FastNetMonを試してみた

(FastNetMon 1.1.3)

@ishizaghi

自己紹介

■石崎豊

フリービット株式会社　R&D

■JANOGとわたし

#	場所	内容
JANOG27.5	愛宕	Hyper Giants CDNキャッシュサーバーの ISPネットワークへの効果と課題
JANOG28	日本橋	会場ネットワーク提供 (フレッツIPv6 PPPoE, 64フォールバック環境)
JANOG29	和歌山	プログラム委員長

FastNetMonとは

■パケットキャプチャやNetFlowデータをもとにDDoSを高速検知するオープンソースソフトウェア

■RIPE71, NANOG66で紹介された

■NANOG66 (Feb, 2016)

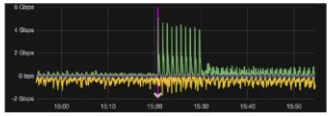
■Research and Education Track

“An opensource recipe for detecting DDoS and automate mitigation techniques”

[Vicente De Luca, Zendesk]

DDoS Attacks

An open-source recipe to improve fast detection and automate mitigation techniques



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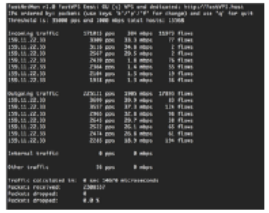
FastNetMon: very fast DDoS analyzer

- collects sFlow (v4/v5), NetFlow (v5/v9/v10), IPFIX and SPAN/mirror
- fast detect IPv4 host above certain threshold
- feed Graphite (compatible) time-series DB
- supports BGP daemons (ExaBGP, GoBGP, others)
- supports Lua processing net flows
- CLI client

