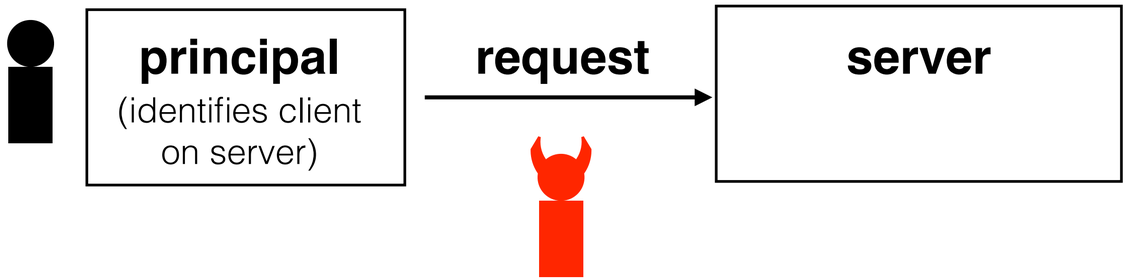
6.1800 Spring 2025

Lecture #25: Network-based attacks

preventing access — *denying service* — to online resources

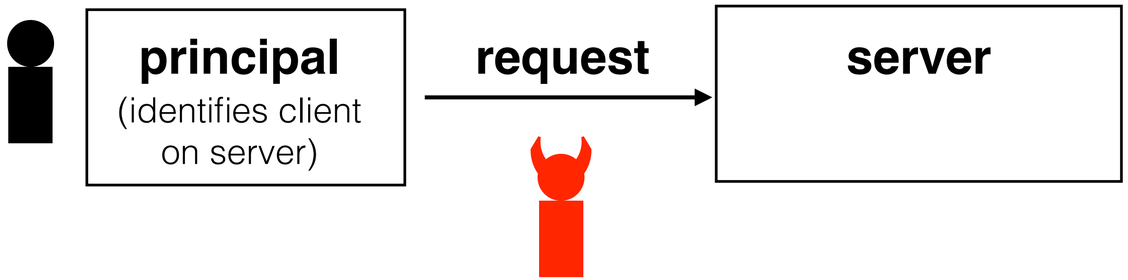
Katrina LaCurts | lacurts@mit.edu | 6.1800 2025

we've been dealing with adversaries on the network for two lectures



adversary's goal: observe or tamper with packets

today, our adversaries are still on the network, but they have new goals



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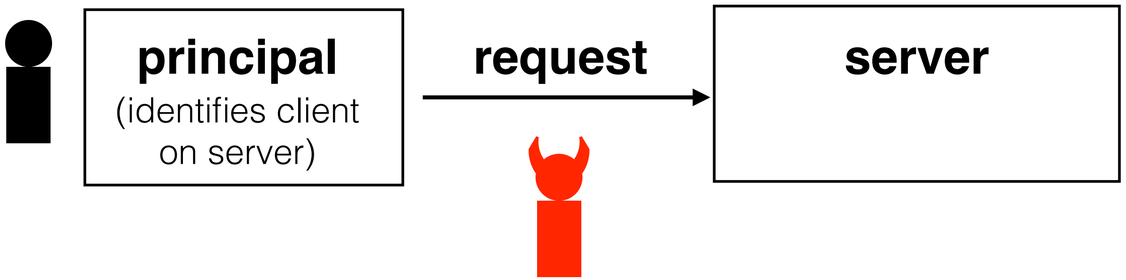

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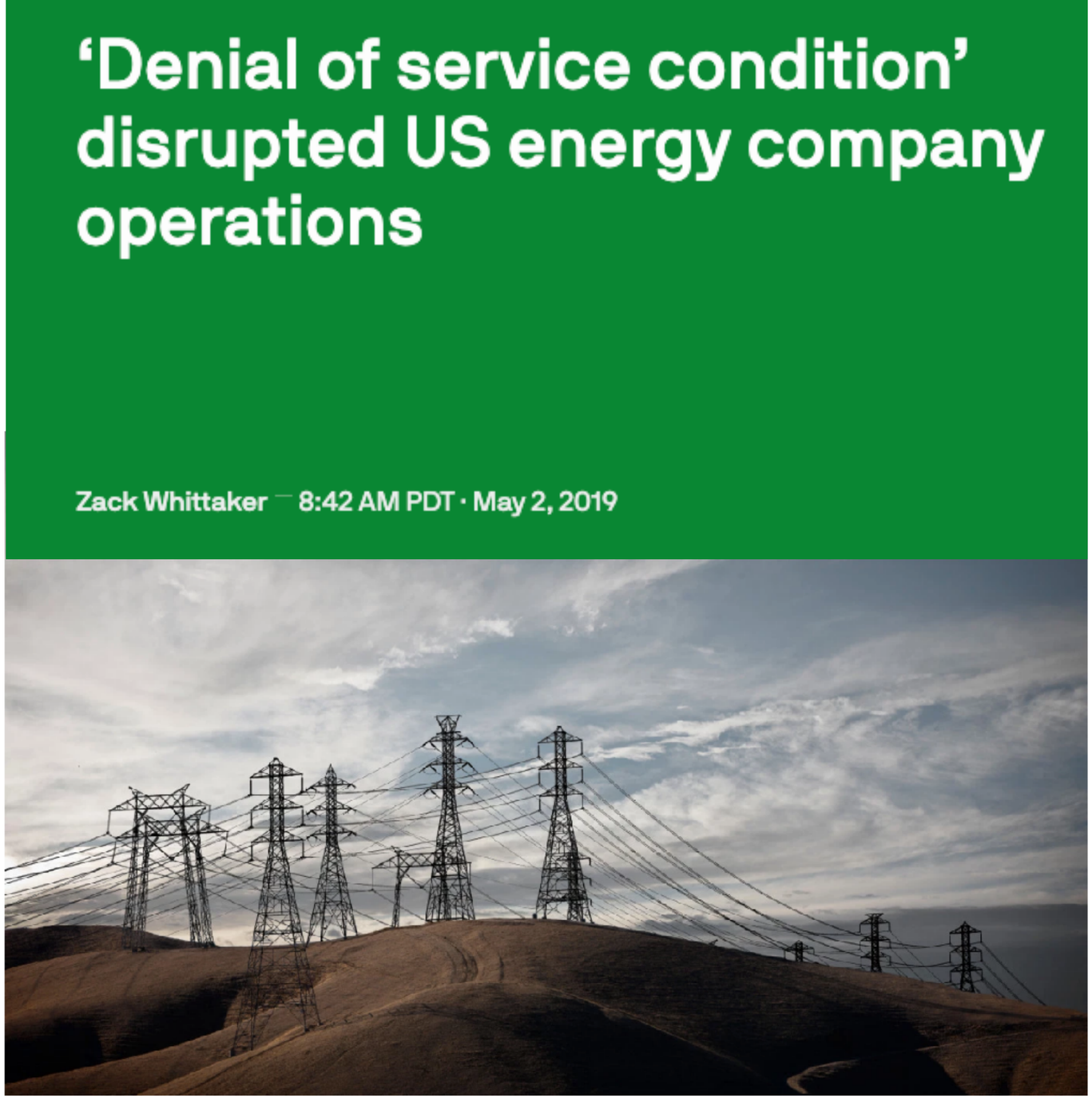

https://techcrunch.com/2019/05/02/ddos-attack-california-energy/

threat model: adversary controls a **botnet**, and is aiming to prevent access to a legitimate service via **DDoS attacks**

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(~100,000 of them)

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6.1800 in the news

Airborne: Wormable Zero-Click Remote Code Execution (RCE) in AirPlay Protocol Puts Apple & IoT Devices at Risk

Uri Katz, Avi Lumelsky, Gal Elbaz
April 29, 2025

CVE-2025-24132 is a stack-based buffer overflow vulnerability. This vulnerability allows for a zero-click RCE on speakers and receivers that leverage the AirPlay SDK. These devices are vulnerable to zero-click RCE under all configurations. The vulnerability allows for wormable exploits under these circumstances, given it enables an attack path that can spread from one device to another with no human interaction.

Examples of successful attack outcomes include more playful actions like displaying an image on the device or playing music, to more serious actions like using the device's microphone to listen to nearby conversations, such as eavesdropping via a device in a high-profile conference room.

https://www.oligo.security/blog/airborne

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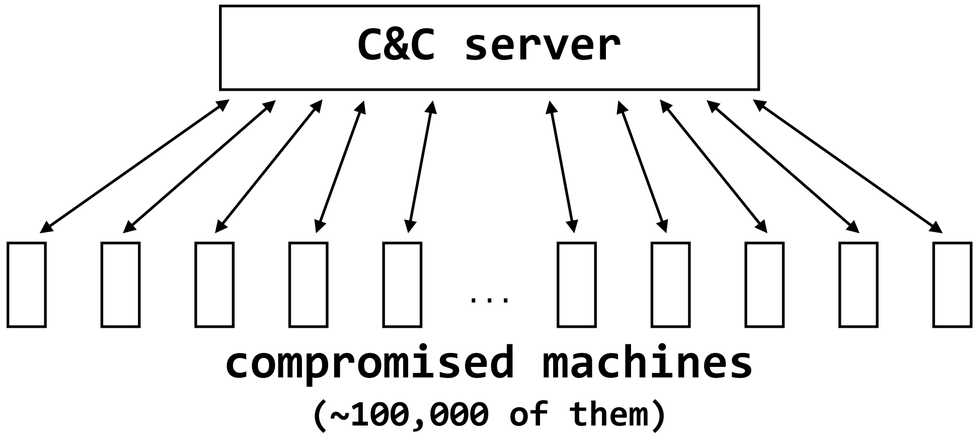
some papers call these “C2 servers” instead of C&C servers



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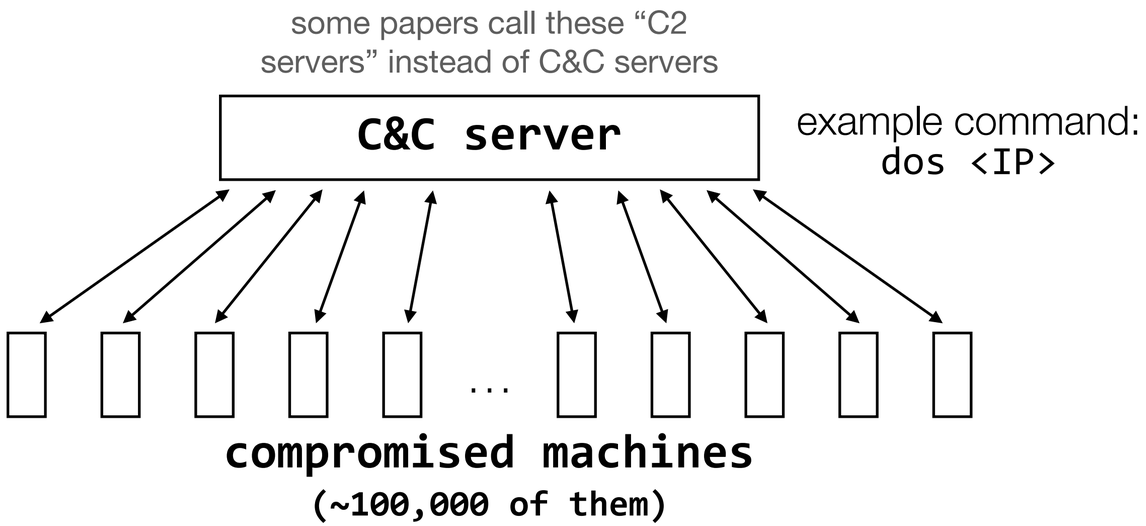

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alert tcp $EXTERNAL_NET any -> $HOME_NET 7597
(msg:"MALWARE-BACKDOOR QAZ Worm Client Login
access"; flow:to_server,established;
content:"qazwsx.hsq"; metadata:ruleset community;
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problem: packets might arrive out of order

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problem: this is more involved than it looks on the slide, and requires keeping a lot of state

it’s certainly not impossible; after all, your computer reconstructs TCP byte streams all the time

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problem 2: it doesn’t even work

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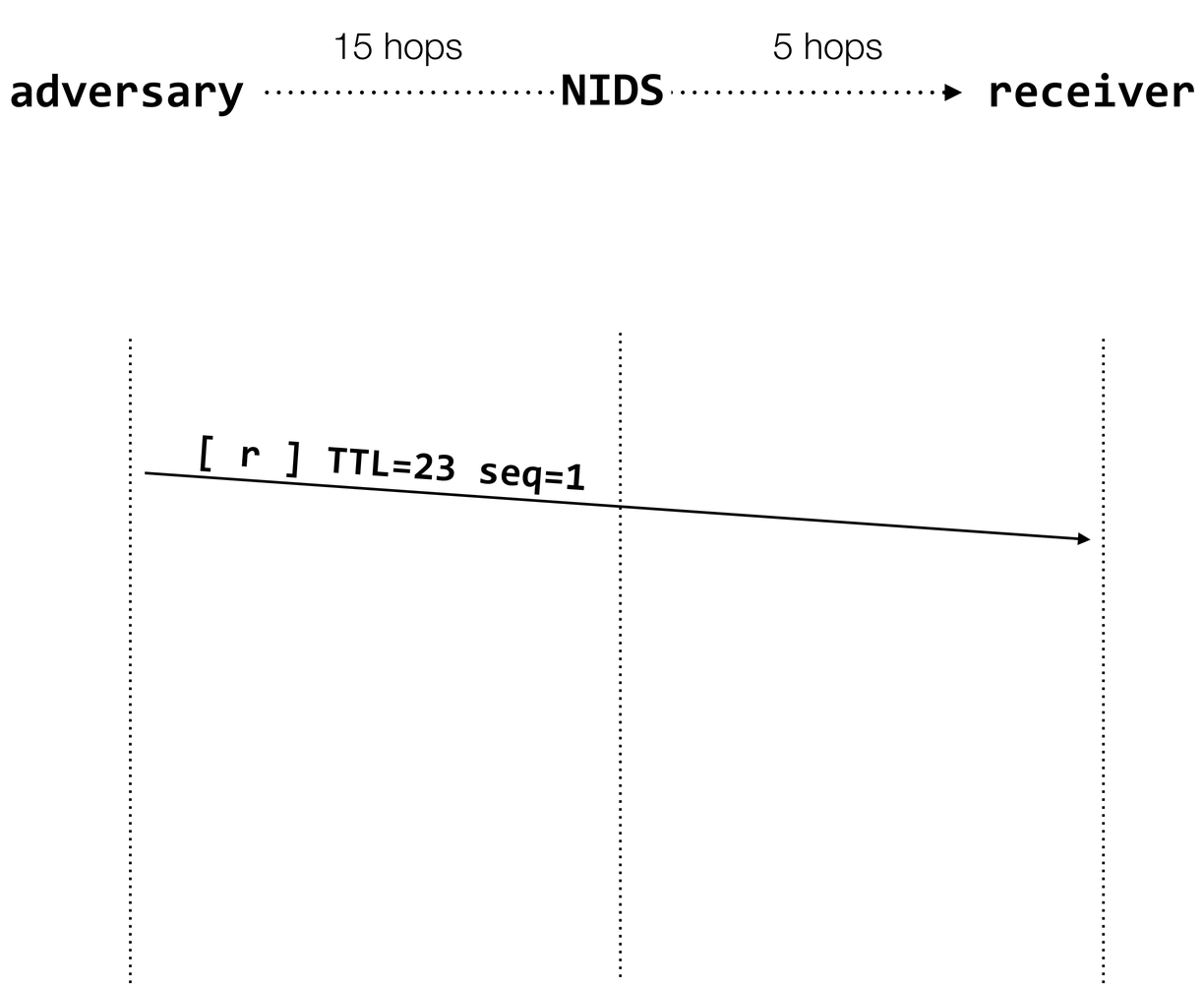

