DDOS Attacks: How small networks can defend

Practical case of protecting an Faculty/University from DDOS

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Size of FCSE/UKIM

- University of Ss Ciryl and Methodius (UKIM) – Skopje, biggest University in North Macedonia
- Faculty of Computer Science and Engineering (FCSE) – Biggest Faculty with 5000+ active students
- Our systems are Electronically First
- We run our own Data Center (Both UKIM & FCSE one DC each)
- We run IXP.mk

Size of FCSE/UKIM Network

- UKIM – announces one /19 (at least /24 for each Faculty)
- Internet access – 2 x 10Gbit from GEANT
- Peering @ IXP.mk – 10 Gbit
- Backup internet via FCSE (cold backup)
- Limited set of services hosted

- FCSE – announces 4 x /24 from UKIM /19 & 4 x /24 directly
- Internet access – 1 x 10Gbir from UKIM, 1 x 1 Gbit from ISP #1, 1 x 10 Gbit from ISP#2 (was not active)
- Peering @ IXP.mk – 10 Gbit
- Hosting: UKIM wide systems (student records system, LMS, etc.), FCSE services (including our own LMS + Video platform), ccTLD for .mk, National health system, Ministry of education systems,…

Attack history

- Lot of IP space, many different user types (Faculty, Students, Governmental, Research) – attacks are daily/weekly usually handled but IPS/FW or Manual NOC intervention
- DDOS protection from GEANT for traffic coming from that Uplink

- In the last 10+ years nothing serious – generally we said: “We are not interesting target so this will not happen to US”

Attack #1 – June 2022

- FCSE LMS (based on Moodle) gets attacked several times a day at the end of the semester;

- Semester was still fully online (because of Covid19)
- Attacks are usually UDP lasting 10-15 minutes – the network survives but Faculty Computer Center (me included) feels uncomfortable and starts to prepare in case things get worse
- Semester ends in second week of June – upcoming exam week and then full month of exams

Attack #2 – June/July 2022

- FCSE LMS (based on Moodle) gets attacked several times a day at the end of the semester;
- FCSE LMS for exams (based on Moodle) gets attacked several times a day at the end of the semester;
- FCSE website gets attacked several times a day at the end of the semester;

- Exams are fully online (because of Covid19)
- Attacks are usually UDP lasting 30-59 minutes – the network starts to brake since Uplink between UKIM/MARNET (which was 1 Gbit gets filled up)
- FCC makes some network changes making most of the services for exams to be available only via IXP.mk
- We need to improve visibility in order to locate the problem faster

Attack #3 – August 2022

- FCSE LMS (based on Moodle) gets attacked several times a day at the end of the semester;
- FCSE LMS for exams (based on Moodle) gets attacked several times a day at the end of the semester;
- FCSE website gets attacked several times a day at the end of the semester;
- We see random targets attacked

- Exams are fully online (because of Covid19)
- Attacks are usually UDP lasting 30-120 minutes – the network brakes, FCC enters “panick mode”

Attack #3 – August 2022 (2)

- We start to improve visibility based on Netflow (we reinstalled Ntopng, installed Fastnetmon)
- We got GEANT OC on board
- We had to limit outside traffic
- Traffic levels are doubled every attack
- GEANT OC switched the DDOS protection to “always on mode”
- Attacks are developing (not only usual UDP volumetric)

We have detected a DDoS attack event affecting your
network which we automatically started to scrub (unless the "Event Type below is *Ended*"). All the information pertaining to it can be found below:

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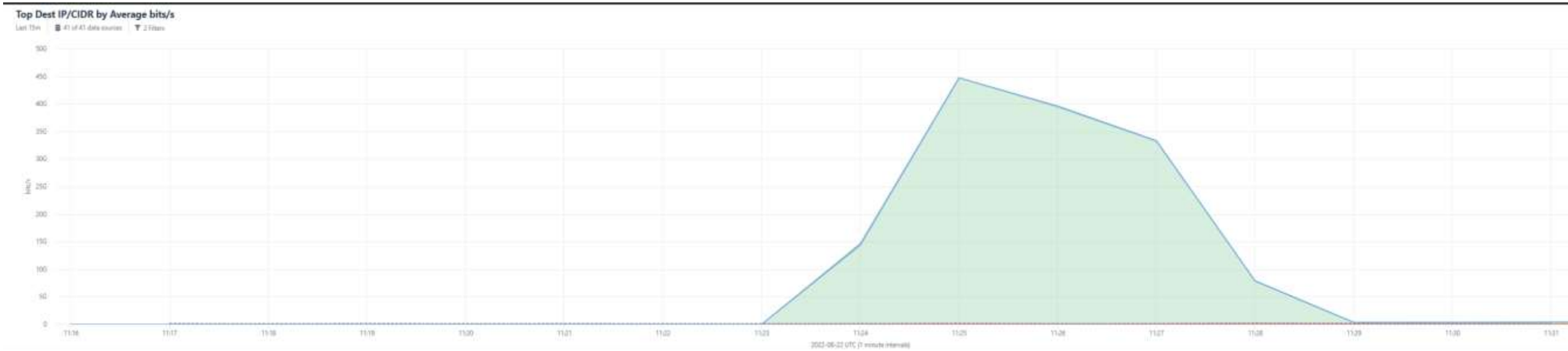
Segment: DST MARnet (subnets:)
Time: 2022-08-16 22:16:31 UTC
Event type: Attack details
Triggered detection methods: UDP
Attack ID: 6581
Attack signature: (protocol 17 AND source 103.192.0.0/10 AND destination 185.153.48.10/32) OR (protocol 17 AND source 103.147.6.109/32 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 103.176.0.0/13 AND destination 185.153.48.10/32) OR (protocol 17 AND source 103.145.0.0/18 AND destination 185.153.48.10/32) OR (protocol 17 AND source 64.0.0.0/3 AND destination 185.153.48.10/32) OR (protocol 17 AND source 45.192.0.0/10 AND destination 185.153.48.10/32) OR (protocol 17 AND source 45.76.187.184/32 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 45.116.156.224/27 AND destination 185.153.48.10/32) OR (protocol 17 AND source 196.0.0.0/6 AND destination 185.153.48.10/32) OR (protocol 17 AND source 128.0.0.0/2 AND destination 185.153.48.10/32) OR (protocol 17 AND source 45.153.165.118/32 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 208.0.0.0/4 AND destination 185.153.48.10/32) OR (protocol 17 AND source 38.0.0.0/8 AND destination 185.153.48.10/32) OR (protocol 17 AND source 45.143.30.59/32 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 0.0.0.0/5 AND destination 185.153.48.10/32) OR (protocol 17 AND source 103.0.0.0/9 AND destination 185.153.48.10/32) OR (protocol 17 AND source 100.36.238.42/32 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 40.0.0.0/6 AND destination 185.153.48.10/32) OR (protocol 17 AND source 193.0.0.0/8 AND destination 185.153.48.10/32) OR (protocol 17 AND source 101.0.0.0/10 AND destination 185.153.48.10/32) OR (protocol 17 AND source 12.0.0.0/6 AND destination 185.153.48.10/32) OR (protocol 17 AND source 101.255.0.0/16 AND destination 185.153.48.10/32) OR (protocol 17 AND source 103.145.247.18/32 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 103.189.206.42/32 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 39.62.59.74/32 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 23.128.0.0/10 AND destination 185.153.48.10/32) OR (protocol 17 AND source 104.0.0.0/5 AND destination 185.153.48.10/32) OR (protocol 17 AND source 103.146.128.0/17 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 112.0.0.0/4 AND destination 185.153.48.10/32) OR (protocol 17 AND source 46.0.0.0/7 AND destination 185.153.48.10/32) OR (protocol 17 AND source 45.65.139.226/32 AND destination 185.153.48.10/32) OR (protocol 17 AND source 103.128.0.0/12 AND destination 185.153.48.10/32) OR (protocol 17 AND source 24.0.0.0/5 AND destination 185.153.48.10/32) OR (protocol 17 AND source 103.160.0.0/12 AND destination 185.153.48.10/32) OR (protocol 17 AND source 45.126.252.169/32 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 103.144.0.0/16 AND destination 185.153.48.10/32) OR (protocol 17 AND source 45.137.98.31/32 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 200.0.0.0/5 AND destination 185.153.48.10/32) OR (protocol 17 AND source 98.175.87.243/32 AND destination 185.153.48.10/32) OR (protocol 17 AND source 100.6.67.52/32 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 102.0.0.0/8 AND destination 185.153.48.10/32) OR (protocol 17 AND source 101.168.176.0/21 AND destination 185.153.48.10/32) OR (protocol 17 AND source 96.0.0.0/7 AND destination 185.153.48.10/32) OR (protocol 17 AND source 45.130.0.0/15 AND destination 185.153.48.10/32) OR (protocol 17 AND source 45.153.50.137/32 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 45.0.0.0/11 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 103.147.246.64/26 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 103.148.0.0/14 AND destination 185.153.48.10/32) OR (protocol 17 AND source 45.65.232.139/32 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 45.128.68.16/28 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 103.188.236.110/32 AND destination 185.153.48.10/32) OR (protocol 17 AND source 101.79.73.105/32 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 36.0.0.0/7 AND destination 185.153.48.10/32) OR (protocol 17 AND source 101.96.0.0/12 AND destination 185.153.48.10/32) OR (protocol 17 AND source 32.0.0.0/6 AND destination 185.153.48.10/32) OR (protocol 17 AND source 103.147.218.34/32 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 101.75.158.2/32 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 103.145.128.0/19 AND destination 185.153.48.10/32) OR (protocol 17 AND source 45.127.134.27/32 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 194.0.0.0/7 AND destination 185.153.48.10/32) OR (protocol 17 AND source 39.152.0.0/14 AND destination 185.153.48.10/32) OR (protocol 17 AND source 8.0.0.0/10 AND destination 185.153.48.10/32) OR (protocol 17 AND source 103.184.0.0/14 AND destination 185.153.48.10/32) OR (protocol 17 AND source 45.137.121.38/32 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 103.152.0.0/13 AND destination 185.153.48.10/32) OR (protocol 17 AND source 45.80.0.0/12 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 45.70.0.0/15 AND destination 185.153.48.10/32) OR (protocol 17 AND source 103.145.180.67/32 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 48.0.0.0/4 AND destination 185.153.48.10/32) OR (protocol 17 AND source 192.0.0.0/8 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 45.146.0.0/15 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 45.160.0.0/11 AND destination 185.153.48.10/32) OR (protocol 17 AND source 8.242.0.0/15 AND destination 185.153.48.10/32) OR (protocol 17 AND source 45.127.121.182/32 AND destination 185.153.48.10/32 AND destination-port =80)

Mitigation status: Auto-mitigation selected by the customer

Attack #3 – August 2022 (3)

- We hear rumors that students may be involved
- We move services to a /24 for better control and analysis and we make them “angry” as exams continue
- The attacker hits us hard (above 50 Gbit)



Attack #3 – August 2022 (4)

- The cat/mouse game starts
- We create direct links for Netflow from Core routers for analysis
- We drop non needed traffic on the GEANT routers in SOF and VIE
- The Student enrollment system for UKIM gets attacked
- They start to “Carpet bomb” the whole IP range
- We see a large botnet in place (so students involvement is partially possible)