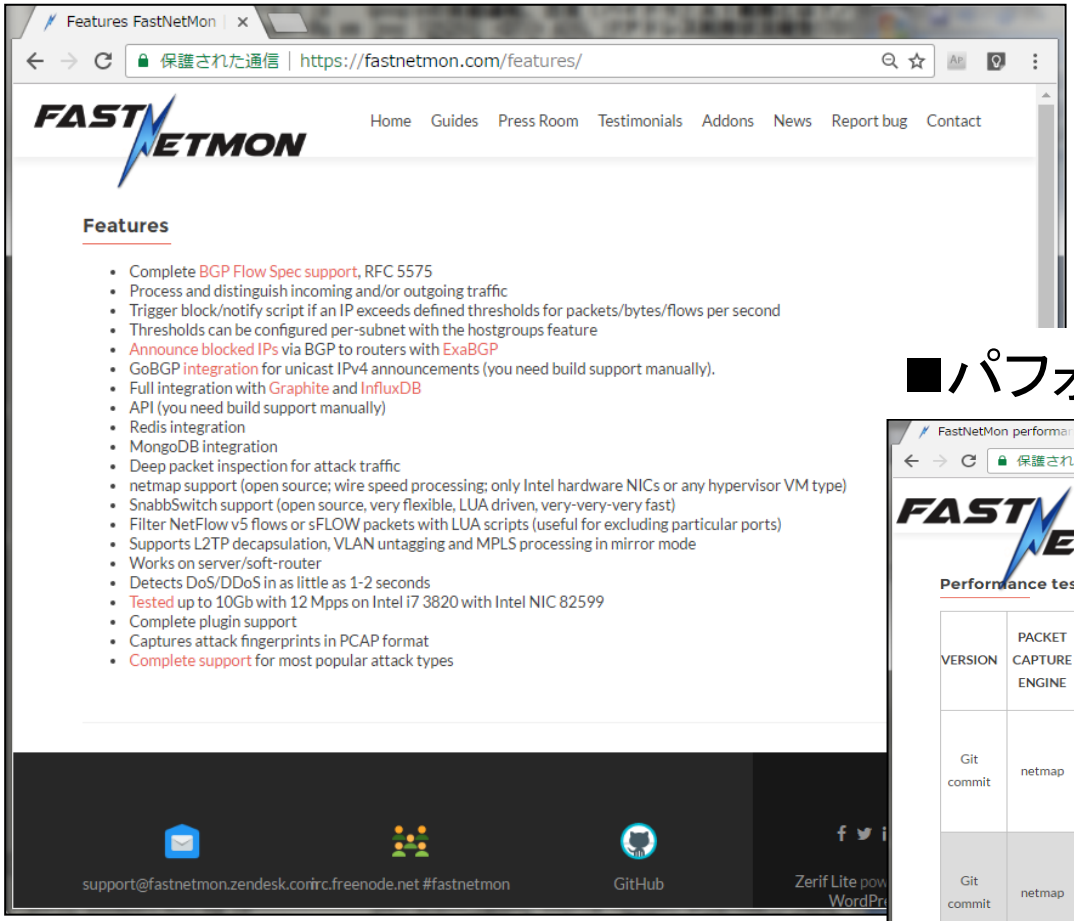


available for CentOS / Ubuntu / Debian / Vyatta / FreeBSD / source / Docker Image
tested with Juniper, Cisco, Extreme, Huawei and Linux (ipt_NETFLOW)

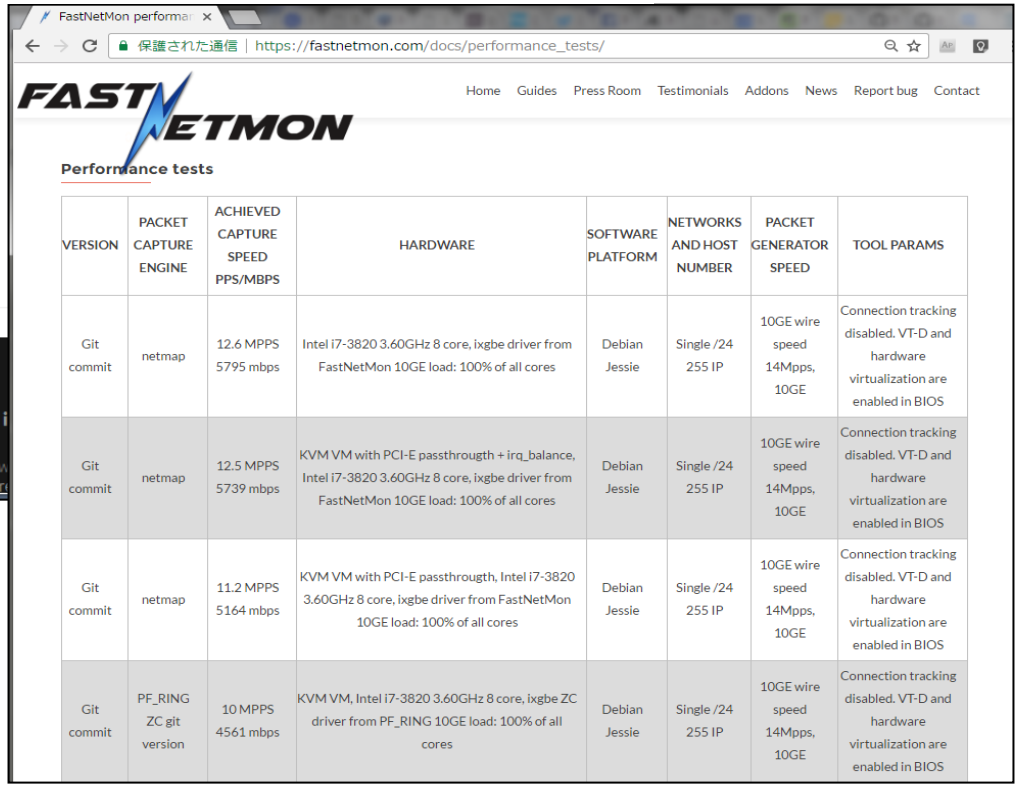
https://github.com/pavel-odintsov/fastnetmon