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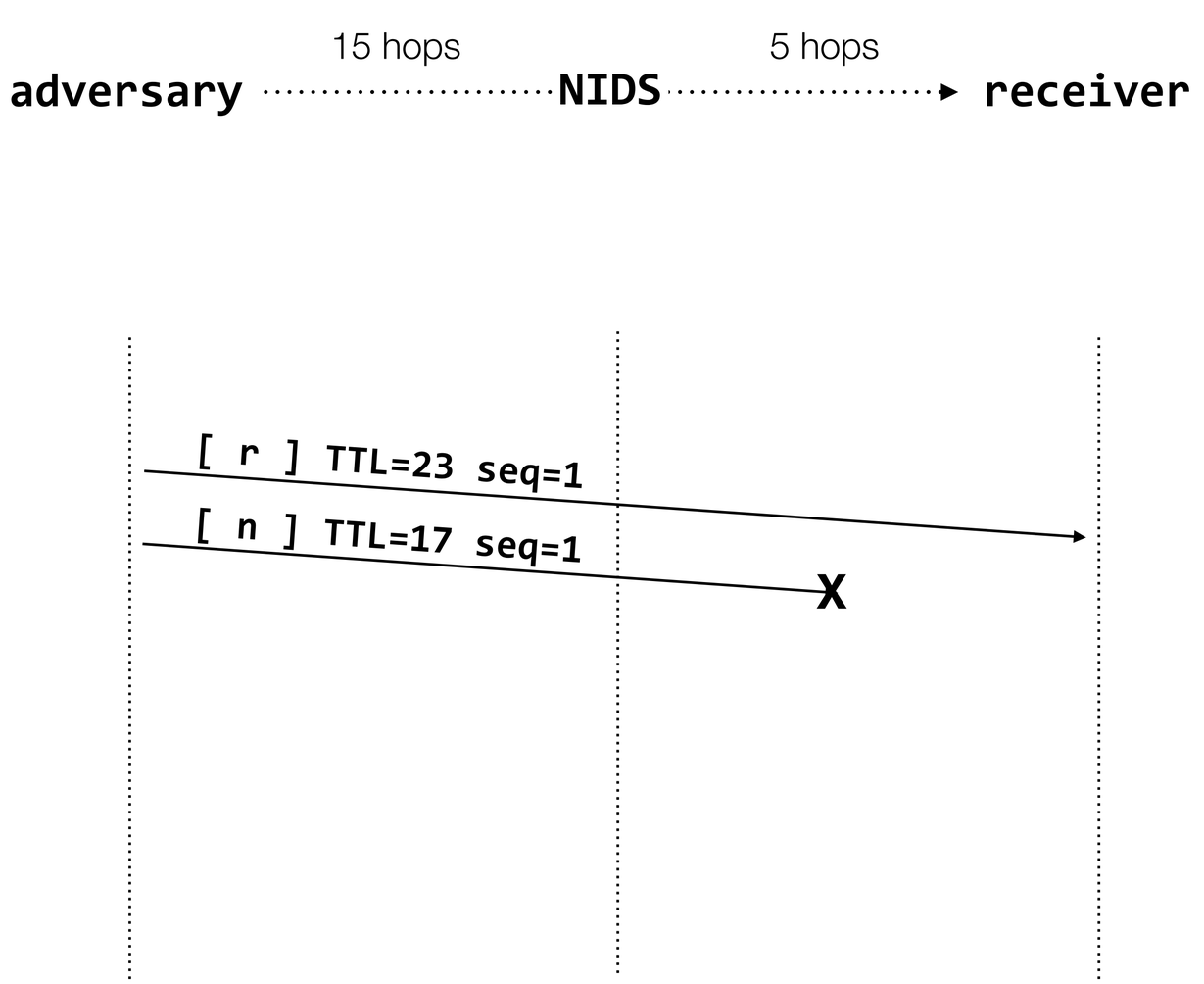

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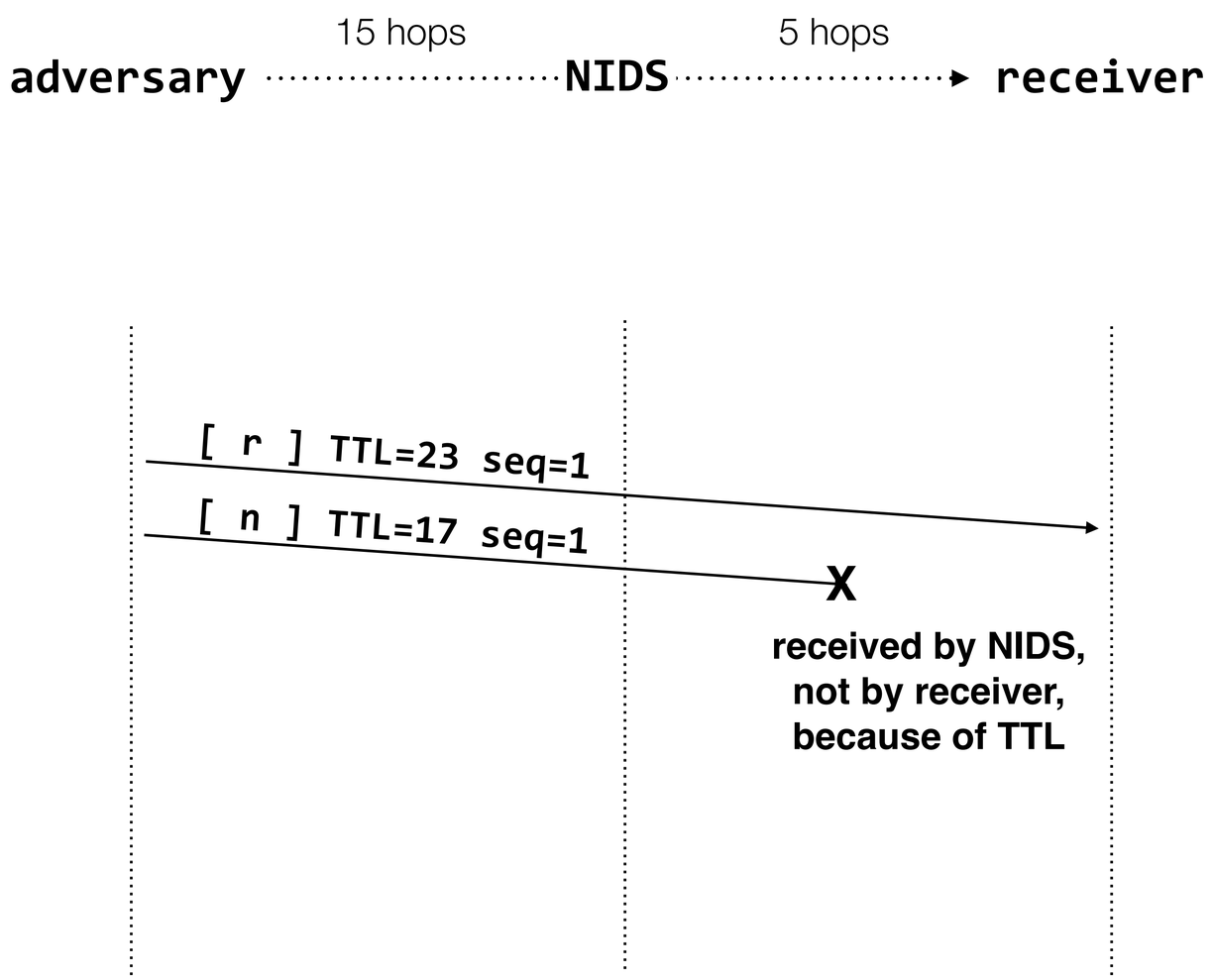

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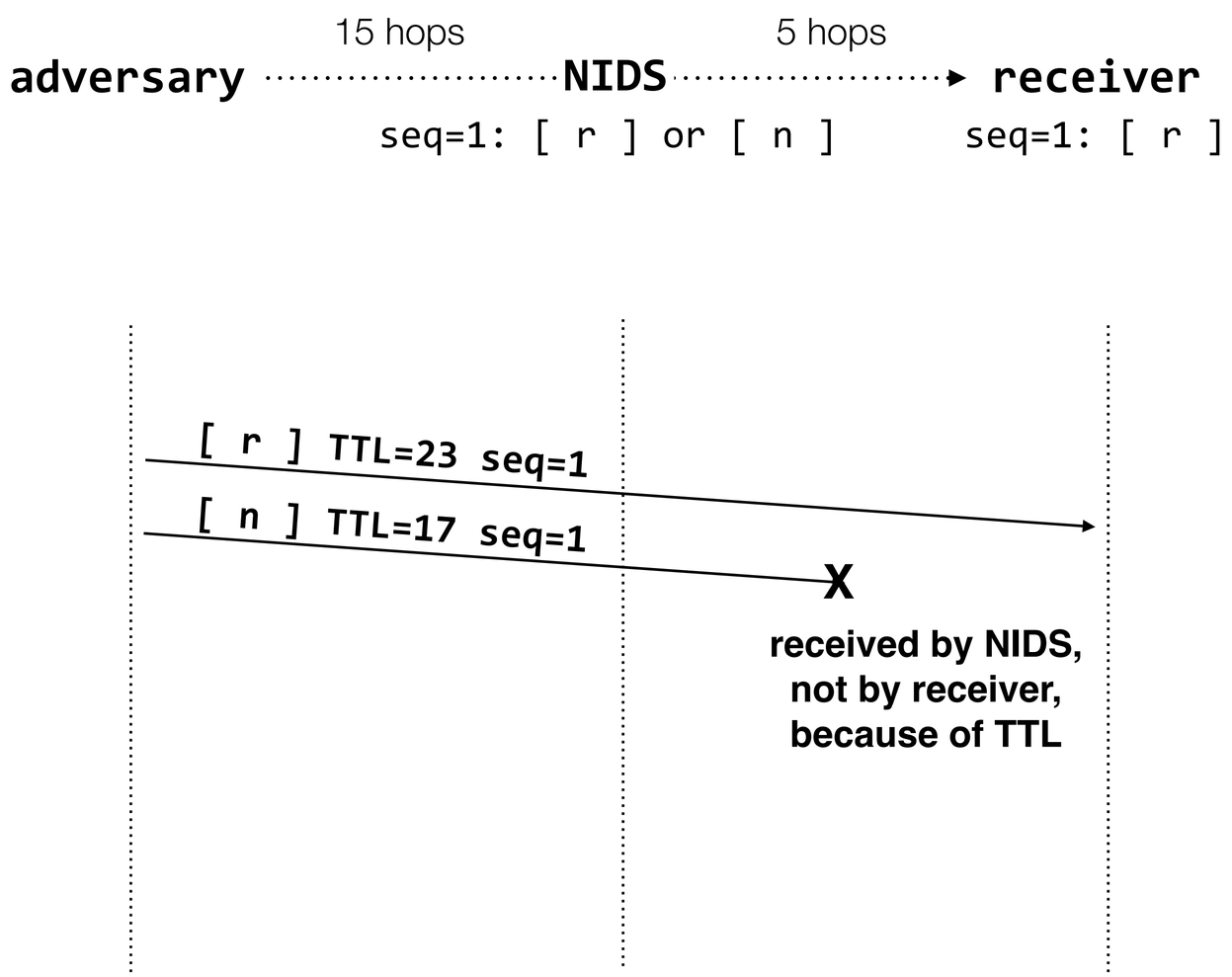

