DoS

Denial of Service

- Denial of Service (DoS) Attack
  - Prevent the server from being used by legitimate users

- General strategy
  - Overwhelm the server with requests
  - The requests use all of the servers resources
  - Anyone attempting to use the app during the attack will not get responses from their requests

- Discuss: How would you attack a server?

DoS Prevention

- Constant back-and-forth between attacks and prevention
- Each side continuously evolves in an attempt to counter the other
- Preventing DoS attacks is difficult without affecting legitimate users

- You'll implement one prevention method in your project:
    - IP Blocking

Demos

DoS -Brute Force

- Brute force attack
  - Just mash refresh on the page... or
  - Write code that will send a request
    - Call that code in a loop

- Very simple attack
- Very simple prevention
  - Write efficient code for your app
  - The attack is effectively a load test
  - Your app should be ready for a large number of users

DoS - Content-Length

- An attacker can get more sophisticated than brute force by playing with the Content-Length header

- How does your code buffer POST requests?
  - Read the content length
  - Read bytes from the TCP socket until you read that many bytes

- How does an attacker exploit this?
  - Send a request with a Content-Length of 20
  - Only send 19 bytes in the body
  - Your code gets stuck in an infinite loop
  - Send these requests in a loop to force the server to keep many connections open

DoS - Slow Send

- Next step of prevention:
  - Set a timeout in your loop
  - If you haven't received any bytes after a fixed amount of time, close the connection

- Next evolution of the attack:
  - Drip feed the content
  - Instead of sending all the bytes right away, send them very slowly
  - eg. Set Content-Length to 100,000, then send 10 bytes/second
  - Prevents the timeout from activating

DoS - Slow Send

- Next evolution of the attack:
  - Send bytes very slowly
- Next step of prevention:
  - No obvious answer for this attack
  - Prevention must distinguish between a slow send attack and a legitimate user with a slow connection
  - Attackers evolve to accurate simulate a user with a slow connection

