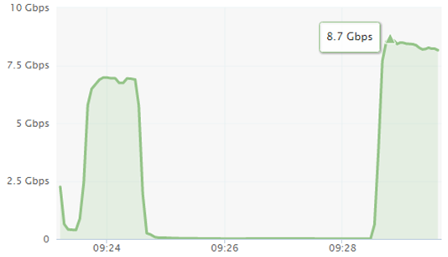
**DoS and DDoS attacks**

DoS attacks are attempts to exhaust server-side assets and designed to prevent client-to-server communication (denial of service). Simply, we can say that stealth server sabotage wires or even the server is denial of service, but in the context of data security we discuss about remote attacks and not physical sabotaging.

DDoS attacks are very similar and sometimes even identical, and their intention is Distributed Denial of Service. In other words, the attack comes not from a single source, but from a large number of end stations – usually triggered by the attacker in the form of a king of virus located on these end stations. Most DDoS attacks are much more powerful and significant. It is important to understand that even an attack by two or three end stations is usually considered as a DoS attack, since there is really no significant flooding of the server.

Earlier this month Cisco released a white paper that is part of the company’s larger report, “Visual Networking Index Complete Forecast Update, 2015-2020.” Here are some statistics from that white paper, relevant to distributed denial of service (DDoS) attacks:

* Frequency of distributed denial-of-service (DDoS) attacks has increased more than 2.5 times over the last 3 years.
* The average size of DDoS attacks is increasing steadily and approaching 1 Gbps, enough to take most organizations completely off line.
* Peak DDoS attack size (Gbps) is increasing in a linear trajectory, with peak attacks reaching 300, 400, and 500 Gbps respectively, in 2013, 2014, and 2015, at about 10 to 15 percent per year.
* In 2015 the top motivation behind DDoS attacks was criminals demonstrating attack capabilities, with gaming and criminal extortion attempts in second and third place, respectively.
* DDoS attacks account for more than 5 percent of all monthly gaming-related traffic and more than 30 percent of gaming traffic while they are occurring.
* Globally the number of DDoS attacks grew 25 percent in 2015 and will increase 2.6-fold to 17 million by 2020.



The DoS and DDoS attacks can be divided into two types:

* Attacks that flood and delay the service.
* Attacks that completely disrupt the service (and these we want to deal with in our project).

We will now include both types of attacks for DoS and DDoS attacks in general, and we will divide the types into different main types, based on the seven-layer-model (OSI).

1. **DoS and DDoS over Application layer**  
   Attacks in the application layer are often generated by POST requests. They are also divided to sub protocols in the application layer – http / https.  
     
   HTTP POST Flood – creating and sending very large number of POST methods, to the extent that the server can't answer all requests, therefore service for real users of the server is compromised.  
     
   HTTPS POST Flood – this is a flood of post methods that pass through SSL Session. The purpose of SSL is to take every message and decrypt it in order to inspect it. Flooding of these methods would harm the service.  
     
   HTTP GET Flood – the attacker creates and sends to the server a huge amount of GET requests. The server needs to analyze all of them and return some data. Some people regard this attack as a Transport-layer attack, since sometimes the server would have to send a lot of data to the user \ attacker. Therefore, traffic and network bandwidth are flooded. Denial and service prevention depends on the server’s capacity to getting and sending back packets. If it is able to handle a huge number of requests – the traffic will be damaged, and if it fails, the requests that it receives from real users will not be handled as the server falls.  
     
   HTTPS GET Flood – overflow of GET requests on HTTPS protocol requires a lot of work from SSL Session – decryption every message and hence load and sabotage the service.
2. **DoS and DDoS over Transport layer**  
   Flooding over Transport layer characterized mainly by packets that the server receives and is required to provide service – mostly by sending a requested data or any response packet.  
     
   Syn Flood – in this attack, the attacker takes advantage of the TCP principles that the server always wants to reach. When a server receives a Syn packet, it is a request from a client to open a connection, and it is obligated to respond to it and must return the client a Syn – Ack certificate. Each Syn message requires time from the server – analyzing the packet (understanding who created it, calculating ‘Check-sum’ etc.), and then be able to reply. Therefore, flooding these messages is slowing down and compromising the server’s serviceability.  
     
   Rst Flood – like Syn flood, the attacker takes advantage of TCP principles, including reliable communication. In case that a socket is closed or when one of the sides disconnected (and in few other situations), TCP has a solution. The connected side still wants to continue the communication (since there was no closing connection process), it sends a packet with a Rst flag and hence they have to re-open the connection. Like Syn packets overflowing, Rst packets overflowing also require a lot of work from the server and would sabotage the service.  
     
   UDP Flood – UDP floods are used frequently for larger bandwidth DDoS attacks because they are connectionless and it is easy to generate UDP messages from many different scripting and compiled languages. The attack can be initiated by sending a large number of UDP packets to random ports. As a result, the server would check for the application listening at that port, realize that no one is and reply with ICMP packet saying ‘Destination Unreachable’. Thus, for a large number of UDP packets, the server will be forced into sending many ICMP packets and much performance.
3. **DoS and DDoS over Network layer**  
   DoS and DDoS attacks over the Network layer are characterized with a large number of packets in order to overload the bandwidth and exhaust network resources. Network resources can be routers, firewalls and servers, and it is clear that their ability is final.  
     
   ICMP Flood – ICMP protocol is typically used for error messages rather than data exchange between systems. Flooding messages with ICMP protocol – e.g. ping – is intended to overload the network.
4. **DoS and DDoS over Link layer**DoS and DDoS attacks over the Network layer require access to the local network. Therefore, they are rare and more easy to detect.MAC Flood – a rare attack, in which the attacker has to be connected to the local switch. The attacker sends multiple dummy Ethernet frames, each with different invalid MAC address. Network switches maintaining their MAC table, and treating MAC addresses separately, and hence reserve some resources for each request. When all the memory in the table is used up, it either shuts down or becomes unresponsive.

APDoS:

APDoS is an attack that combines many DoS and DDoS attacks, and is carried out by a lot of hostile elements over time. APDoS represents the worst Denial of Service attack that can occur. The idea behind it is a combination of many attacks from multiple endpoints, and over long period of time, hence its name Advances Persistent DoS. In this attack, the attackers usually attack several stations in order to create a distraction from the DoS defenses, but concentrate on one main victim in the organization.