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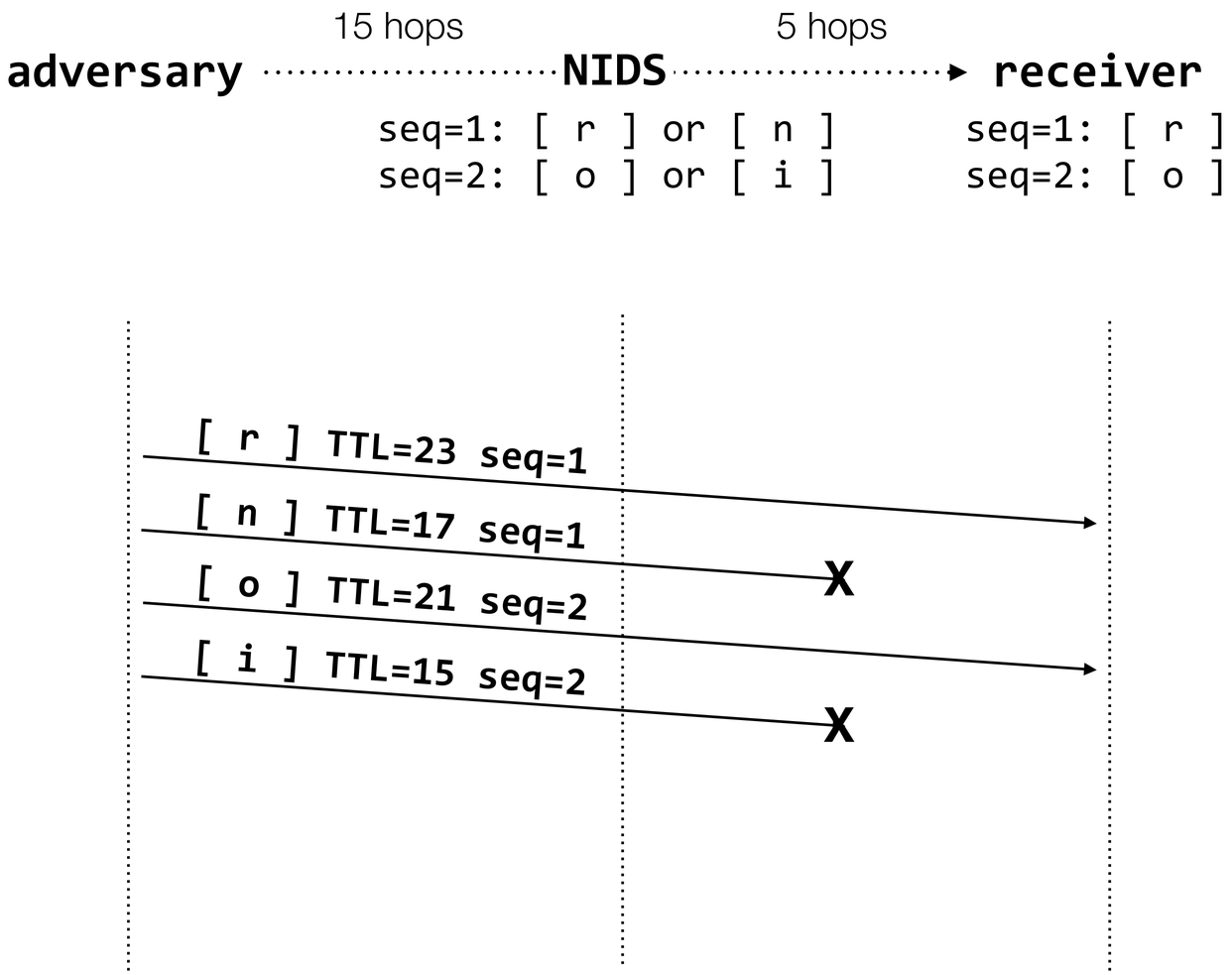

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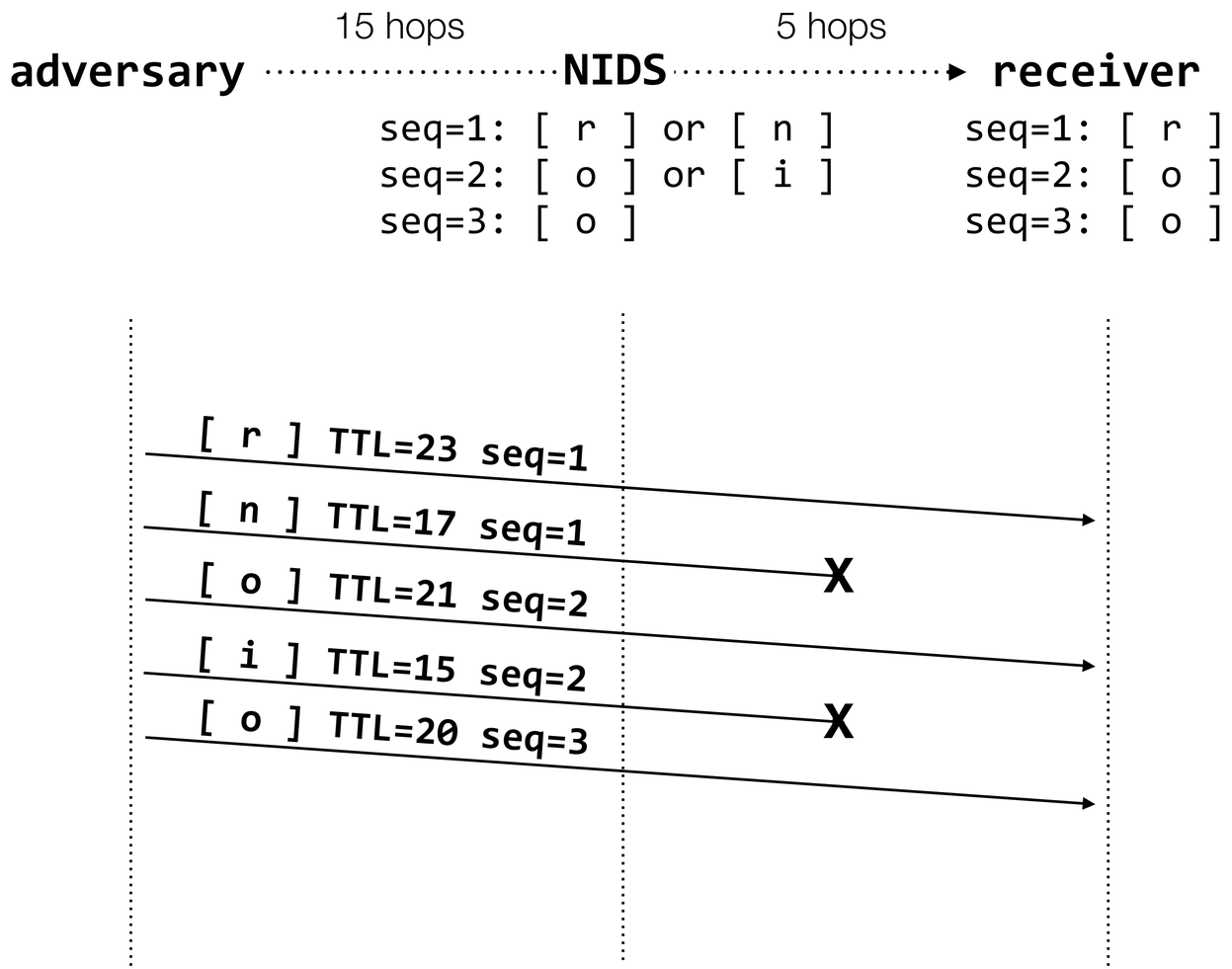

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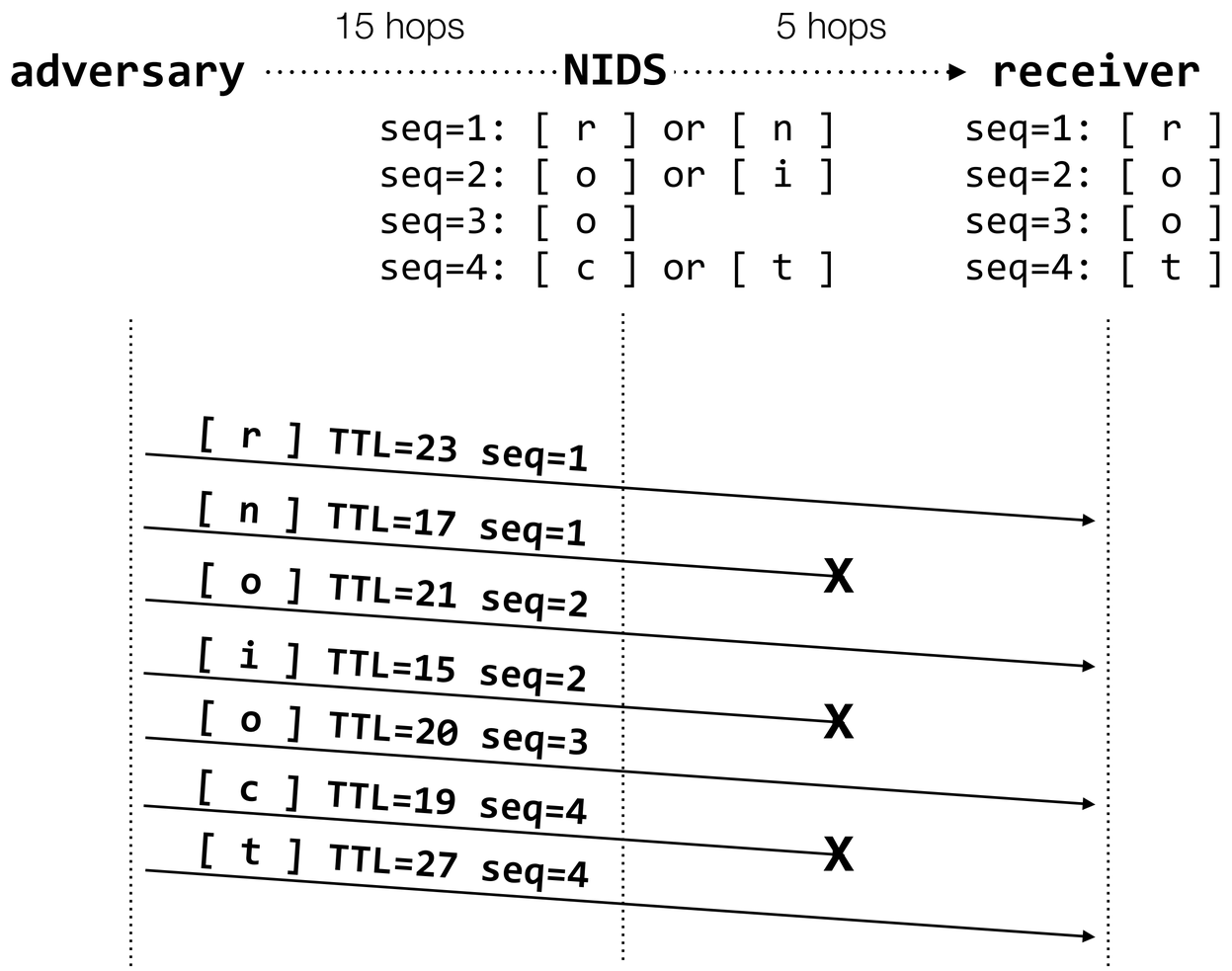

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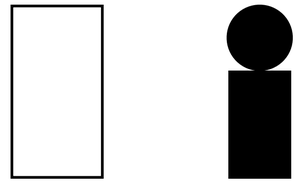

victim's webserver

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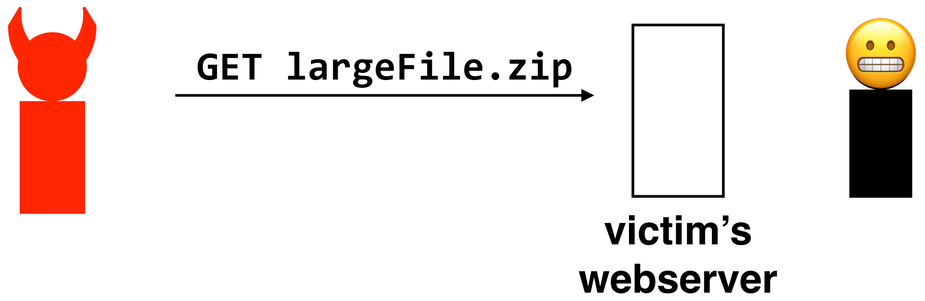

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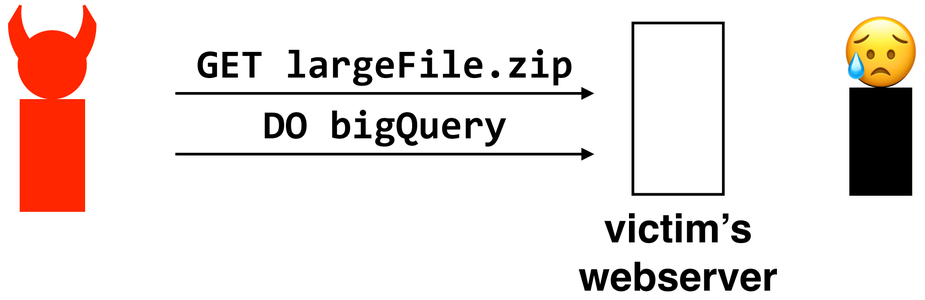

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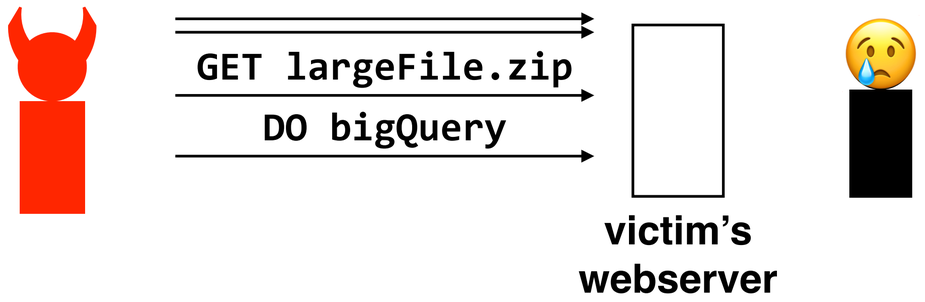

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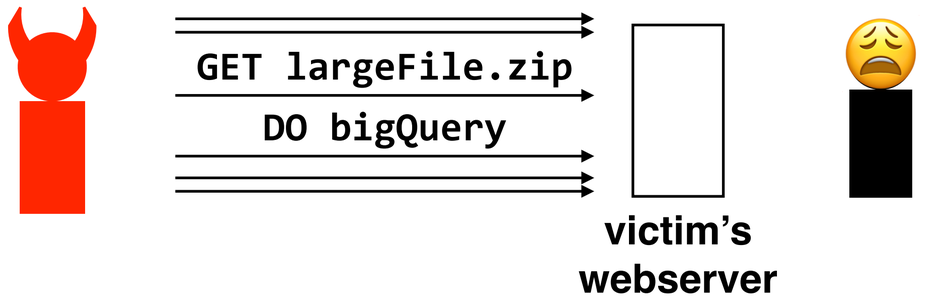