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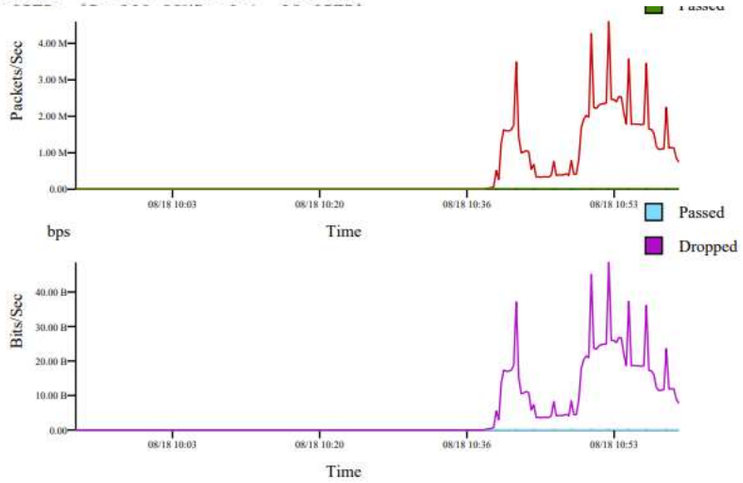
Segment: DST MARnet (subnets: )
Time: 2022-08-18 07:27:48 - 2022-08-18 10:31:43 UTC
Event type: Ended
Triggered detection methods: UDP, TCP (flag SYN, ACK), All, ICMP
Attack ID: 6591
Attack signature: (protocol 1 AND source 112.0.0.0/4 AND destination 194.149.137.130/32) OR (protocol 17 AND source 101.51.224.0/20 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 6 AND source 185.0.0.0/14 AND destination 194.149.135.130/32) OR (protocol 17 AND source 204.0.0.0/6 AND destination 185.153.48.10/32) OR (protocol 17 AND source 189.203.192.0/21 AND destination 194.149.137.199/32 AND destination-port =80) OR (protocol 17 AND source 173.208.192.0/18 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 1 AND source 101.0.0.0/9 AND destination 194.149.137.160/32) OR (protocol 17 AND source 51.128.0.0/9 AND destination 194.149.137.199/32 AND destination-port =80) OR (protocol 17 AND source 217.160.0.0/11 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 17 AND source 167.114.4.72/32 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 1 AND source 1.20.0.0/16 AND destination 194.149.137.130/32) OR (protocol 17 AND source 203.192.0.0/11 AND destination 185.153.48.10/32) OR (protocol 17 AND source 64.0.0.0/3 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 17 AND source 196.250.0.0/15 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 1 AND source 10.0.0.0/7 AND destination 194.149.137.130/32) OR (protocol 1 AND source 36.0.0.0/6 AND destination 194.149.137.160/32) OR (protocol 17 AND source 202.0.0.0/8 AND destination 185.153.48.10/32) OR (protocol 6 AND source 0.0.0.0/4 AND destination 194.149.137.160/32) OR (protocol 1 AND source 184.0.0.0/5 AND destination 194.149.135.130/32) OR (protocol 1 AND source 10.0.0.0/7 AND destination 194.149.137.160/32) OR (protocol 17 AND source 128.0.0.0/2 AND destination 185.153.48.10/32) OR (protocol 17 AND source 208.0.0.0/4 AND destination 185.153.48.10/32) OR (protocol 6 AND source 24.0.0.0/5 AND destination 194.149.137.160/32) OR (protocol 17 AND source 137.74.95.61/32 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 17 AND source 103.151.64.0/18 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 1 AND source 128.0.0.0/2 AND destination 194.149.135.130/32) OR (protocol 6 AND source 64.0.0.0/2 AND destination 194.149.137.160/32) OR (protocol 6 AND source 16.0.0.0/6 AND destination 194.149.137.160/32) OR (protocol 6 AND source 144.0.0.0/4 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 1 AND source 5.0.0.0/8 AND destination 194.149.137.130/32) OR (protocol 17 AND source 202.64.0.0/10 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 1 AND source 192.0.0.0/3 AND destination 194.149.137.160/32) OR (protocol 1 AND source 1.10.128.0/17 AND destination 194.149.137.160/32) OR (protocol 1 AND source 64.0.0.0/3 AND destination 194.149.137.130/32) OR (protocol 17 AND source 199.0.0.0/8 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 17 AND source 207.128.0.0/10 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 6 AND source 20.0.0.0/8 AND destination 194.149.135.130/32) OR (protocol 1 AND source 101.108.0.0/15 AND destination 194.149.137.130/32) OR (protocol 6 AND source 128.0.0.0/2 AND destination 194.149.137.160/32) OR (protocol 17 AND source 194.0.0.0/8 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 6 AND source 128.0.0.0/3 AND destination 194.149.135.130/32) OR (protocol 17 AND source 0.0.0.0/1 AND destination 194.149.137.199/32) OR (protocol 17 AND source 144.0.0.0/8 AND destination 194.149.137.199/32 AND destination-port =80) OR (protocol 6 AND source 160.0.0.0/4 AND destination 194.149.135.130/32) OR (protocol 1 AND source 64.0.0.0/3 AND destination 194.149.135.130/32) OR (protocol 6 AND source 184.128.0.0/10 AND destination 194.149.135.130/32) OR (protocol 1 AND source 101.0.0.0/10 AND destination 194.149.137.130/32) OR (protocol 17 AND source 103.227.144.97/32 AND destination 194.149.137.199/32 AND destination-port =80) OR (protocol 17 AND source 192.192.0.0/10 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 17 AND source 129.0.0.0/8 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 1 AND source 102.0.0.0/7 AND destination 194.149.135.130/32) OR (protocol 17 AND source 192.0.0.0/3 AND destination 194.149.137.199/32) OR (protocol 17 AND source 101.96.120.0/22 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 17 AND source 135.125.233.240/32 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 17 AND source 192.185.178.103/32 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 1 AND source 1.0.0.0/13 AND destination 194.149.135.130/32) OR (protocol 17 AND source 135.181.132.177/32 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 1 AND source 45.7.135.174/32 AND destination 194.149.137.160/32) OR (protocol 6 AND source 32.0.0.0/3 AND destination 194.149.137.160/32) OR (protocol 17 AND source 192.99.55.22/32 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 17 AND source 176.0.0.0/4 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 6 AND source 48.0.0.0/4 AND destination 194.149.135.130/32) OR (protocol 17 AND source 139.0.0.0/8 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 17 AND source 103.131.104.0/23 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 6 AND source 216.0.0.0/5 AND destination 194.149.135.130/32) OR (protocol 6 AND source 184.0.0.0/9 AND destination 194.149.135.130/32) OR (protocol 1 AND source 48.0.0.0/4 AND destination 194.149.135.130/32) OR (protocol 6 AND source 24.0.0.0/5 AND destination 194.149.135.130/32) OR (protocol 17 AND source 196.202.128.0/17 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 17 AND source 203.128.0.0/10 AND destination 185.153.48.10/32) OR (protocol 6 AND source 36.0.0.0/6 AND destination 194.149.135.130/32) OR (protocol 17 AND source 104.0.0.0/5 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 17 AND source 192.0.0.0/5 AND destination 185.153.48.10/32) OR (protocol 6 AND source 192.0.0.0/3 AND destination 194.149.137.160/32) OR (protocol 17 AND source 207.192.0.0/12 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 1 AND source 104.0.0.0/5 AND destination 194.149.137.130/32) OR (protocol 1 AND source 112.0.0.0/6 AND destination 194.149.137.160/32) OR (protocol 17 AND source 135.181.134.56/32 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 17 AND source 195.201.9.76/32 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 1 AND source 5.0.0.0/8 AND destination 194.149.135.130/32) OR (protocol 6 AND source 23.0.0.0/8 AND destination 194.149.137.160/32) OR (protocol 1 AND source 128.0.0.0/2 AND destination 194.149.137.130/32) OR (protocol 1 AND source 1.20.0.0/16 AND destination 194.149.135.130/32) OR (protocol 17 AND source 101.96.128.0/22 AND destination 194.149.137.199/32 AND destination-port =80) OR (protocol 17 AND source 38.43.77.12/32 AND destination 194.149.137.199/32 AND destination-port =80) OR (protocol 17 AND source 49.0.80.0/20 AND destination 194.149.137.199/32 AND destination-port =80) OR (protocol 1 AND source 10.0.0.0/7 AND destination 194.149.135.130/32) OR (protocol 1 AND source 1.20.0.0/16 AND destination 194.149.137.160/32) OR (protocol 17 AND source 15.192.0.0/10 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 17 AND source 193.0.0.0/8 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 17 AND source 180.26.80.55/32 AND destination 194.149.137.199/32 AND destination-port =80) OR (protocol 1 AND source 1.10.128.0/17 AND destination 194.149.135.130/32) OR (protocol 1 AND source 40.0.0.0/5 AND destination 194.149.135.130/32) OR (protocol 17 AND source 198.89.91.0/24 AND destination 194.149.137.199/32 AND destination-port =80) OR (protocol 6 AND source 40.0.0.0/5 AND destination 194.149.135.130/32) OR (protocol 17 AND source 210.87.250.107/32 AND destination 194.149.137.199/32 AND destination-port =80) OR (protocol 6 AND source 0.0.0.0/4 AND destination 194.149.135.130/32) OR (protocol 17 AND source 192.208.0.0/12 AND destination 194.149.137.199/32 AND destination-port =80) OR (protocol 17 AND source 192.99.1.6/32 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 17 AND source 101.200.0.0/15 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 1 AND source 16.0.0.0/4 AND destination 194.149.135.130/32) OR (protocol 17 AND source 93.126.64.0/19 AND destination 194.149.137.199/32 AND destination-port =80) OR (protocol 1 AND source 192.0.0.0/3 AND destination 194.149.137.130/32) OR (protocol 1 AND source 40.0.0.0/6 AND destination 194.149.137.160/32) OR (protocol 17 AND source 195.90.1.153/32 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 17 AND source 128.0.0.0/2 AND destination 194.149.137.199/32) OR (protocol 1 AND source 104.0.0.0/5 AND destination 194.149.137.160/32) OR (protocol 17 AND source 191.192.0.0/11 AND destination 194.149.137.199/32 AND destination-port =80) OR (protocol 6 AND source 34.0.0.0/8 AND destination 194.149.135.130/32) OR (protocol 17 AND source 200.0.0.0/7 AND destination 185.153.48.10/32) OR (protocol 1 AND source 2.188.192.0/18 AND destination 194.149.135.130/32) OR (protocol 17 AND source 112.0.0.0/4 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 6 AND source 23.0.0.0/8 AND destination 194.149.135.130/32) OR (protocol 17 AND source 208.0.0.0/5 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 17 AND source 0.0.0.0/1 AND destination 194.149.137.130/32) OR (protocol 17 AND source 16.0.0.0/4 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 6 AND source 64.0.0.0/2 AND destination 194.149.135.130/32) OR (protocol 17 AND source 160.0.0.0/6 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 17 AND source 135.181.0.0/17 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 6 AND source 176.0.0.0/5 AND destination 194.149.135.130/32) OR (protocol 1 AND source 112.0.0.0/4 AND destination 194.149.135.130/32) OR (protocol 17 AND source 43.224.0.0/14 AND destination 194.149.137.199/32 AND destination-port =80) OR (protocol 1 AND source 101.0.0.0/8 AND destination 194.149.135.130/32) OR (protocol 17 AND source 204.12.252.122/32 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 17 AND source 196.207.28.146/32 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 17 AND source 103.0.0.0/9 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 1 AND source 120.0.0.0/5 AND destination 194.149.137.160/32) OR (protocol 6 AND source 35.128.0.0/9 AND destination 194.149.135.130/32) OR (protocol 17 AND source 192.0.0.0/3 AND destination 194.149.137.130/32) OR (protocol 17 AND source 169.62.81.64/29 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 6 AND source 20.0.0.0/8 AND destination 194.149.137.160/32) OR (protocol 17 AND source 51.210.0.0/16 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 1 AND source 48.0.0.0/4 AND destination 194.149.137.160/32) OR (protocol 1 AND source 192.0.0.0/3 AND destination 194.149.135.130/32) OR (protocol 1 AND source 64.0.0.0/3 AND destination 194.149.137.160/32) OR (protocol 1 AND source 1.4.128.0/17 AND destination 194.149.137.130/32) OR (protocol 6 AND source 17.0.0.0/8 AND destination 194.149.135.130/32) OR (protocol 17 AND source 54.36.19.34/32 AND destination 194.149.137.199/32 AND destination-port =80) OR (protocol 17 AND source 203.0.0.0/8 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 17 AND source 198.27.70.57/32 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 17 AND source 128.0.0.0/2 AND destination 194.149.137.130/32) OR (protocol 17 AND source 142.4.96.81/32 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 6 AND source 185.0.0.0/13 AND destination 194.149.135.130/32) OR (protocol 1 AND source 1.10.128.0/17 AND destination 194.149.137.130/32) OR (protocol 17 AND source 0.0.0.0/1 AND destination 185.153.48.10/32) OR (protocol 17 AND source 172.96.0.0/16 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 1 AND source 118.0.0.0/7 AND destination 194.149.137.160/32) OR (protocol 1 AND source 102.0.0.0/7 AND destination 194.149.137.160/32) OR (protocol 17 AND source 32.0.0.0/3 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 1 AND source 36.0.0.0/6 AND destination 194.149.135.130/32) OR (protocol 17 AND source 74.192.0.0/11 AND destination 194.149.137.199/32 AND destination-port =80) OR (protocol 17 AND source 91.188.24.0/22 AND destination 194.149.137.199/32 AND destination-port =80) OR (protocol 1 AND source 1.0.0.0/13 AND destination 194.149.137.160/32) OR (protocol 17 AND source 170.249.176.0/20 AND destination 194.149.137.199/32 AND destination-port =80) OR (protocol 1 AND source 102.0.0.0/7 AND destination 194.149.137.130/32) OR (protocol 17 AND source 135.148.34.184/32 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 17 AND source 195.74.115.148/32 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 1 AND source 45.128.0.0/9 AND destination 194.149.137.160/32) OR (protocol 17 AND source 41.75.144.0/20 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 203.0.0.0/9 AND destination 185.153.48.10/32) OR (protocol 17 AND source 100.42.80.0/20 AND destination 194.149.137.199/32 AND destination-port =80) OR (protocol 1 AND source 16.0.0.0/4 AND destination 194.149.137.130/32) OR (protocol 17 AND source 93.122.168.0/22 AND destination 194.149.137.199/32 AND destination-port =80) OR (protocol 1 AND source 46.0.0.0/7 AND destination 194.149.137.160/32) OR (protocol 17 AND source 210.0.0.0/10 AND destination 194.149.137.199/32 AND destination-port =80) OR (protocol 17 AND source 197.254.0.0/17 AND destination 194.149.137.199/32 AND destination-port =80) OR (protocol 17 AND source 192.99.11.195/32 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 1 AND source 128.0.0.0/2 AND destination 194.149.137.160/32) OR (protocol 17 AND source 216.0.0.0/8 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 17 AND source 218.0.0.0/7 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 1 AND source 32.0.0.0/3 AND destination 194.149.137.130/32) OR (protocol 17 AND source 211.20.0.0/15 AND destination 194.149.137.199/32 AND destination-port =80) OR (protocol 17 AND source 110.49.144.0/25 AND destination 185.153.48.10/32 AND destination-port =80) OR (protocol 17 AND source 211.36.193.253/32 AND destination 194.149.137.199/32 AND destination-port =80) OR (protocol 17 AND source 0.0.0.0/5 AND destination 194.149.137.130/32 AND destination-port =80) OR (protocol 1 AND source 1.0.0.0/14 AND destination 194.149.137.130/32)

