dur	proto	service	state
spkts	dpkts	rate	sttl
dttl	sload	dload	sinpkt
dinpkt	sjit	djit	swin
stcpb	dtcpb	tcprtt	smeanz
dmeanz	trans_depth	res_body_len	ct_srv_src
ct_state_ttl	ct_dst_ltm	is_ftp_login	ct_flw_http_m

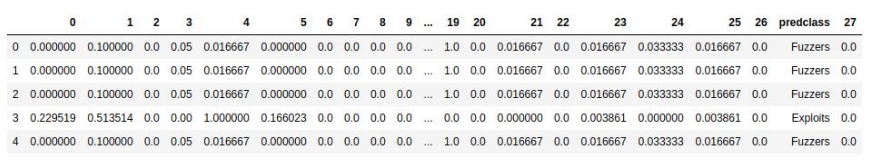
Cleaning - feature extraction

- Retrieve the byte stream from the previous step.
- Generate the “extra” features that are based on some algorithms.
- Generate from the above the dataframe that we will forward to the model.

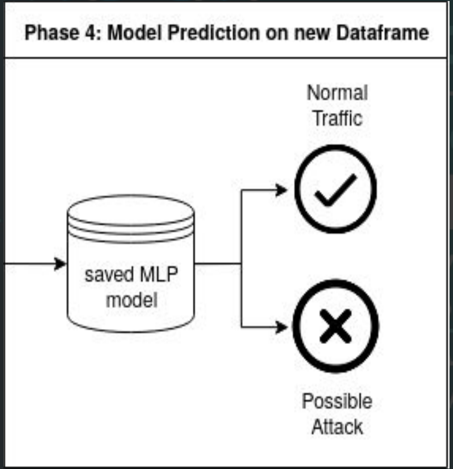

Phase 3: Data Cleaning, Additional Feature Computation With Custom Algorithms
Feature cleaning
Pandas Dataframe
Additional feature computation

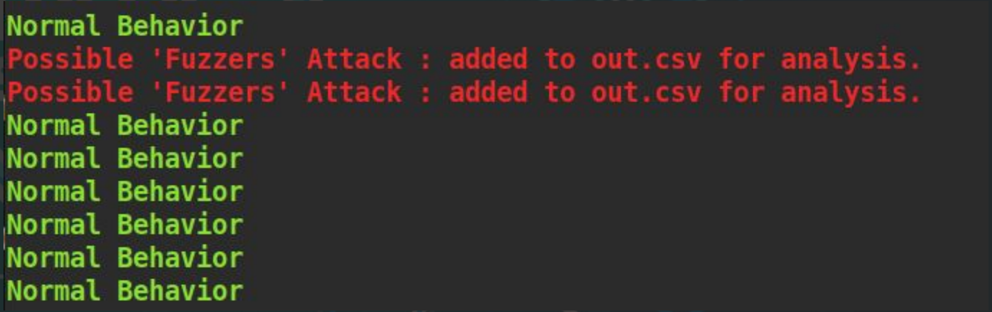
Model Prediction

We feed the generated dataframe to the model and after some processing it produces the result.



	0	1	2	3	4	5	6	7	8	9	...	19	20	21	22	23	24	25	26	predclass	27
0	0.000000	0.100000	0.0	0.05	0.016667	0.000000	0.0	0.0	0.0	0.0	...	1.0	0.0	0.016667	0.0	0.016667	0.033333	0.016667	0.0	Fuzzers	0.0
1	0.000000	0.100000	0.0	0.05	0.016667	0.000000	0.0	0.0	0.0	0.0	...	1.0	0.0	0.016667	0.0	0.016667	0.033333	0.016667	0.0	Fuzzers	0.0
2	0.000000	0.100000	0.0	0.05	0.016667	0.000000	0.0	0.0	0.0	0.0	...	1.0	0.0	0.016667	0.0	0.016667	0.033333	0.016667	0.0	Fuzzers	0.0
3	0.229519	0.513514	0.0	0.00	1.000000	0.166023	0.0	0.0	0.0	0.0	...	0.0	0.0	0.000000	0.0	0.003861	0.000000	0.003861	0.0	Exploits	0.0
4	0.000000	0.100000	0.0	0.05	0.016667	0.000000	0.0	0.0	0.0	0.0	...	1.0	0.0	0.016667	0.0	0.016667	0.033333	0.016667	0.0	Fuzzers	0.0





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Normal Behavior
Possible 'Fuzzers' Attack : added to out.csv for analysis.
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Normal Behavior
Normal Behavior
Normal Behavior
Normal Behavior
Normal Behavior
Normal Behavior
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Thank you for your attention!