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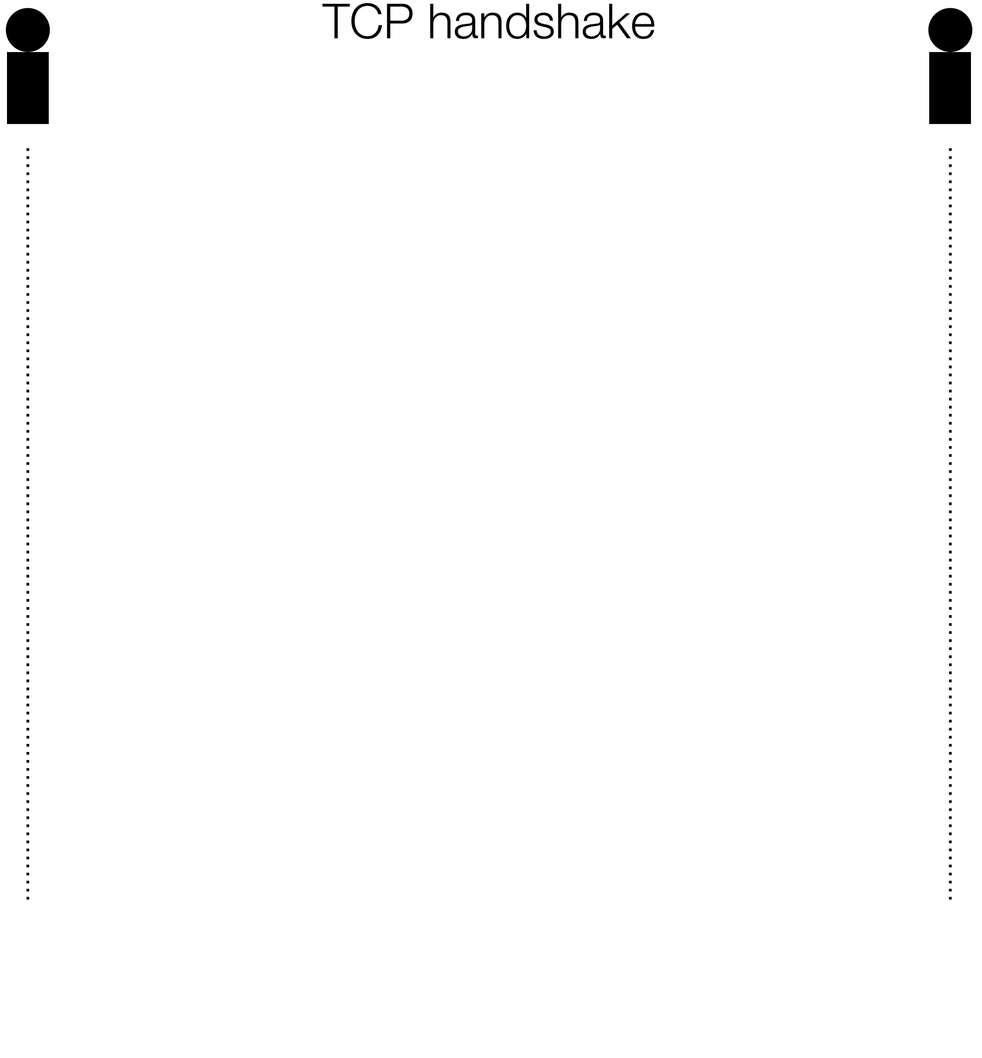

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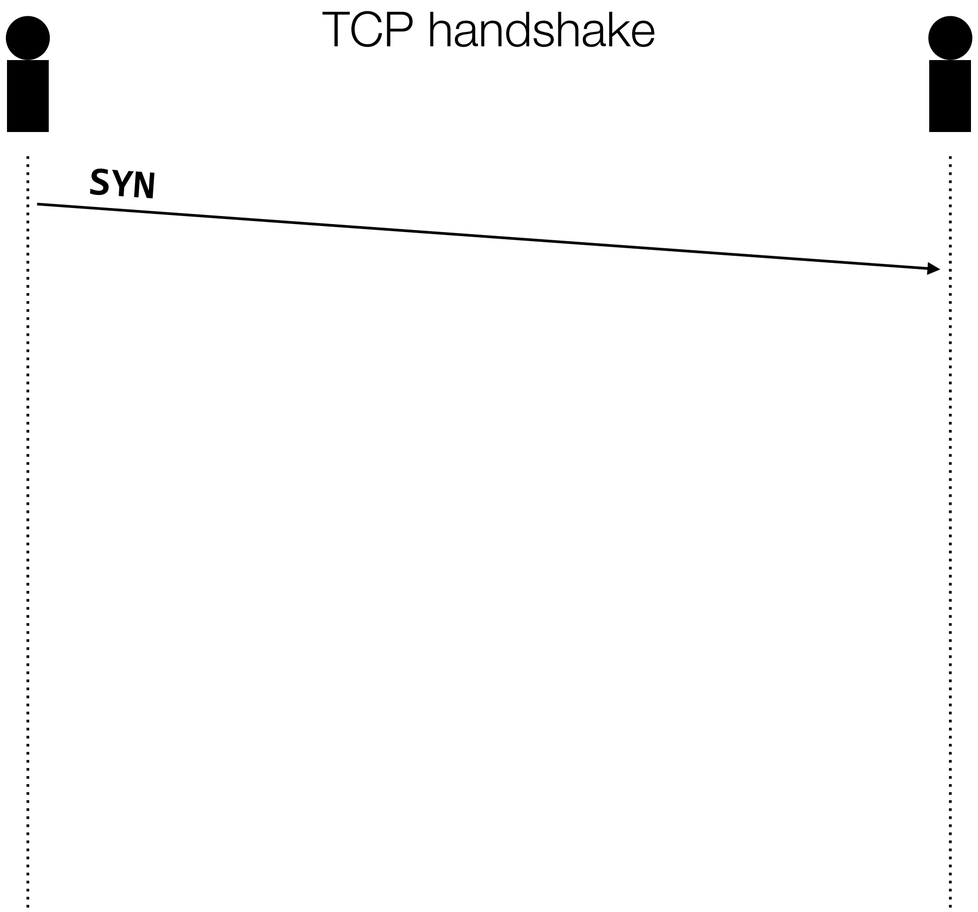

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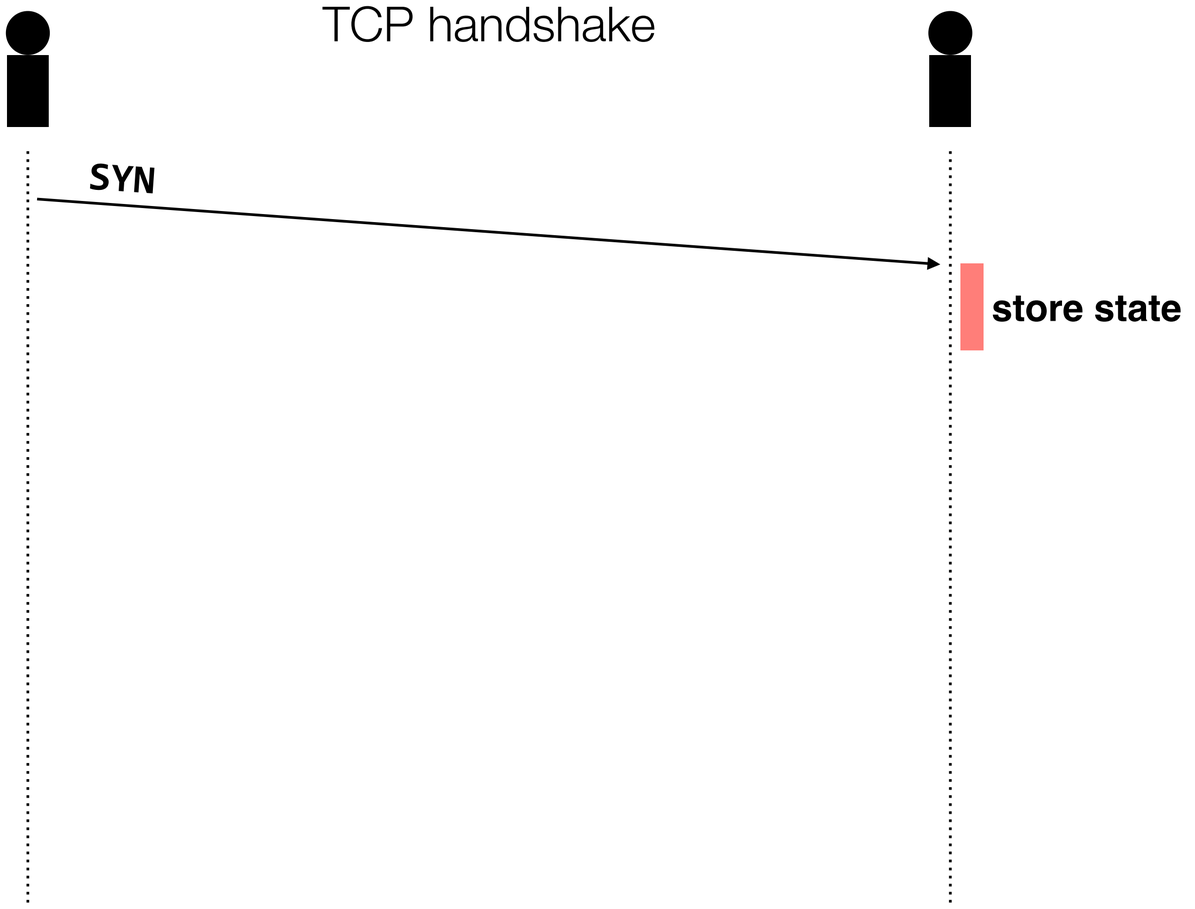

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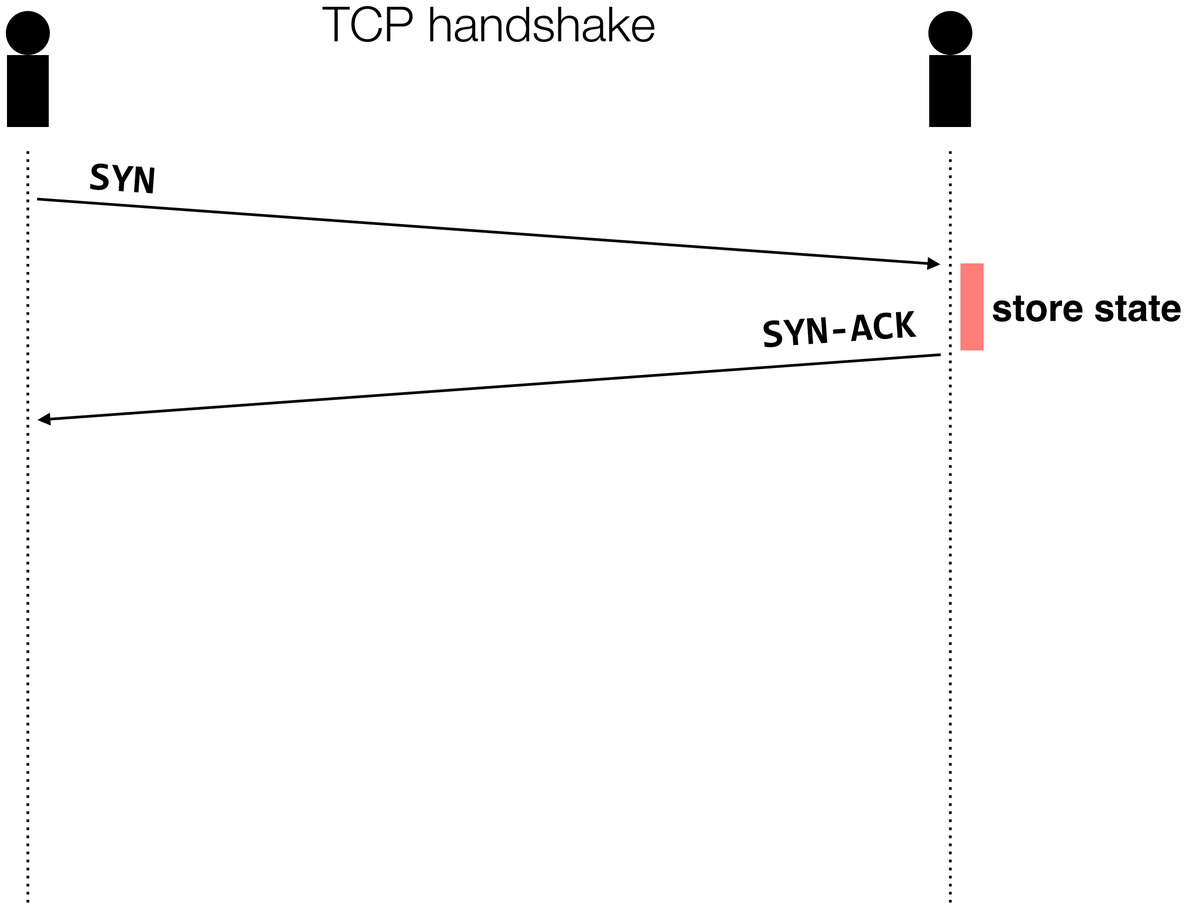