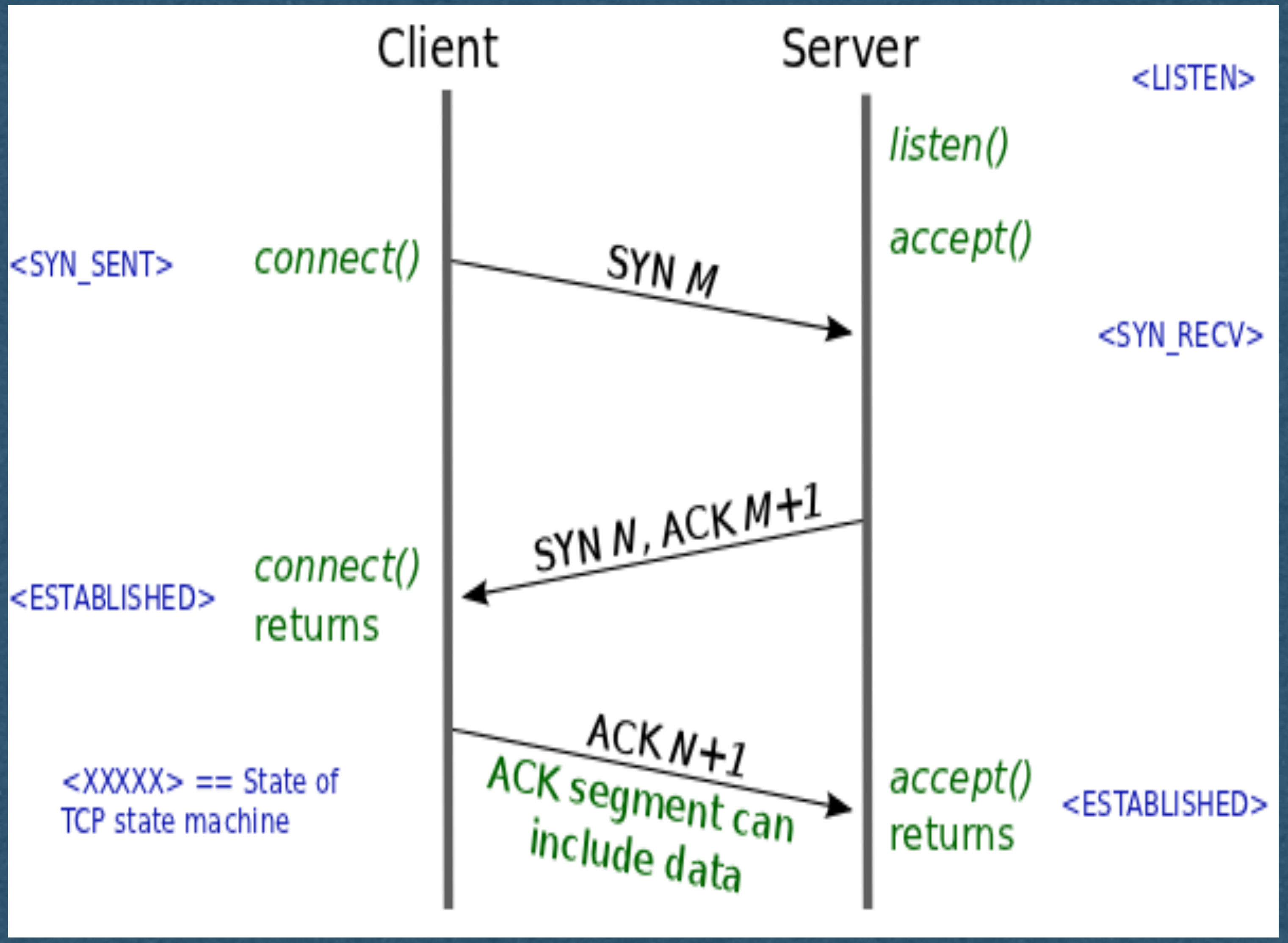
DoS - Slow Read

- A related attack is to read server responses very slowly

- Instead of reading 2048 whenever data is ready, read a few bytes/second
- Can take a very long time to read one response from the server
  - Server must keep this TCP connection open the whole time