Mitigation status: Auto-mitigation selected by the customer
```

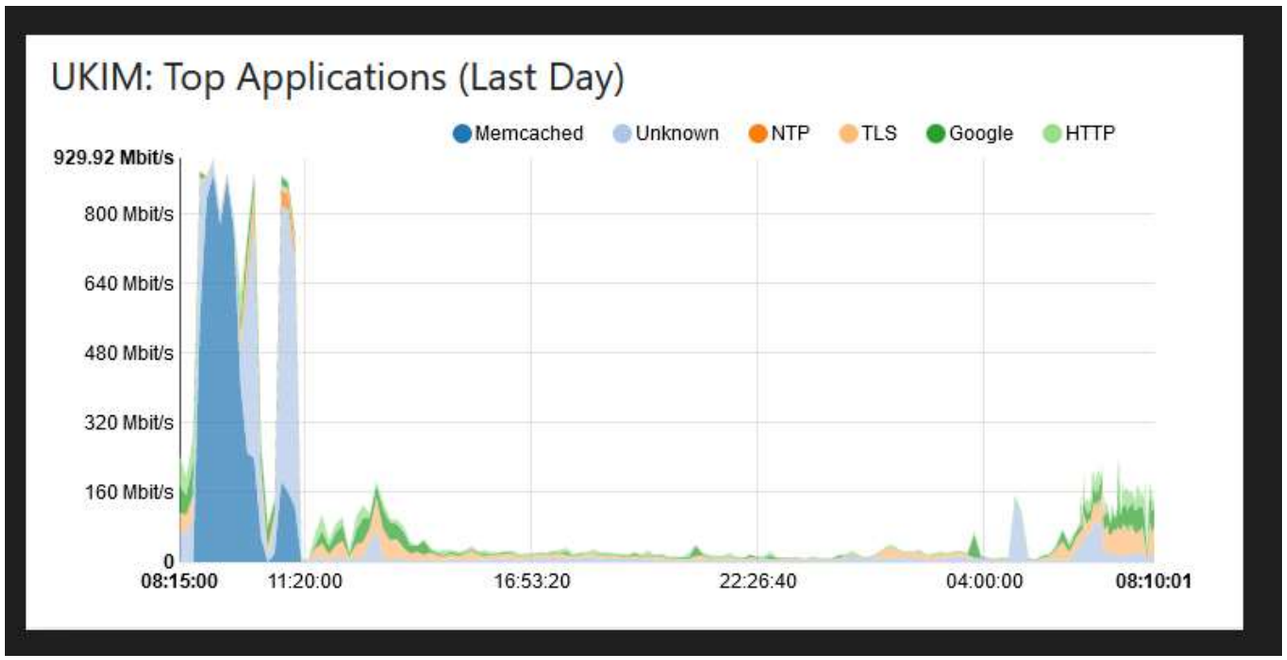
Attack #3 – August 2022 (5)

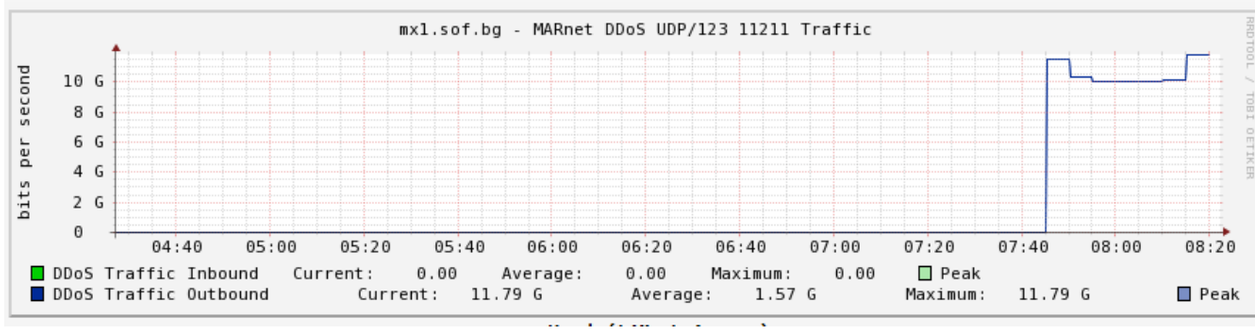
- Lets collect data about machines attacking us, but make services available
- We move important services to new /24 which is IXP.mk only, our users are in .mk and all operators in MK have peering with us
- We drop volumetric (UDP: 53, 80, 123) at GEANT but still monitor all else
- We see more TCP advanced flooding



Attack #3 – August 2022 (6)

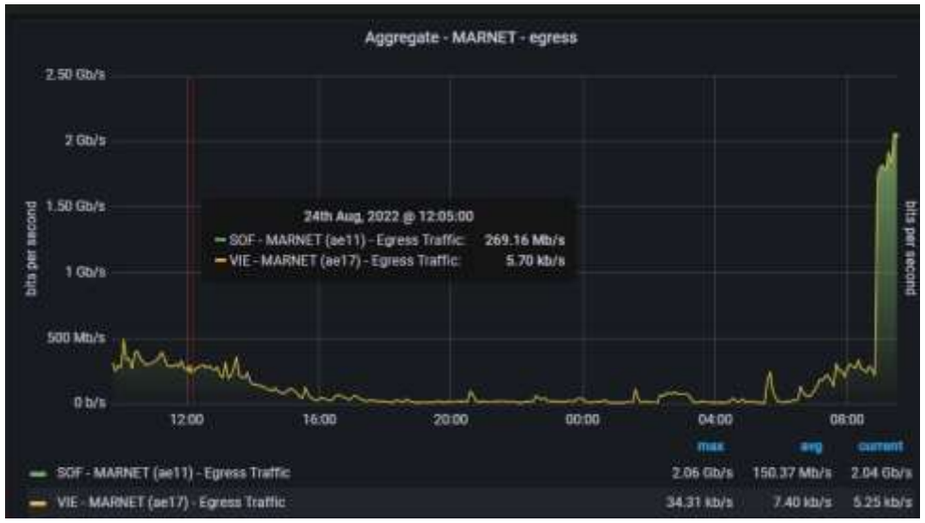
- Lets collect data about machines attacking us, but make services available
- MEMCACHE enters the arena

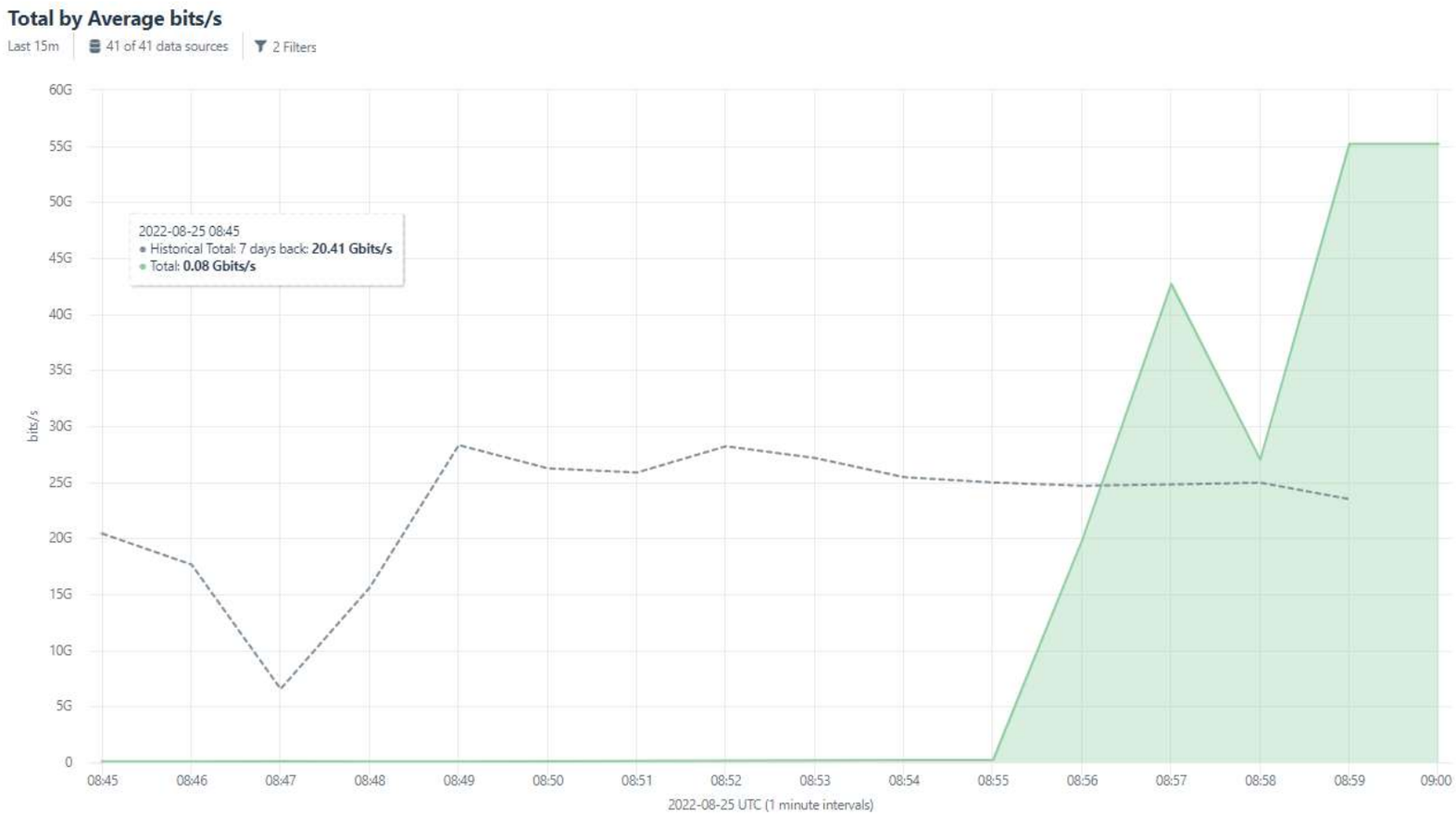




Attack #3 – August 2022 (7)

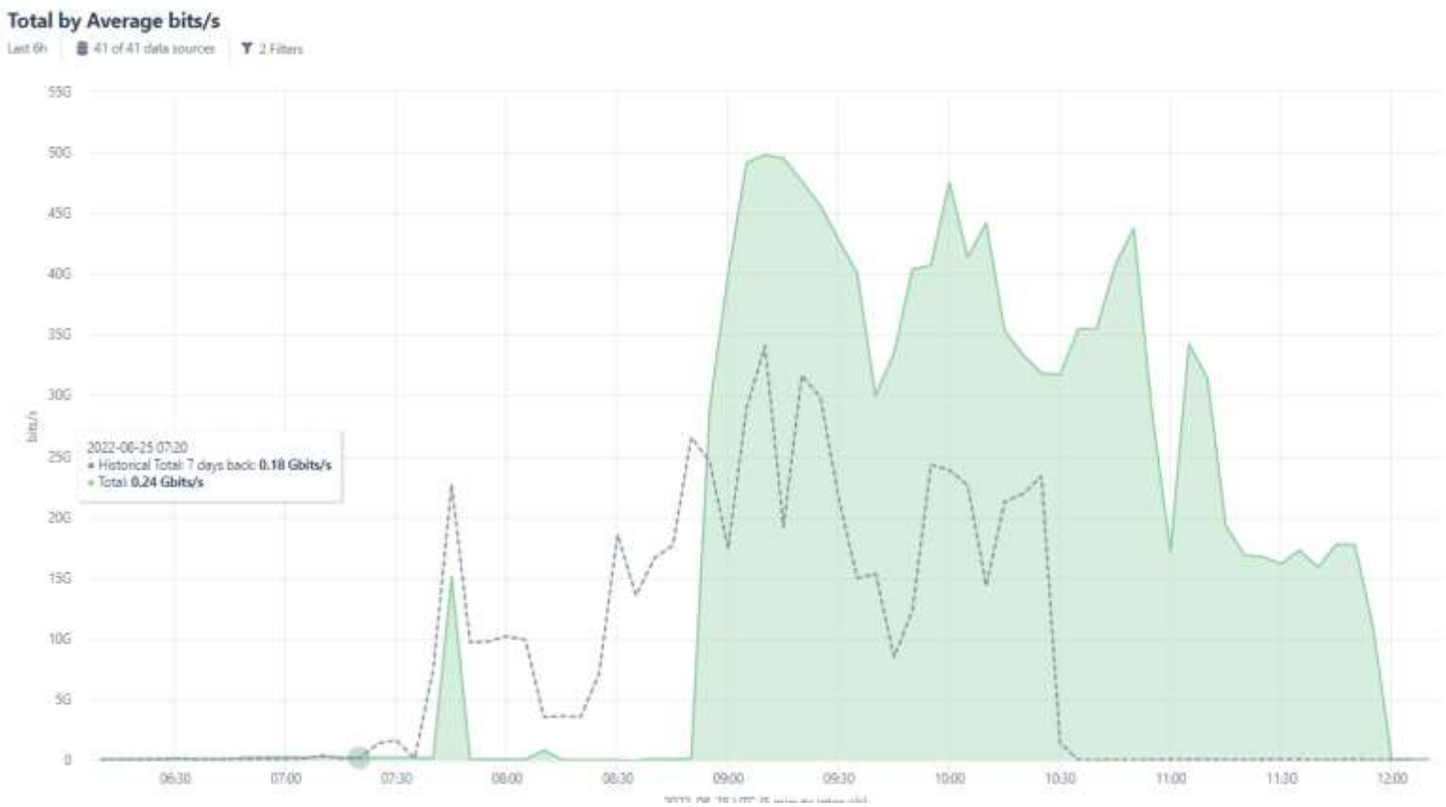
- Volumes are over the top…

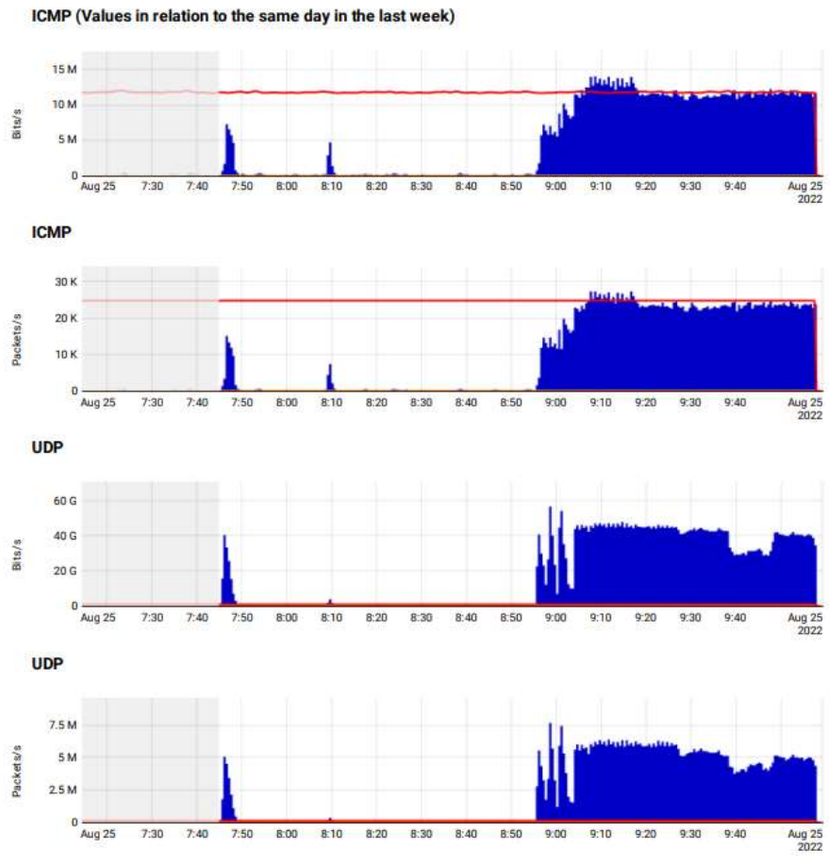


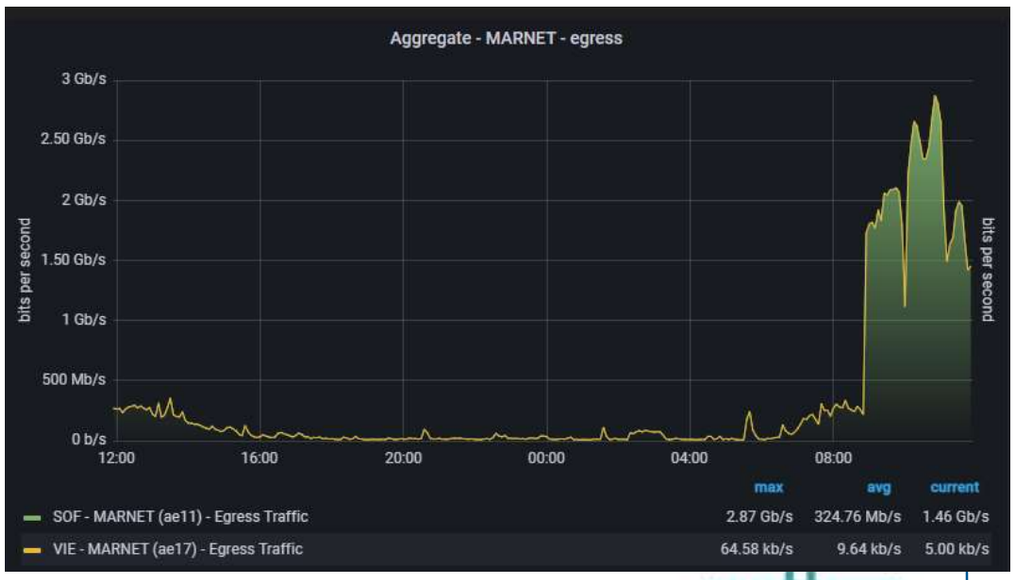


Attack #3 – August 2022 (8)

- Battle stations!!!







Attack #3 – August 2022 (8)

- We decide and announce to move exams back in the classrooms/labs
- We create some volumetric rules

Name	Match	Then	Status	Expires	Actions