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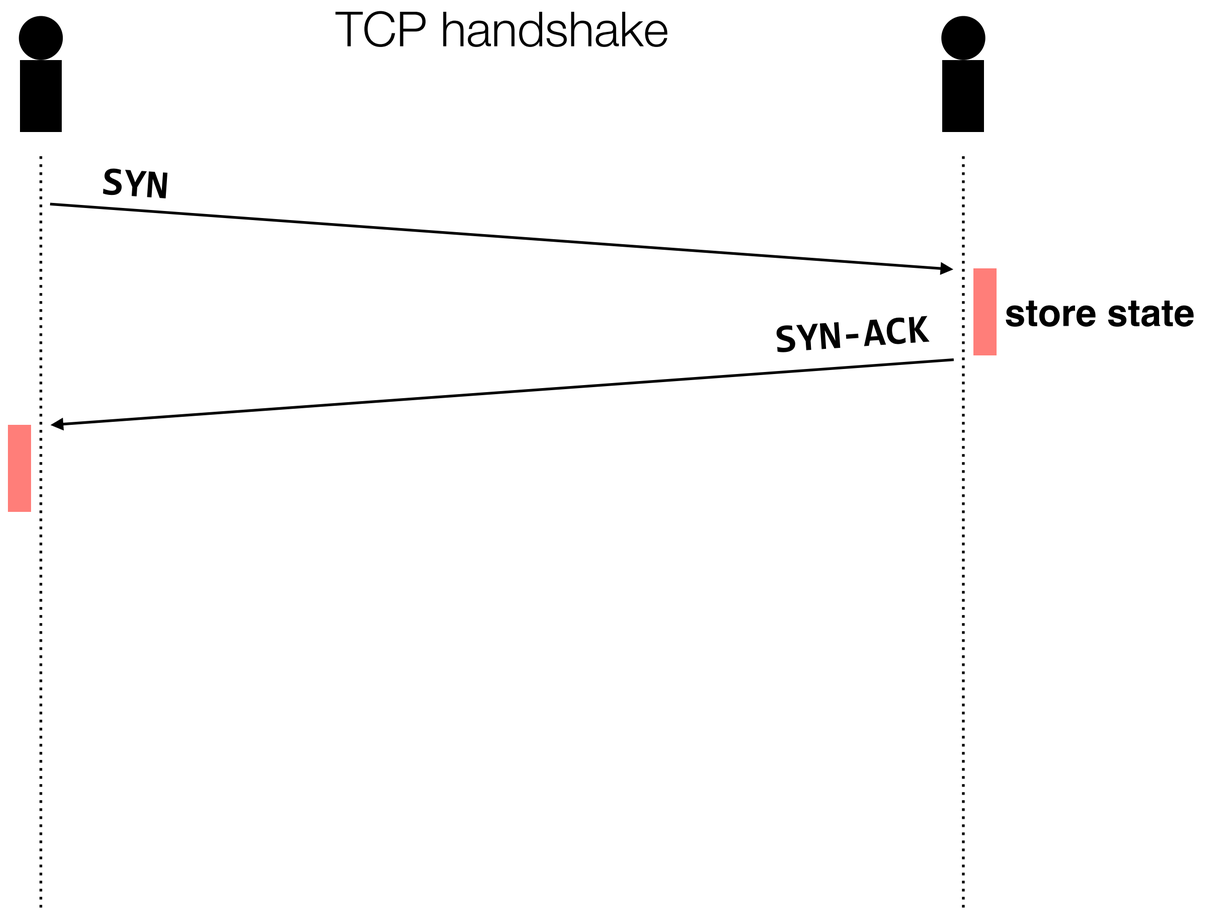

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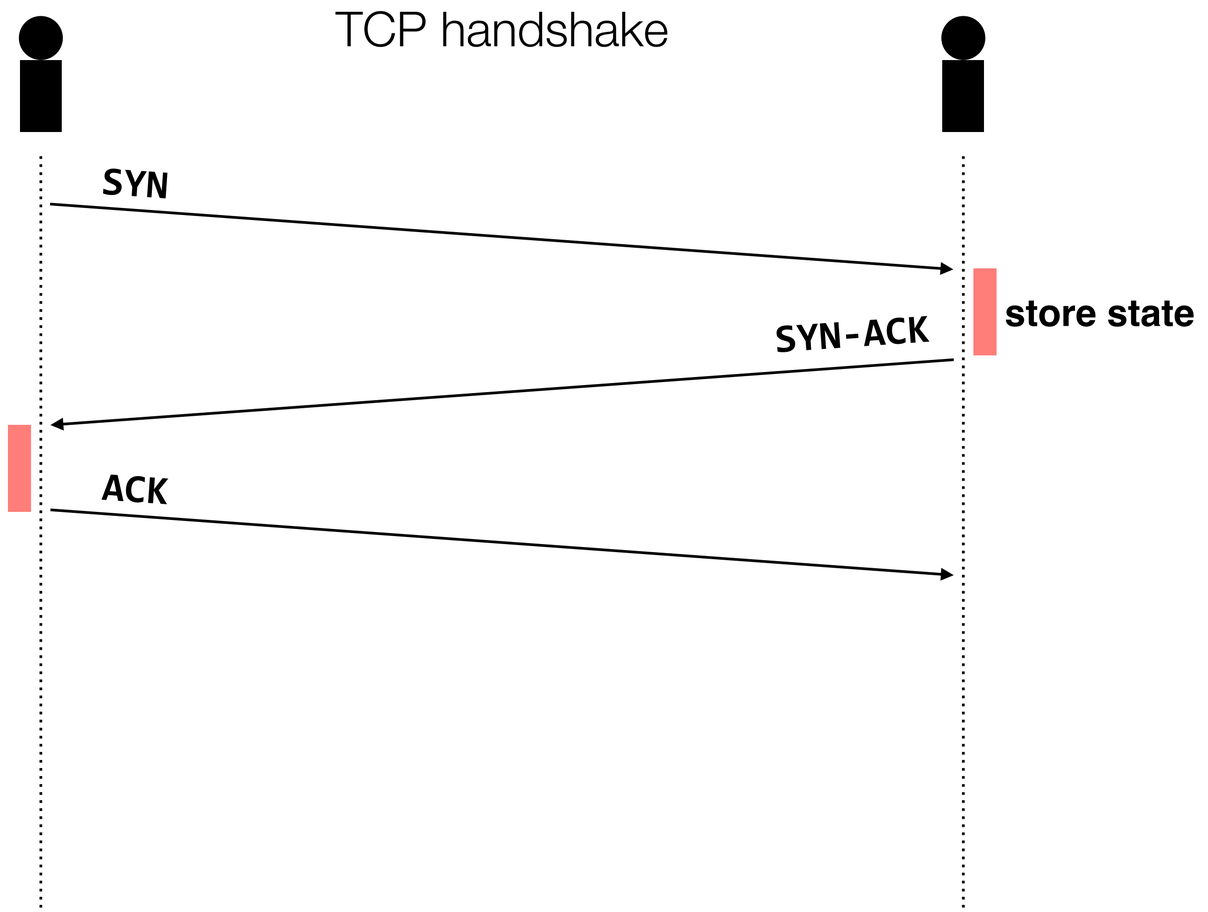

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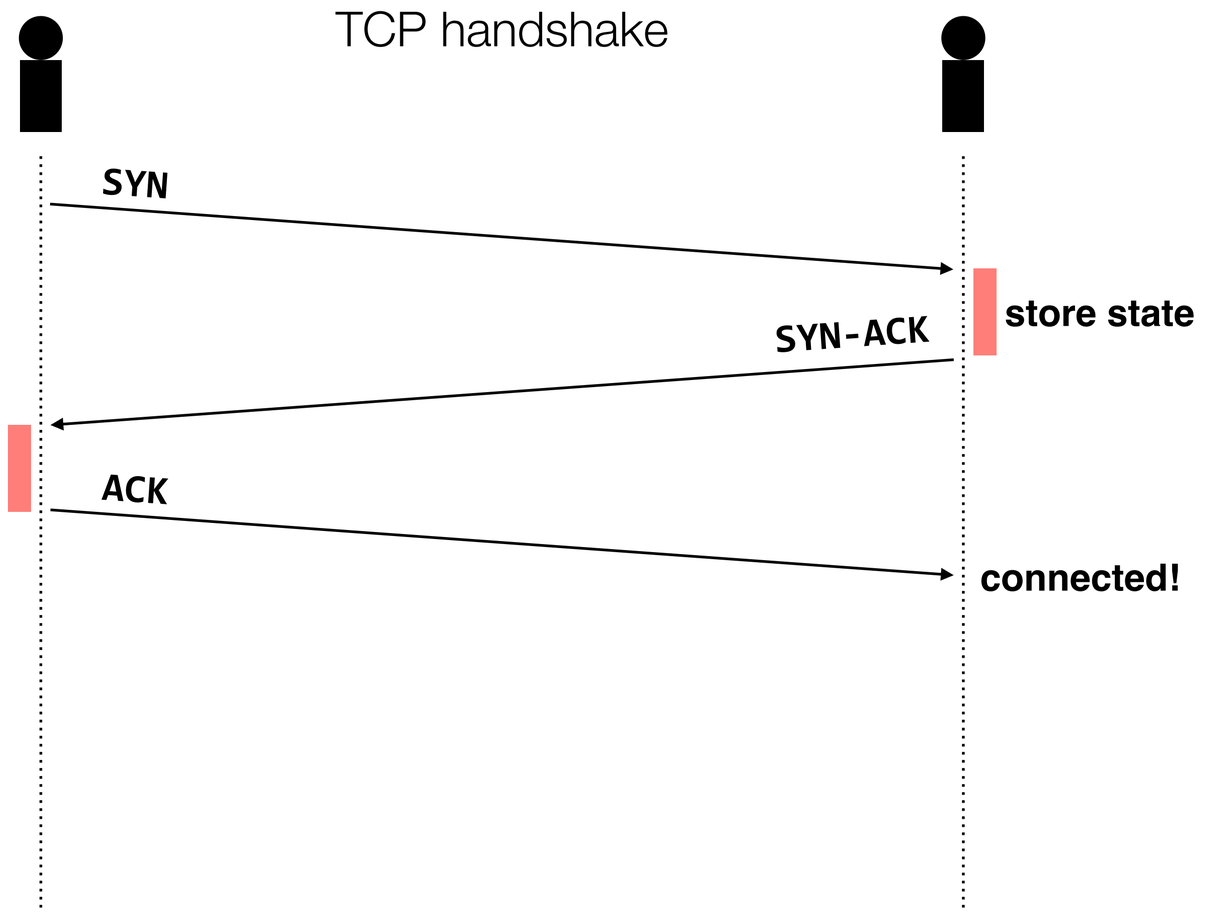

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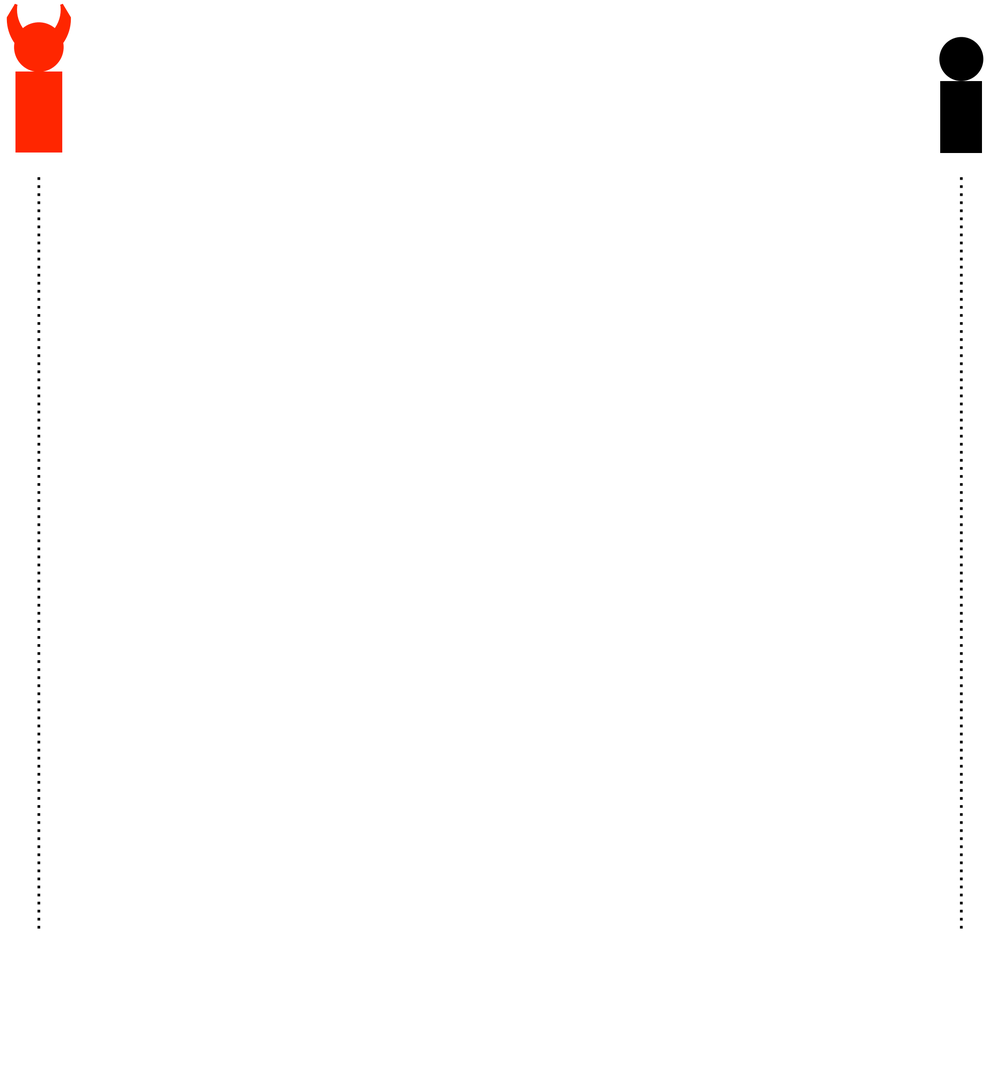

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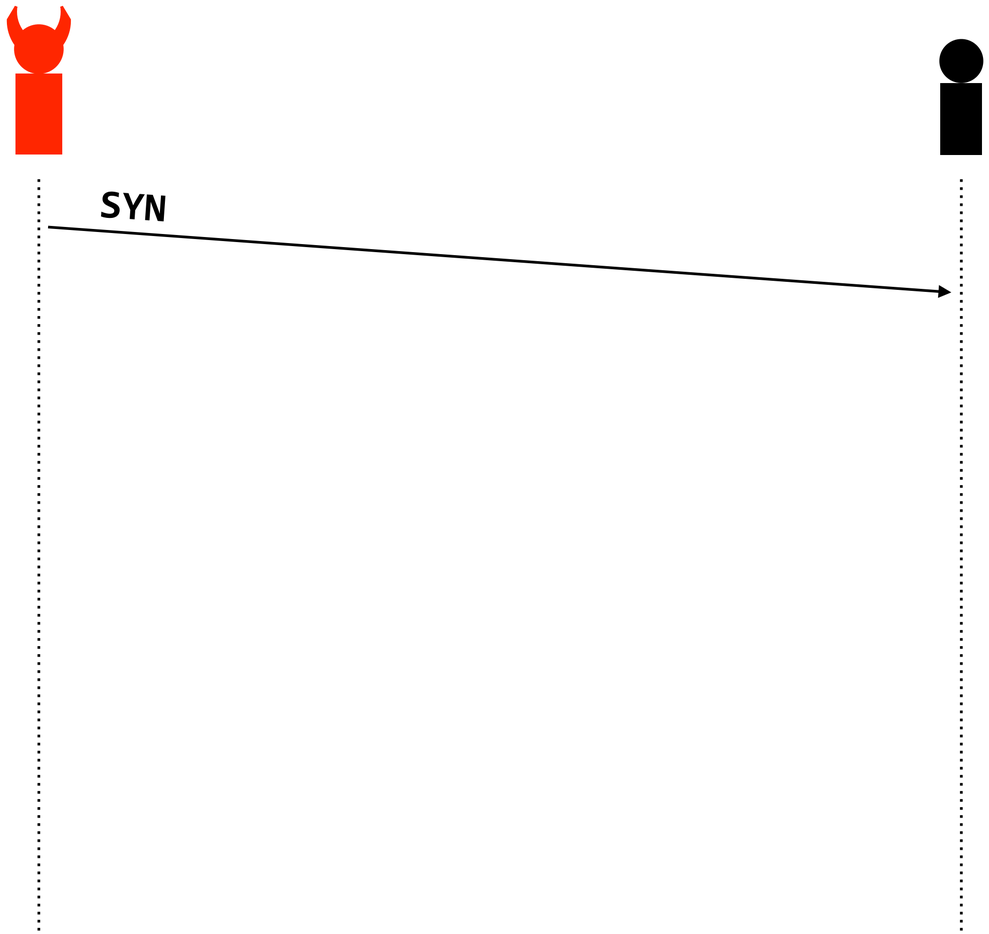