FastNetMonとは

■主な機能



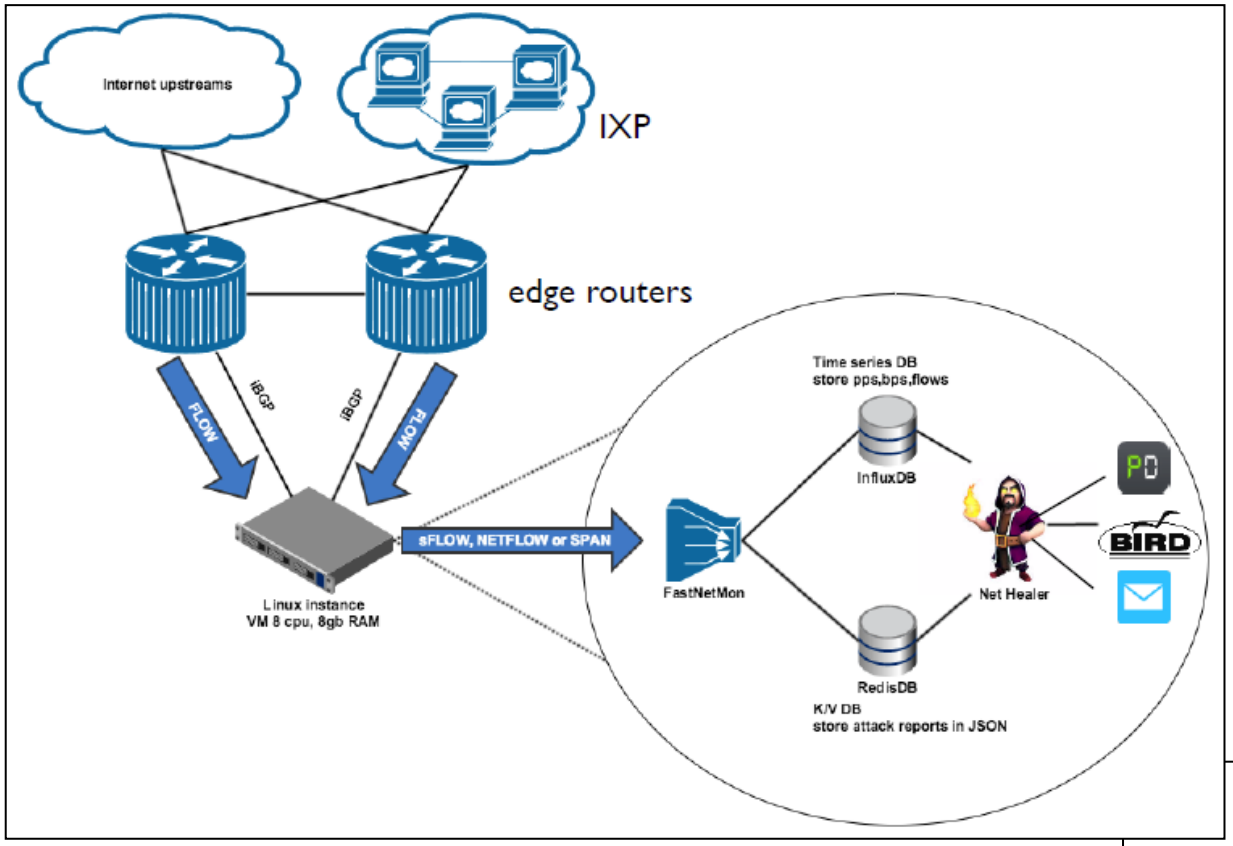
■パフォーマンス



VERSION	PACKET CAPTURE ENGINE	ACHIEVED CAPTURE SPEED PPS/MBPS	HARDWARE	SOFTWARE PLATFORM	NETWORKS AND HOST NUMBER	PACKET GENERATOR SPEED	TOOL PARAMS
Git commit	netmap	12.6 MPPS 5795 mbps	Intel i7-3820 3.60GHz 8 core, ixgbe driver from FastNetMon 10GE load: 100% of all cores	Debian Jessie	Single /24 255 IP	10GE wire speed 14Mpps, 10GE	Connection tracking disabled. VT-D and hardware virtualization are enabled in BIOS
Git commit	netmap	12.5 MPPS 5739 mbps	KVM VM with PCI-E passthrougth + irq_balance, Intel i7-3820 3.60GHz 8 core, ixgbe driver from FastNetMon 10GE load: 100% of all cores	Debian Jessie	Single /24 255 IP	10GE wire speed 14Mpps, 10GE	Connection tracking disabled. VT-D and hardware virtualization are enabled in BIOS
Git commit	netmap	11.2 MPPS 5164 mbps	KVM VM with PCI-E passthrougth, Intel i7-3820 3.60GHz 8 core, ixgbe driver from FastNetMon 10GE load: 100% of all cores	Debian Jessie	Single /24 255 IP	10GE wire speed 14Mpps, 10GE	Connection tracking disabled. VT-D and hardware virtualization are enabled in BIOS
Git commit	PF_RING ZC git version	10 MPPS 4561 mbps	KVM VM, Intel i7-3820 3.60GHz 8 core, ixgbe ZC driver from PF_RING 10GE load: 100% of all cores	Debian Jessie	Single /24 255 IP	10GE wire speed 14Mpps, 10GE	Connection tracking disabled. VT-D and hardware virtualization are enabled in BIOS