MARNET_ATTACK_5MPFL0	Dst Addr 185.153.48.10/32 Src Addr 0.0.0.0/0	discard	ACTIVE	2022-09-18	Edit Deactivate
MARNET2_VCL002	Dst Addr 194.149.137.199/32 Src Addr 0.0.0.0/0	discard	ACTIVE	2022-09-18	Edit Deactivate
MARNET_6_8I5UQE	Dst Addr 194.149.137.138/32 Src Addr 0.0.0.0/0 Protocols udp DstPorts 80	discard	ACTIVE	2022-09-19	Edit Deactivate
MARNET_9_U04ITS	Dst Addr 194.149.137.231/32 Src Addr 0.0.0.0/0 Protocols udp DstPorts 80	discard	ACTIVE	2022-09-19	Edit Deactivate
MARnet_194-149-137-131_NJTKI4	Dst Addr 194.149.137.131/32 Src Addr 0.0.0.0/0 Protocols udp SrcPorts 11211	discard	ACTIVE	2022-09-20	Edit Deactivate

Post analysis

- We survived ☺
- We collected botnet data and shared with all important parties
- We saw serious capability from infected machines
- We worked with partners (Microsoft, Google, AWS, GEANT OC, Other security organizations) to notify owners of infection
- We are (re)building our network

194.149.137.0/24	ukc@ukim.edu.mk
104.164.67.0/24	abuse@egihosting.com
81.31.42.0/24	abuse@master.cz
152.67.99.0/24	abuse@oracleemaildelivery.com
92.204.135.0/24	abuse@godaddy.com
37.220.22.0/24	abuse@redstation.com