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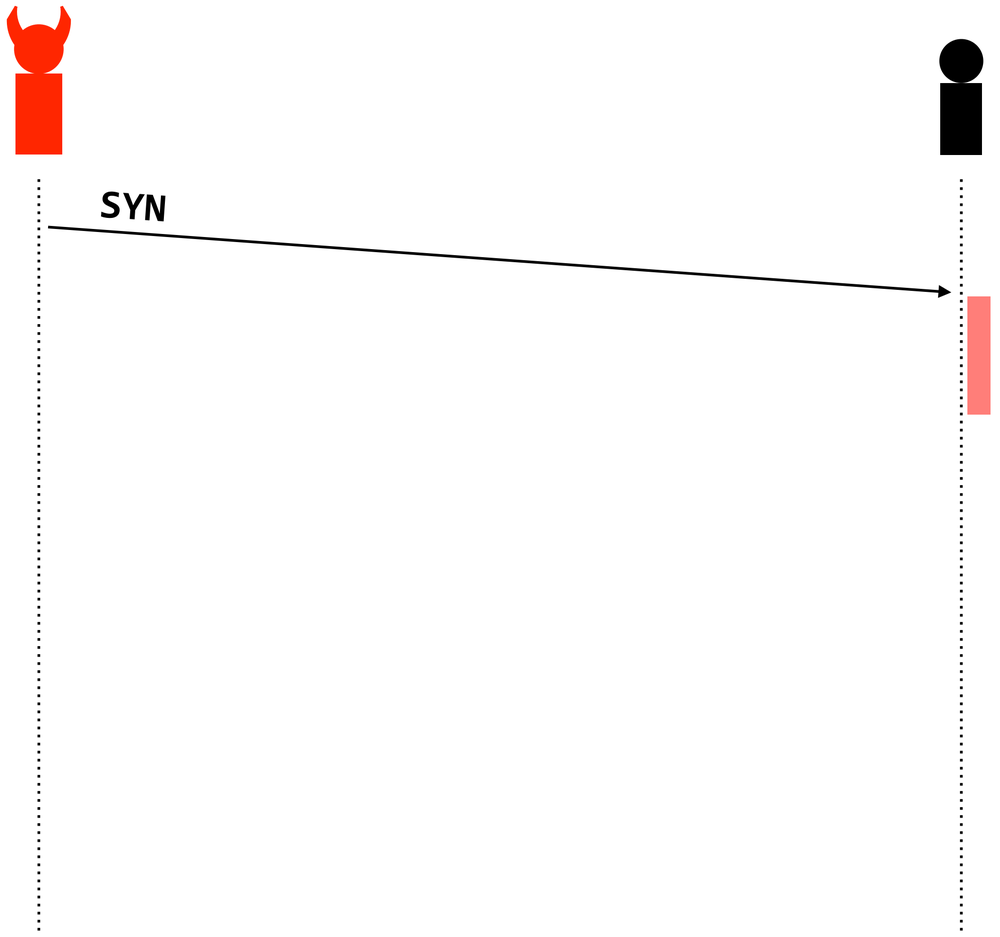

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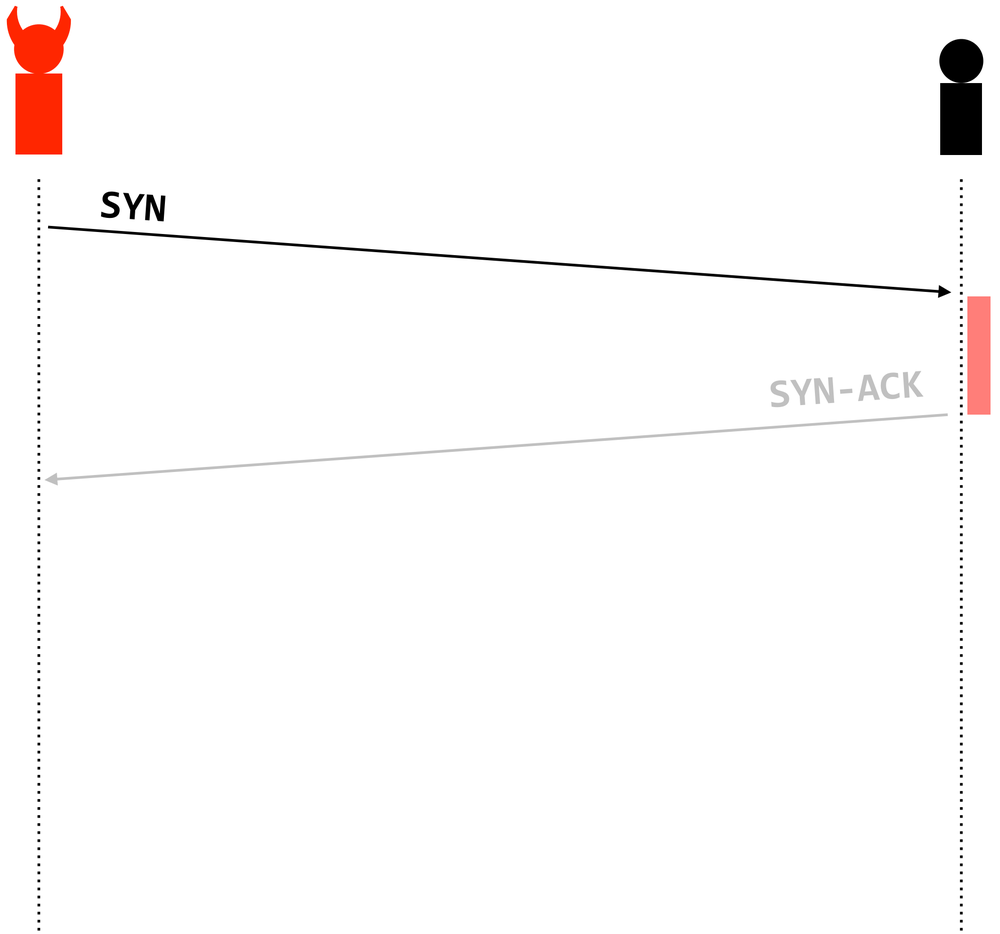

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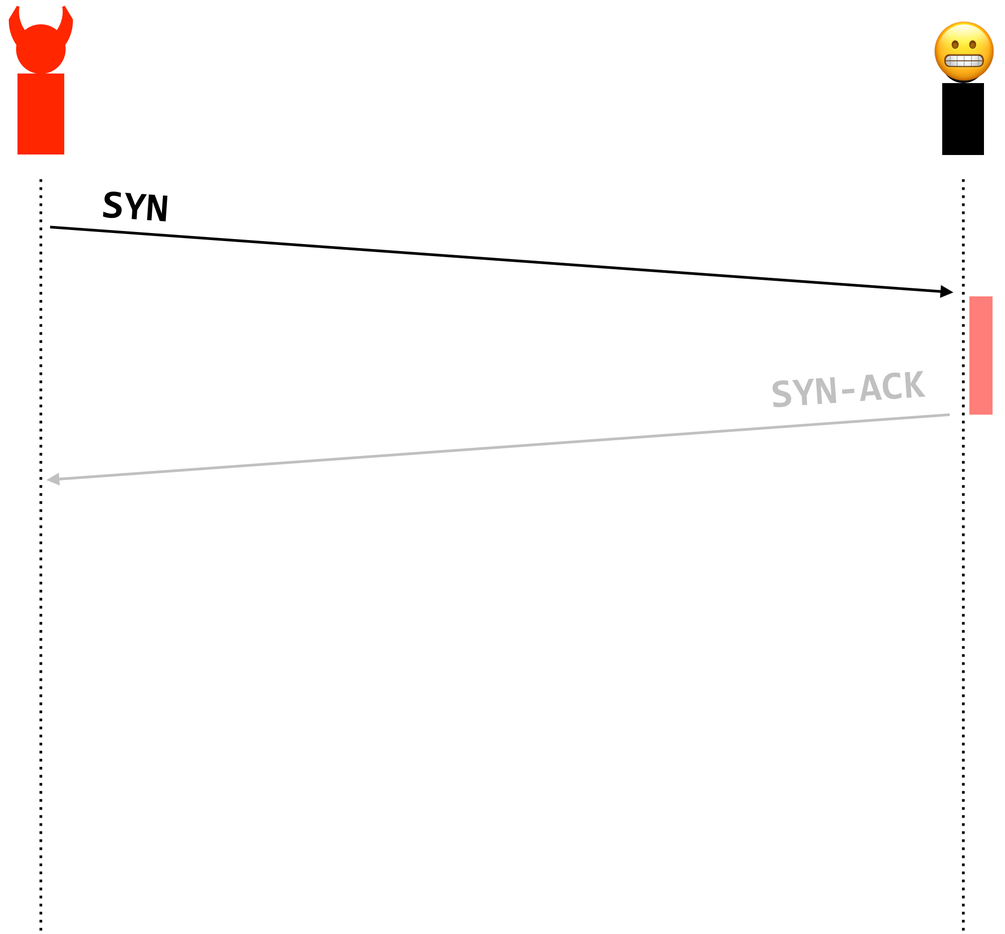

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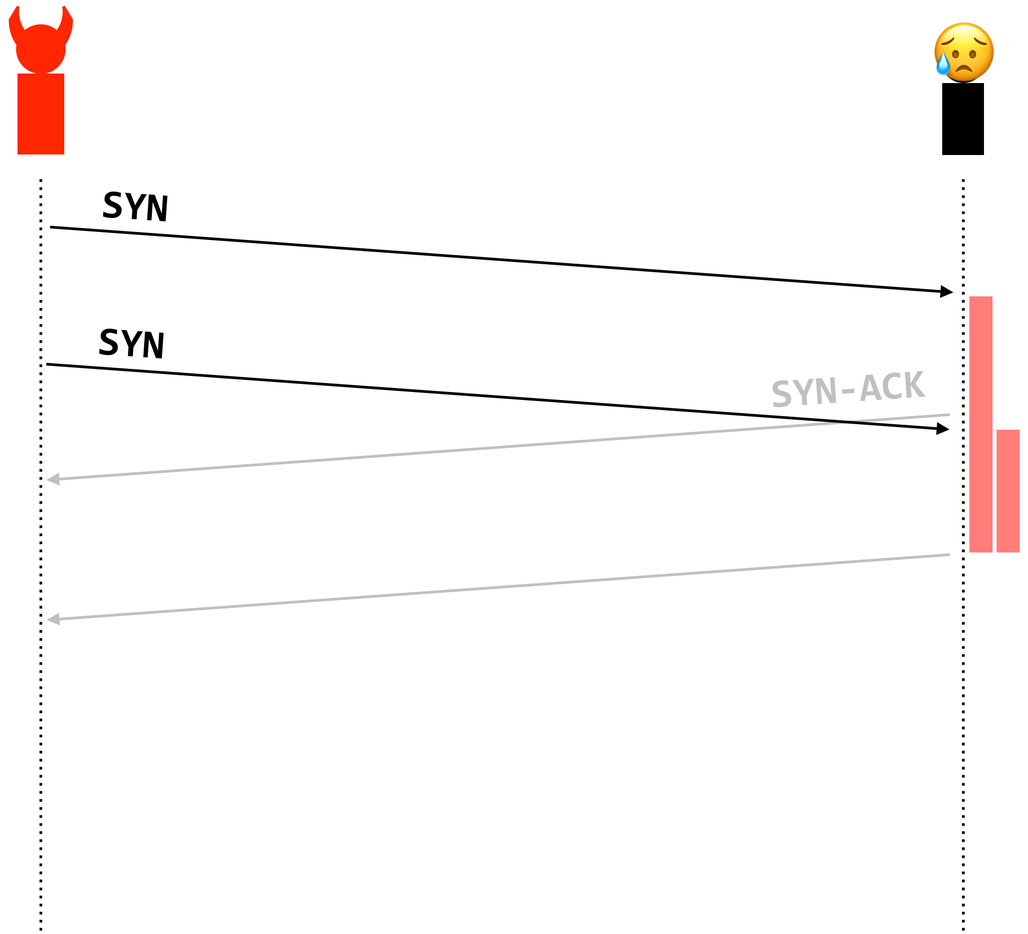