FastNetMonとは

■アーキテクチャ



Opensource recipe

- **FastNetMon**: main core of our solution. DDoS analyzer with sflow/netflow/mirror support
- **InfluxDB**: Scalable data store for metrics, events, and real-time analytics
- **Grafana**: Gorgeous metric viz, dashboards & editors
- **Redis**: An in-memory database that persists on disk
- **Morgoth**: Metric anomaly detection for Influx databases
- **BIRD**: a fully functional dynamic IP routing daemon
- **Net Healer**: experimental code to "glue" all moving parts, trigger actions and provide API queries

FastNetMonとは

■アタック検知ロジック

FastNetMon

Detection Logic:
- number of **pps, mbps and flows** to/from a /32
- number of **fragmented packets** to/from a /32
- number of **tcp syn / udp** to/from a /32
- global / per protocol (udp/tcp/icmp) / per host group (CIDR)
- nDPI support (SPAN/mirror)

Complete support most popular attacks for channel overflow:
- **SYN Flood**
- **UDP Flood** (amplified SSDP, Chargen, DNS, SNMP, NTP, etc)
- **IP Fragmentation**

■アタック検知時の反応

FastNetMon

How it can react during an attack ?

- Custom script (send email, apply an ACL, shutdown a VM, etc etc etc...)
- BGP Announce (community, blackhole, selective blackhole, cloud mitigation)
- BGP Flow Spec (**RFC 5575**) for selective traffic blocking
- Populate Redis DB (target, type, attack peak, tcpdump during attack, etc)

インストール、基本設定、起動 (Ubuntu16)

■ インストール

```
$ wget https://raw.githubusercontent.com/pavel-odintsov/fastnetmon/master/src/fastnetmon_install.pl -fastnetmon_install.pl
$ sudo perl fastnetmon_install.pl
```

■ 設定

```
#  vi /etc/networks_list
203.0.113.0/24
198.51.100.0/24
```

```
#  vi /etc/fastnetmon.conf
後述….
```

■ 起動

```
# systemctl start fastnetmon
```

設定

■ /etc/fastnetmon.conf (抜粋)

```
# Different approaches to attack detection
ban_for_pps = on
ban_for_bandwidth = on
ban_for_flows = off

# Limits for Dos/DDoS attacks
threshold_pps = 20000
threshold_mbps = 1000
threshold_flows = 3500

# Per protocol attack thresholds
# We don't implement per protocol flow limits, sorry :(
# These limits should be smaller than global pps/mbps limits

ban_for_tcp_bandwidth = off
ban_for_udp_bandwidth = off
ban_for_icmp_bandwidth = off

threshold_tcp_mbps = 100000
threshold_udp_mbps = 100000
threshold_icmp_mbps = 100000

ban_for_tcp_pps = off
ban_for_udp_pps = off
ban_for_icmp_pps = off

threshold_tcp_pps = 100000
threshold_udp_pps = 100000
threshold_icmp_pps = 100000
```

総トラフィックのしきい値設定 (pps, mbps, flows)

プロトコル毎のしきい値設定 (mbps)

プロトコル毎のしきい値設定 (pps)

つづき..

```
##
### Actions when attack detected
###

# This script executed for ban, unban and attack detail collection
notify_script_path = /usr/local/bin/notify_about_attack.sh

# announce blocked IPs with BGP protocol with ExaBGP
exabgp = off
exabgp_command_pipe = /var/run/exabgp.cmd
exabgp_community = 65001:666
```