135.148.34.0/24	abuse@ovh.us
137.74.95.0/24	abuse@ovh.net
103.25.196.0/24	beben@wika.co.id
162.248.64.0/24	abuse@ufl.edu
51.210.116.0/24	abuse@ovh.net
27.50.17.0/24	abuse@moratelindo.co.id
91.185.198.0/24	abuse@telemach.si
167.114.4.0/24	abuse@ovh.net
169.62.81.0/24	abuse@softlayer.com
89.163.140.0/24	abuse@myloc.de
185.223.95.0/24	abuse@king-servers.com
135.148.46.0/24	abuse@ovh.us
78.40.108.0/24	abuse@ps.kz
78.129.208.0/24	abuse@rapidswitch.com
45.91.67.0/24	abuse-bg-network@consortnetwork.com
217.170.193.0/24	abuse@servetheworld.net
190.80.8.0/24	admin@GTT.CO.GY
51.254.118.0/24	abuse@ovh.net
210.40.190.0/24	abuse@cernet.edu.cn
149.56.142.0/24	abuse@ovh.ca
77.120.113.0/24	abuse@dc.volia.com
103.86.141.0/24	support@frozbit.com
65.108.238.0/24	abuse@hetzner.com
193.168.3.0/24	abuse@timeweb.ru
188.225.58.0/24	abuse@timeweb.ru
15.235.167.0/24	noc@ovh.net
94.228.118.0/24	abuse@timeweb.ru
142.4.96.0/24	abuse@petaexpress.com
139.99.9.0/24	noc@ovh.net
194.44.203.0/24	dataservice@ukr.net
135.181.61.0/24	abuse@hetzner.com
58.181.180.0/24	abuse-ip@ksc.net
95.217.79.0/24	abuse@hetzner.com
217.182.74.0/24	abuse@ovh.net