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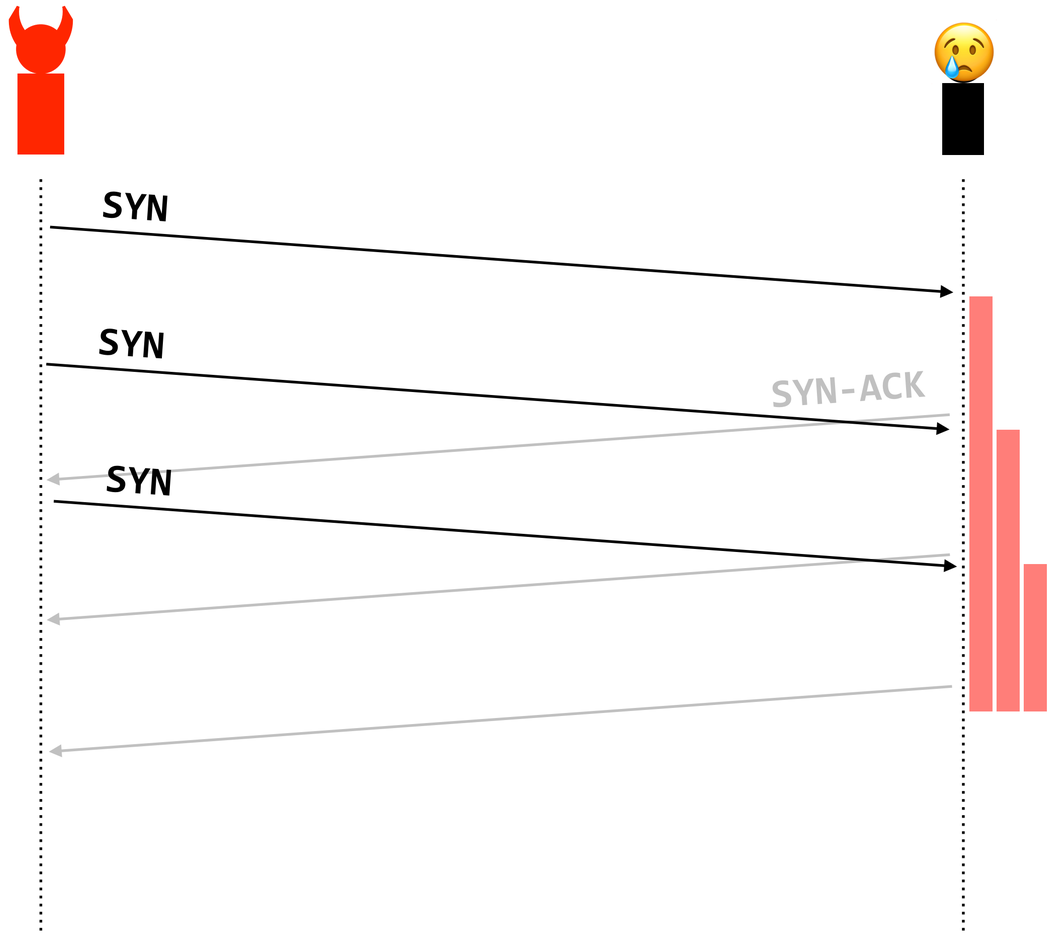

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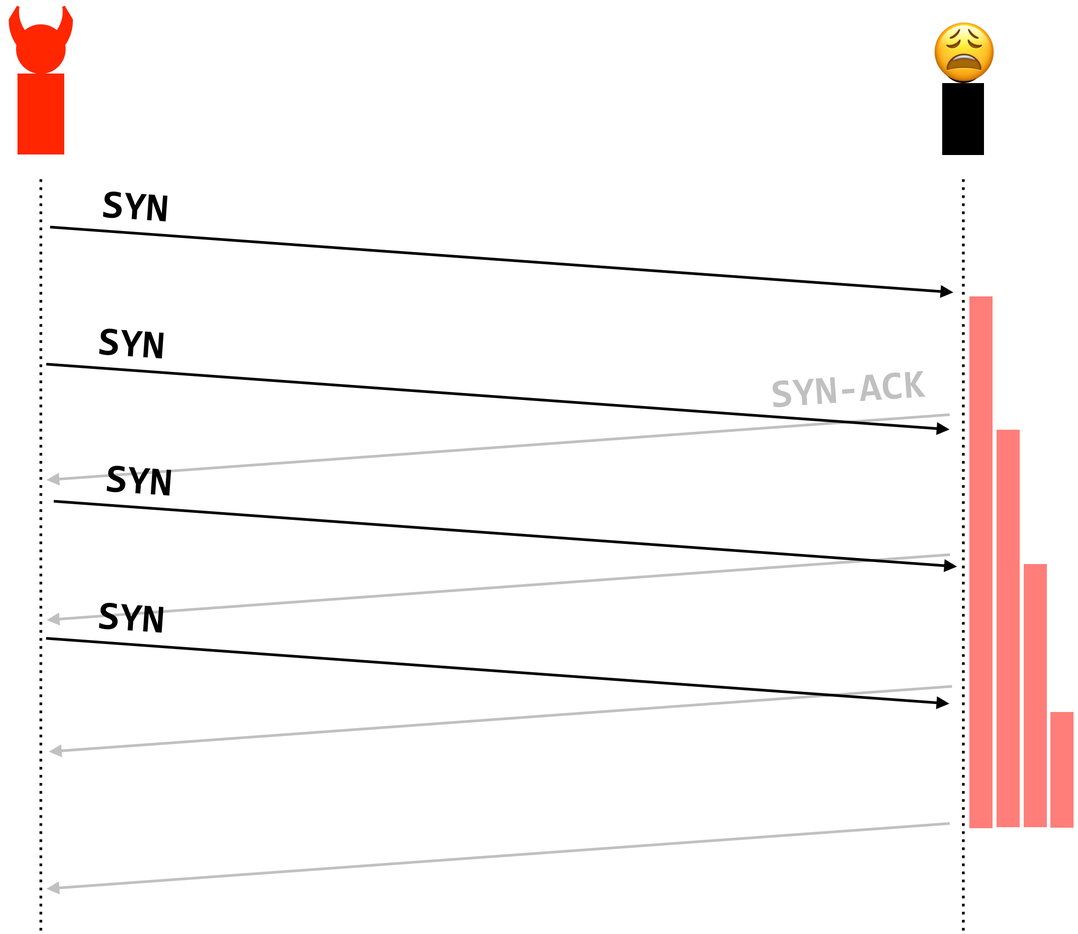

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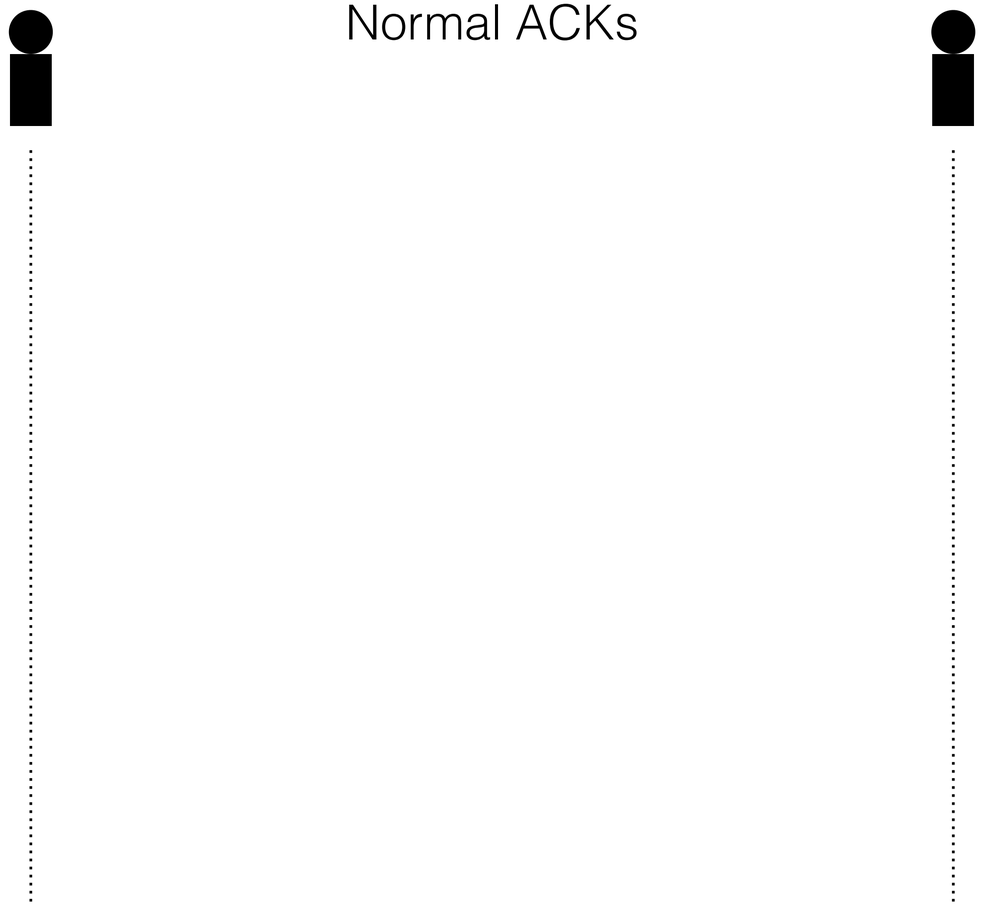

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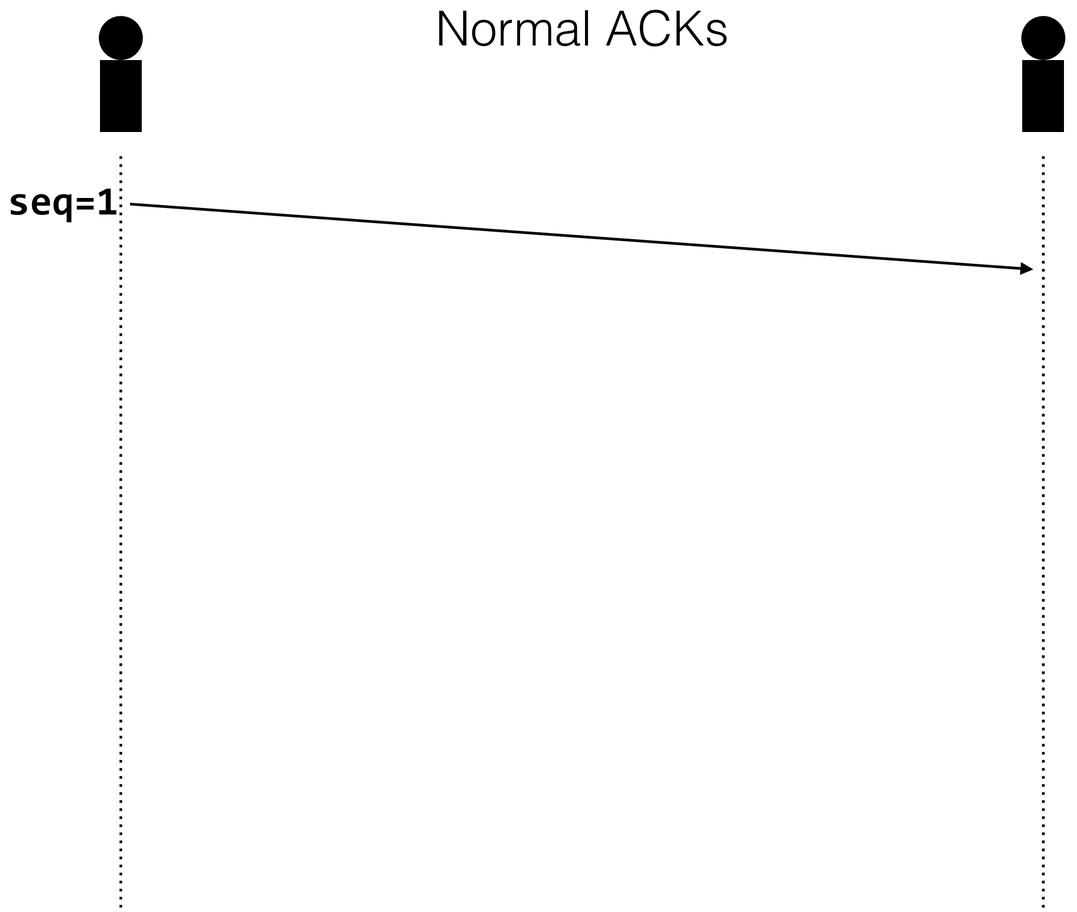

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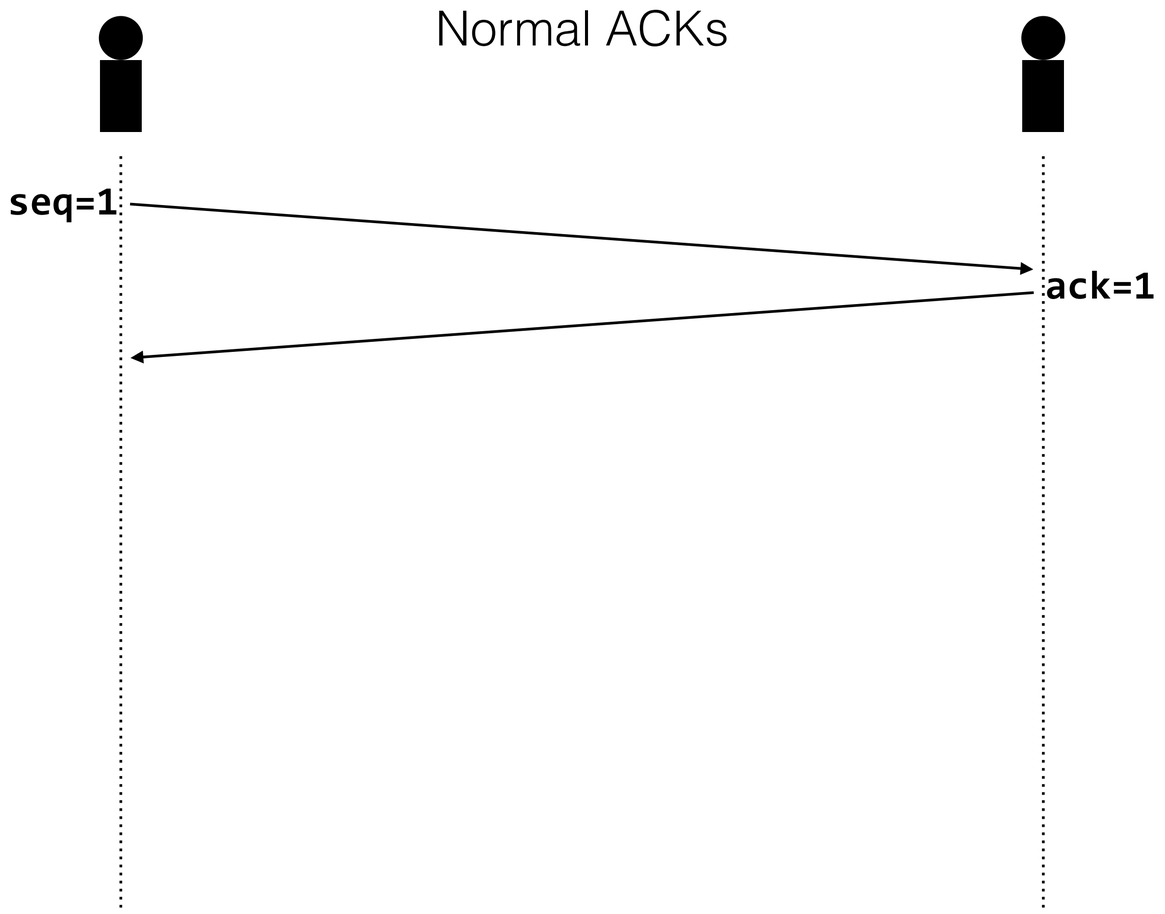