アタック検知時に起動するscript

■ /usr/local/bin/notify_about_attack.sh

```
#!/usr/bin/env bash

# This script will get following params:
#  $1 client_ip_as_string
#  $2 data_direction
#  $3 pps_as_string
#  $4 action (ban or unban)

email_notify="root, please_fix_this_email@domain "

#
# Please be carefult! You should not remove cat >
#

if [ "$4" = "unban" ]; then
    # No details arrived to stdin here

    # Unban actions if used
    exit 0
fi

if [ "$4" = "ban" ]; then
    cat | mail -s "FastNetMon Guard: IP $1 blocked because $2 attack with power $3 pps" $email_notify;
    # You can add ban code here!
    exit 0
fi

if [ "$4" == "attack_details" ]; then
     cat | mail -s "FastNetMon Guard: IP $1 blocked because $2 attack with power $3 pps" $email_notify;

    exit 0
fi
```

オプションパラメーター例
$1 = 203.0.113.123
$2 = incoming / outgoing
$3 = 1000521 (string)
$4 = ban / unban / attack_details

CLIモニタリング

■ /opt/fastnetmon_client

```
# /opt/fastnetmon/fastnetmon_client

FastNetMon 1.1.3 master git-94f4947e87753b8be193ca54d17dac24cac599fb Pavel Odintsov: stableit.ru
IPs ordered by: packets
Incoming traffic          3167 pps     36 mbps      0 flows
203.0.113.164             3166 pps     36 mbps      0 flows  *banned*
203.0.113.165                6 pps      0 mbps      0 flows

Outgoing traffic          1152 pps      0 mbps      0 flows
203.0.113.164             1151 pps      0 mbps      0 flows  *banned*
203.0.113.165                4 pps      0 mbps      0 flows

Internal traffic             0 pps      0 mbps

Other traffic                0 pps      0 mbps

Screen updated in:              0 sec 340 microseconds
Traffic calculated in:          0 sec 180 microseconds
Total amount of IPv6 packets related to our own network: 0
Not processed packets: 0 pps

Ban list:
203.0.113.164/4725 pps incoming at 13_01_17_15:28:57

Subnet load:
203.0.113.160/29  pps in: 0       out: 0       mbps in: 0     out: 0
203.0.113.168/29  pps in: 0       out: 0       mbps in: 0     out: 0
203.0.113.174/32  pps in: 0       out: 0       mbps in: 0     out: 0
```

InfluxDBにストアされるテーブル、タグキー

InfluxDB Write Data Documentation Database: graphite

Query: show measurements

measurements

name
hosts
networks
total

InfluxDB Write Data Documentation Database: graphite

Query: show tag keys

Generate Query URL Query Templates

hosts

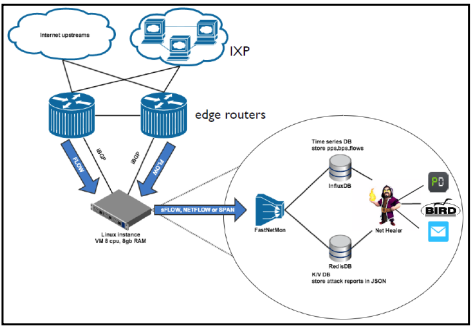
tagKey
app
cidr
direction
function
resource