135.181.119.0/24	abuse@hetzner.com
79.126.127.0/24	abuse@rt.ru
39.104.123.0/24	ipas@cnnic.cn
91.121.173.0/24	abuse@ovh.net
65.21.95.0/24	abuse@hetzner.com
89.47.161.0/24	abuse@iv.lt
62.173.139.0/24	secure@spacenet.ru
135.125.233.0/24	abuse@ovh.net
39.99.32.0/24	ipas@cnnic.cn
135.181.134.0/24	abuse@hetzner.com
213.140.213.0/24	abuse@cablenetcy.net
49.12.154.0/24	abuse@hetzner.com
204.144.184.0/24	abuse@massivenetworks.com

Network upgrades

- More powerful routers for FCSE
- GEANT Network upgrade – 2 x 100Gb
- Total visibility (we will monitor Netflow with several options and try to correlate)
- BGP black hole (looking into options)
- Onsite DDOS filter/scrubber for “high profile targets”
- More upstream capacity and diversity
- We have a big list of tools/products we are analyzing one by one and see which has best value for money
- Need some fast network transport system (we have some fiber, we do not have the right technology like CDWM/DWDM for speeds faster than 10G
- Make IXP.mk even more useful for local ISP

Connect with us – www.ixp.mk

Questions?

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@bidikov