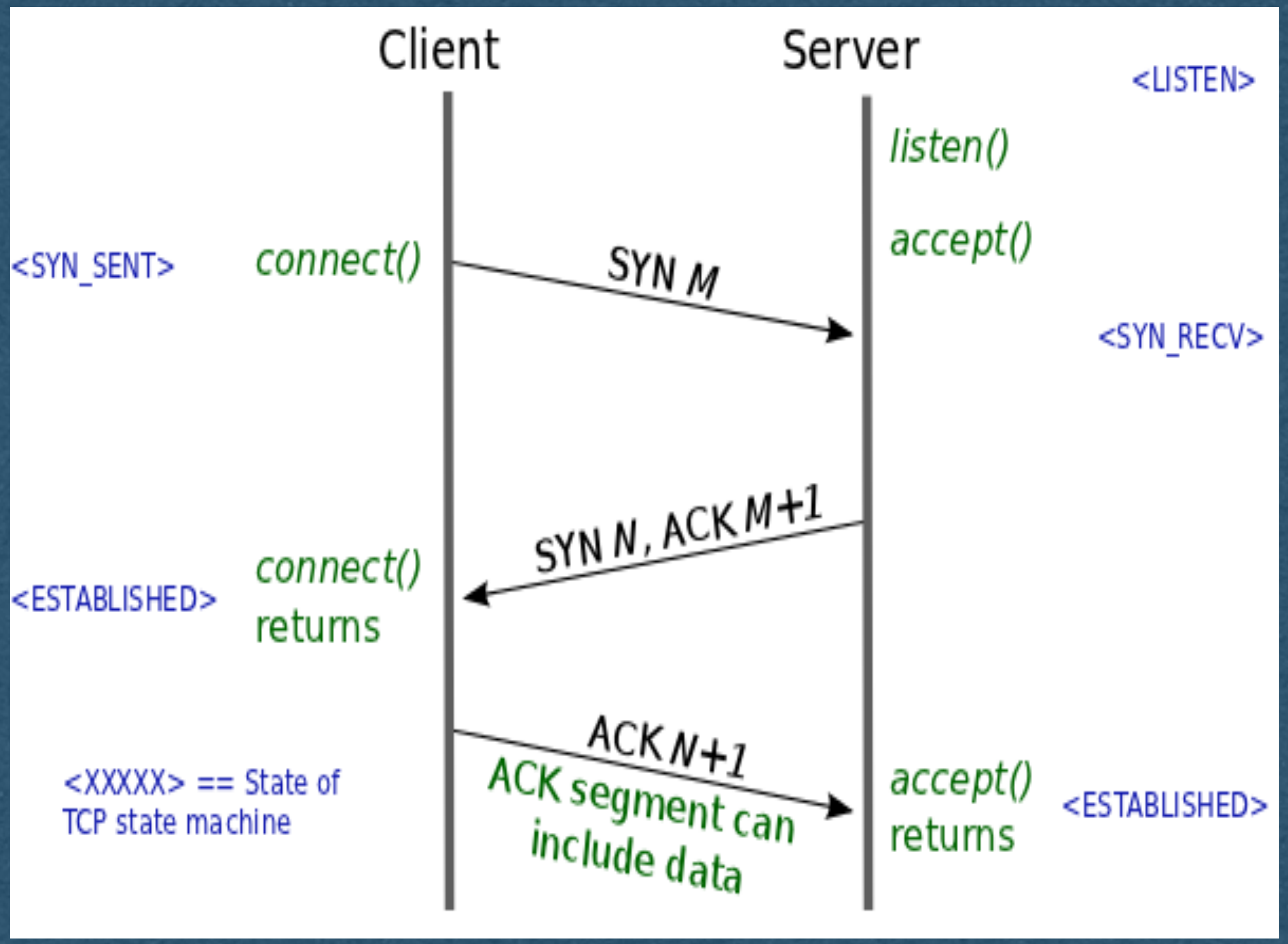
DoS - SYN Flood

- Recall the TCP three way handshake
  - Client sends SYN
  - Server responds with SYN + ACK
  - Client responds with ACK



DoS - SYN Flood

- SYN Flood attack:
  - Send a SYN to the server
  - Stop.
- Very cheap to send a SYN packet
  - Can send large numbers of them very quickly
  - Server responds and waits for the ACK that never comes
  - Server has lots of half-open connections until they time out
  - Uses servers resources to keep these connections open



DoS Prevention: IP Blocking

- IP blocking
  - If you see many requests, or other suspicious behavior, from the same IP address
    - Block connections from that IP address

- When setting this up for your project:
  - All requests will come from nginx (ie. localhost)
  - Configure nginx to forward the real ip address of the client in a header
  - Read the header in your server code to add IP blocking

DDoS

- So we block offending IP addresses
  - Game Over. Eventually block all attacker IPs..
  - IP addresses can be spoofed..
  - But more problematic is the DDoS attack

DDoS

- Distributed Denial of Service (DDoS)
  - Instead of using one machine to launch an attack..
    - Use as many machines as you can access
    - Launch any/all of the previous attacks from all machines
  - Very difficult to prevent against since it can look much more like legitimate traffic from a variety of users

DDoS and BotNets

- How does an attacker gain access to enough machines to launch a DDoS attack?
  - Using a BotNet

- Viruses "Back in the day"
  - Attacker infects your device with a virus
  - The virus destroys your device and renders it unusable
  - Do it for the lolz
  - No real gain for the attacker

DDoS and BotNets

- Viruses in current year
  - Attacker infects your device with a virus
  - The virus runs silently in the background waiting for commands from the attacker
  - Infected machines become part of the attackers BotNet
  - The attacker can now use the resources of all these machines
    - Launch a DDoS attack from their BotNet
      - Looks even more like legitimate users since many of them *are* legitimate users
  - Lucrative for the attacker
    - Can sell access to their BotNot
      - Or just mine crypto..