networks

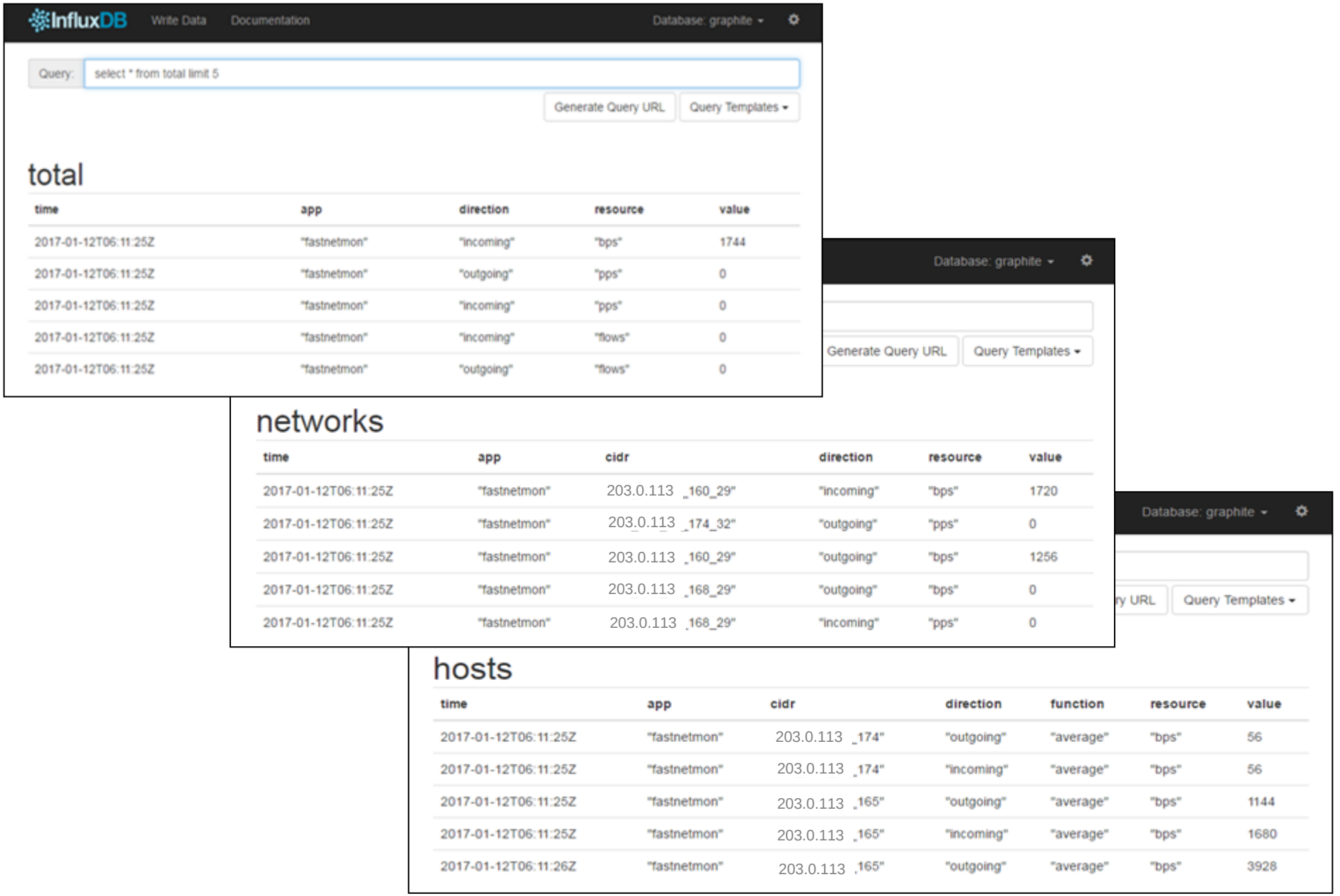
tagKey
app
cidr
direction
resource

total

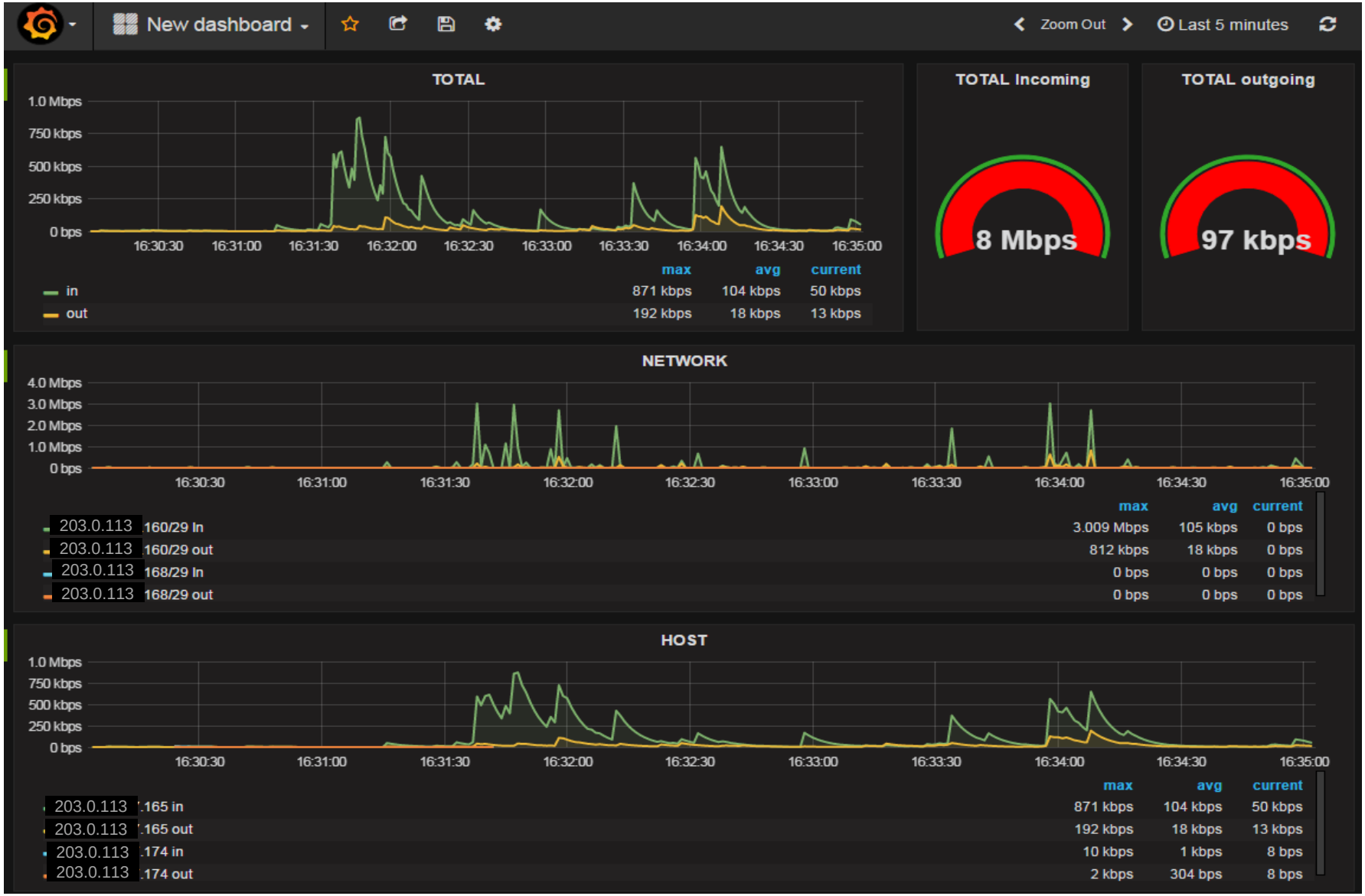
tagKey
app
direction
resource



InfluxDBにストアされるレコード



Grafanaで可視化すると

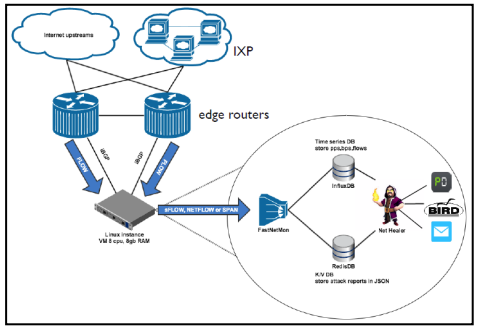


情報量少ない..

redisにストアされるレコード (アタック検知時の情報)

```
$ redis-cli keys fastnetmon *
fastnetmon_203.0.113.162_packets_dump
fastnetmon_203.0.113.162_information
fastnetmon_203.0.113.174_packets_dump
fastnetmon_203.0.113.174_information
fastnetmon_203.0.113.165_packets_dump
fastnetmon_203.0.113.165_information
```

```
$ redis-cli get fastnetmon_203.0.113.165_information
{ "ip": "203.0.113.165", "attack_details": { "attack_type": "udp_flood",
"initial_attack_power": 515, "peak_attack_power": 515, "attack_direction": "incoming",
"attack_protocol": "udp", "total_incoming_traffic": 670292, "total_outgoing_traffic":
26985, "total_incoming_pps": 515, "total_outgoing_pps": 276,
"total_incoming_flows": 0, "total_outgoing_flows": 0, "average_incoming_traffic":
670292, "average_outgoing_traffic": 26985, "average_incoming_pps": 515,
"average_outgoing_pps": 276, "average_incoming_flows": 0,
"average_outgoing_flows": 0, "incoming_ip_fragmented_traffic": 0,
"outgoing_ip_fragmented_traffic": 0, "incoming_ip_fragmented_pps": 0,
"outgoing_ip_fragmented_pps": 0, "incoming_tcp_traffic": 6340,
"outgoing_tcp_traffic": 1277, "incoming_tcp_pps": 8, "outgoing_tcp_pps": 7,
"incoming_syn_tcp_traffic": 2906, "outgoing_syn_tcp_traffic": 159,
"incoming_syn_tcp_pps": 6, "outgoing_syn_tcp_pps": 0, "incoming_udp_traffic":
663951, "outgoing_udp_traffic": 25706, "incoming_udp_pps": 503,
"outgoing_udp_pps": 267, "incoming_icmp_traffic": 0, "outgoing_icmp_traffic": 0,
"incoming_icmp_pps": 0, "outgoing_icmp_pps": 0 }, "network_load": { "incoming
traffic": 3685711, "outgoing traffic": 144473, "incoming pps": 2828, "outgoing pps":
1514 }, "network_average_load": { "incoming traffic": 184833, "outgoing traffic": 8353,
"incoming pps": 137, "outgoing pps": 73 } }
```




```
$ redis-cli get fastnetmon_203.0.113.165_packets_dump
IP: 203.0.113.165
Attack type: udp_flood
Initial attack power: 510 packets per second
Peak attack power: 510 packets per second
Attack direction: incoming
Attack protocol: udp
Total incoming traffic: 4 mbps
Total outgoing traffic: 0 mbps
Total incoming pps: 510 packets per second
Total outgoing pps: 310 packets per second
Total incoming flows: 0 flows per second
Total outgoing flows: 0 flows per second
Average incoming traffic: 4 mbps
Average outgoing traffic: 0 mbps
Average incoming pps: 510 packets per second
Average outgoing pps: 310 packets per second
Average incoming flows: 0 flows per second
Average outgoing flows: 0 flows per second

~ 省略 ~

Network: 203.0.113.160/29
Network incoming traffic: 0 mbps
Network outgoing traffic: 0 mbps
Network incoming pps: 21 packets per second
Network outgoing pps: 15 packets per second
Average network incoming traffic: 1 mbps
Average network outgoing traffic: 0 mbps
Average network incoming pps: 151 packets per second
Average network outgoing pps: 103 packets per second
Average packet size for incoming traffic: 1102.8 bytes
Average packet size for outgoing traffic: 124.6 bytes

2017-01-13 12:39:39.000000 216.58.197.193:443 > 203.0.113.165:61325 protocol: udp
frag: 0  packets: 9 size: 11079 bytes ttl: 0 sample ratio: 1
2017-01-13 12:39:39.000000 203.0.113.165:58099 > 172.217.27.66:443 protocol: udp
frag: 0  packets: 6 size: 2542 bytes ttl: 0 sample ratio: 1
2017-01-13 12:39:39.000000 172.217.27.66:443 > 203.0.113.165:58099 protocol: udp
frag: 0  packets: 7 size: 3446 bytes ttl: 0 sample ratio: 1
2017-01-13 12:39:39.000000 203.0.113.165:58411 > 174.129.255.59:443 protocol: tcp
flags: syn,psh,ack frag: 0  packets: 4 size: 1414 bytes ttl: 0 sample ratio: 1
2017-01-13 12:39:39.000000 203.0.113.165:58432 > 52.71.208.179:443 protocol: tcp
flags: syn,psh,ack frag: 0  packets: 11 size: 12203 bytes ttl: 0 sample ratio: 1

つづく
```

まとめと所感

- よいところ
  - 高パフォーマンス
  - 高速検知
  - 検知時のアクションの作り込みが容易
- もう少しなところ
  - しきい値ベースの検知のみ
  - TCP/UDPポート毎でのトラフィックの検知もしてほしいところ
  - DBへ書き込む情報が少ない
    (NetFlow v5 recordぶんかせめてTCP/UDPポート番号情報くらいはデータストアして欲しい)
- 使い方としては..
  - トラフィック可視化のデータ収集
    - いまいち..
  - トラフィック異常検知
    - 異常検知のトリガーとしては使えそう
    - DDoS mitigationさせるためには他のコンポーネントと併用が良さそう
      - InfluxDB (Collection)
        → Chronograf (Visualization)
        → Kapacitor/Morgoth (Detection)
        Relative value alert, Lossy Counting Algorithm(LSA)
        → BGP FlowSpec (Mitigation)

- Chronograf / Kapacitor