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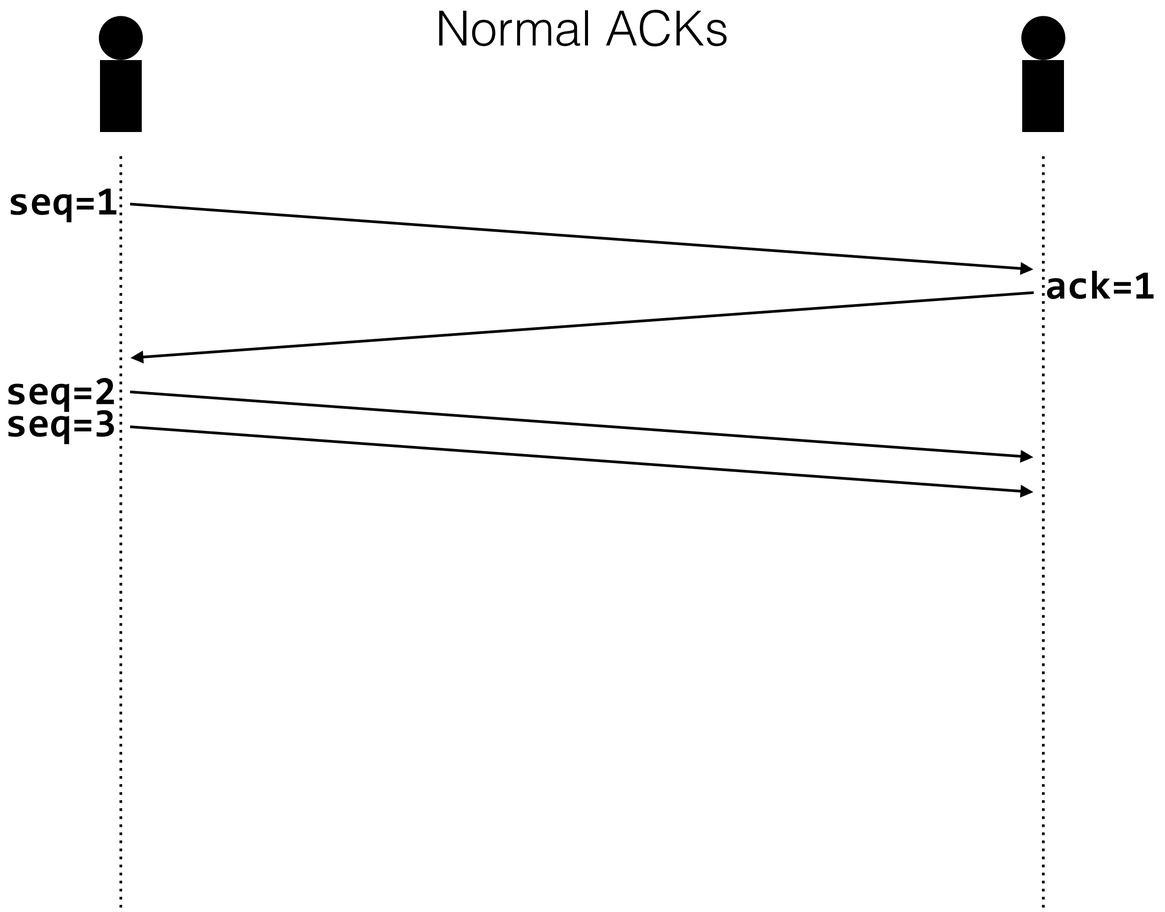

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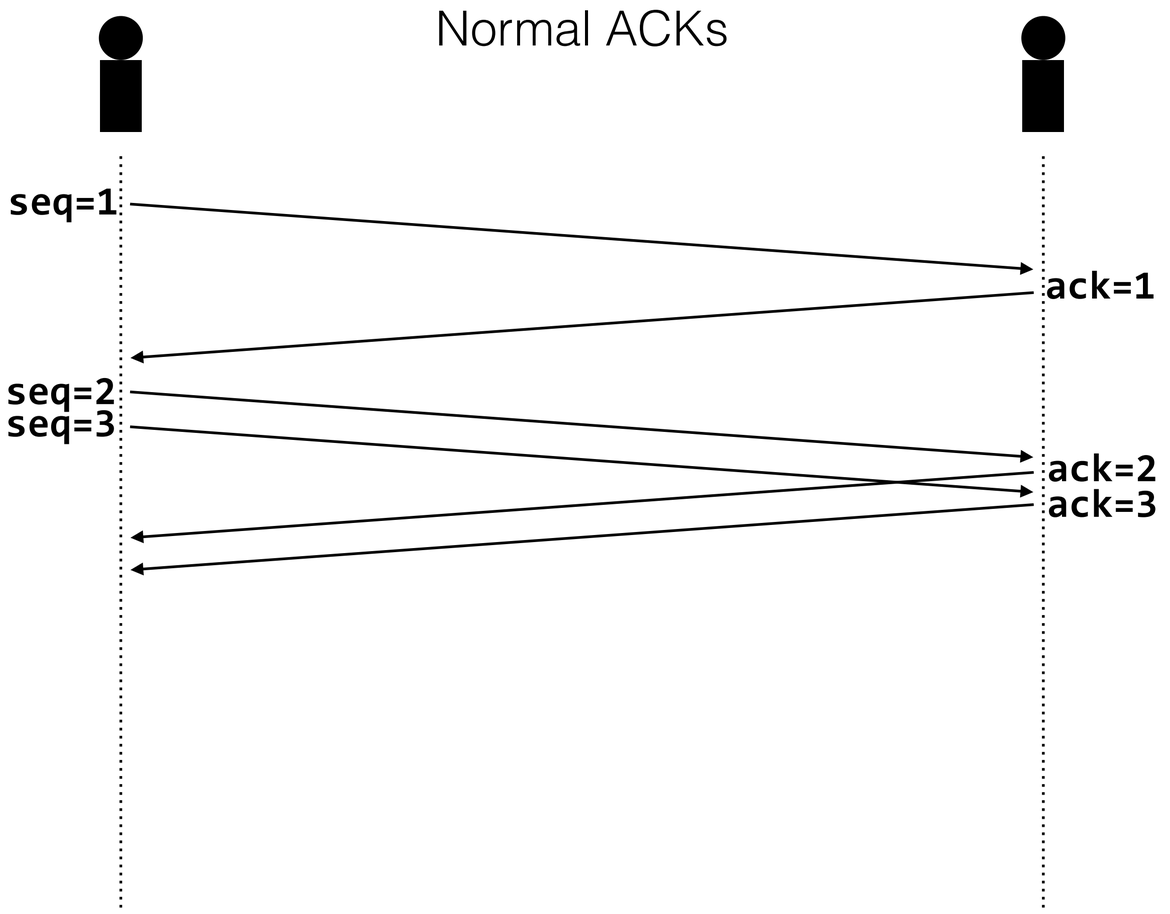

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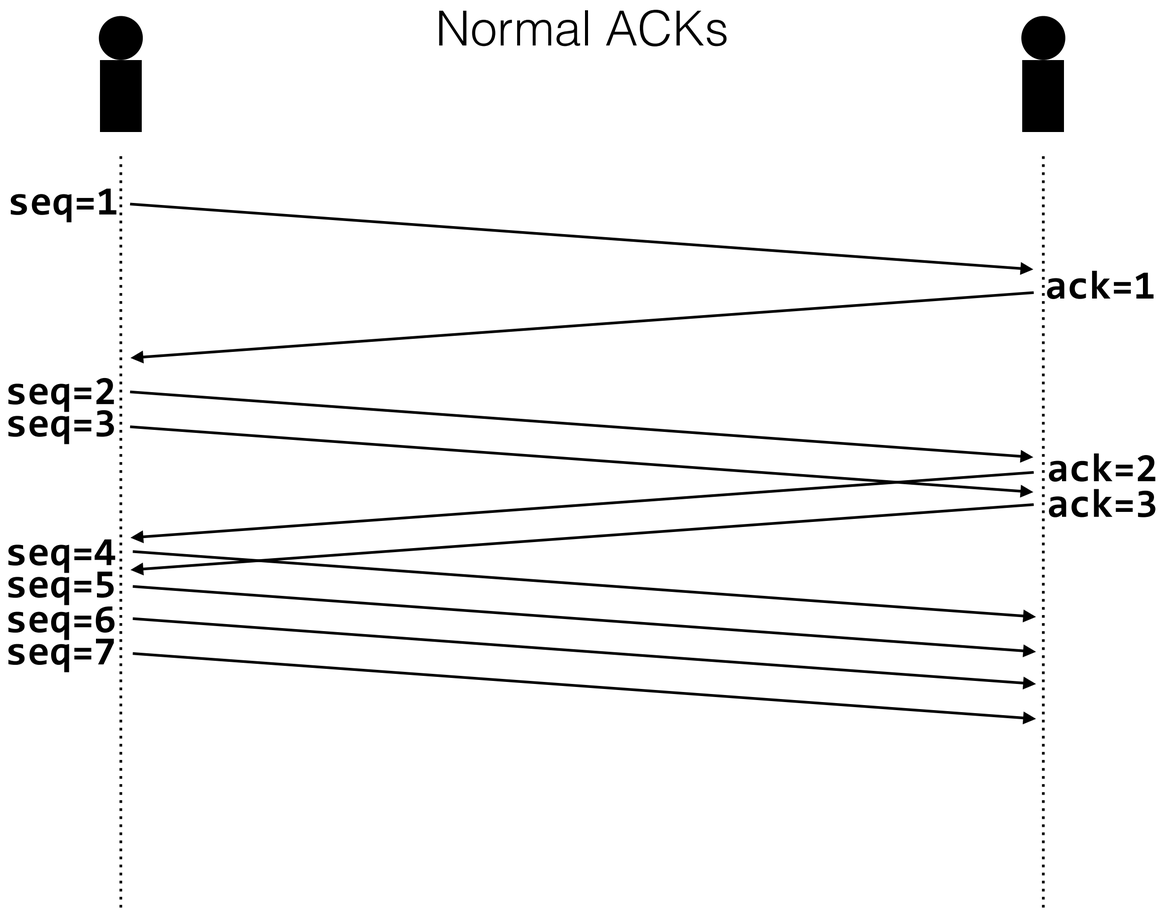

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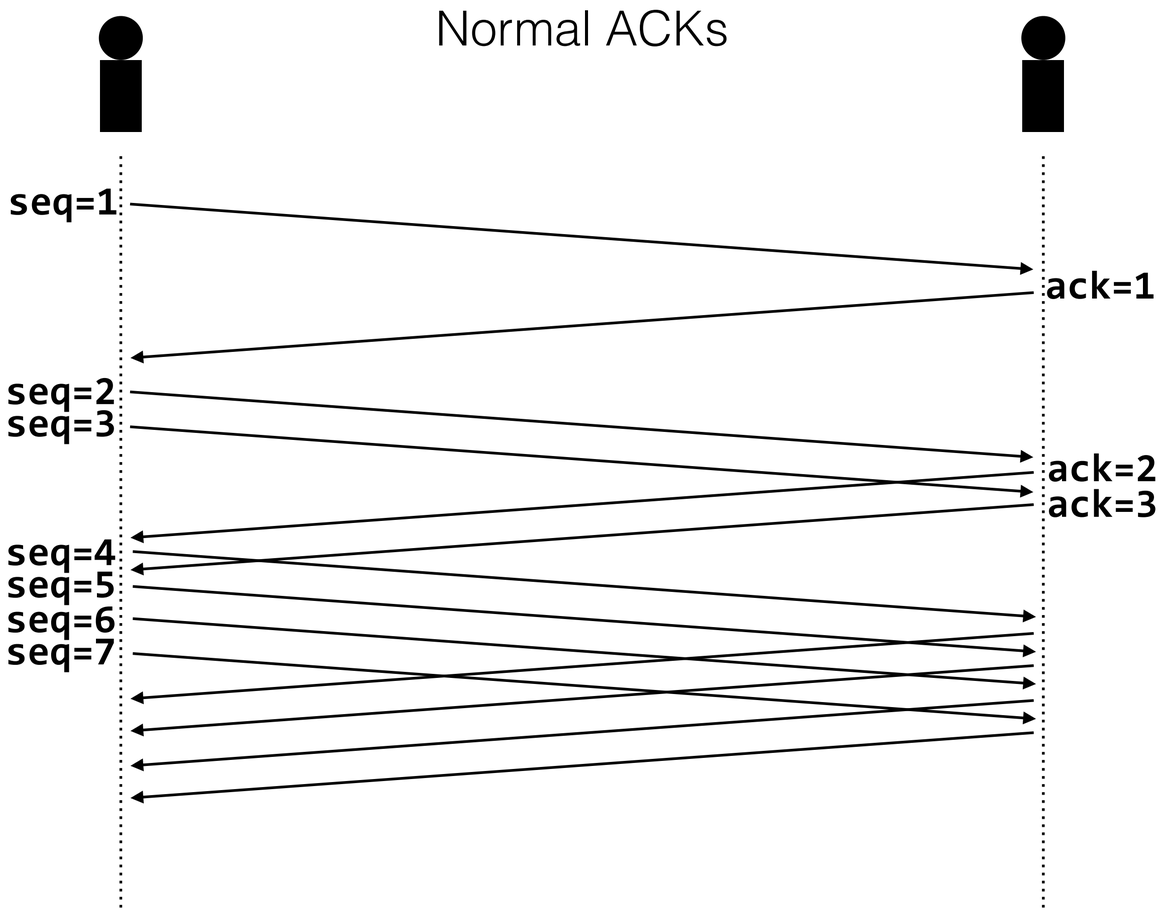

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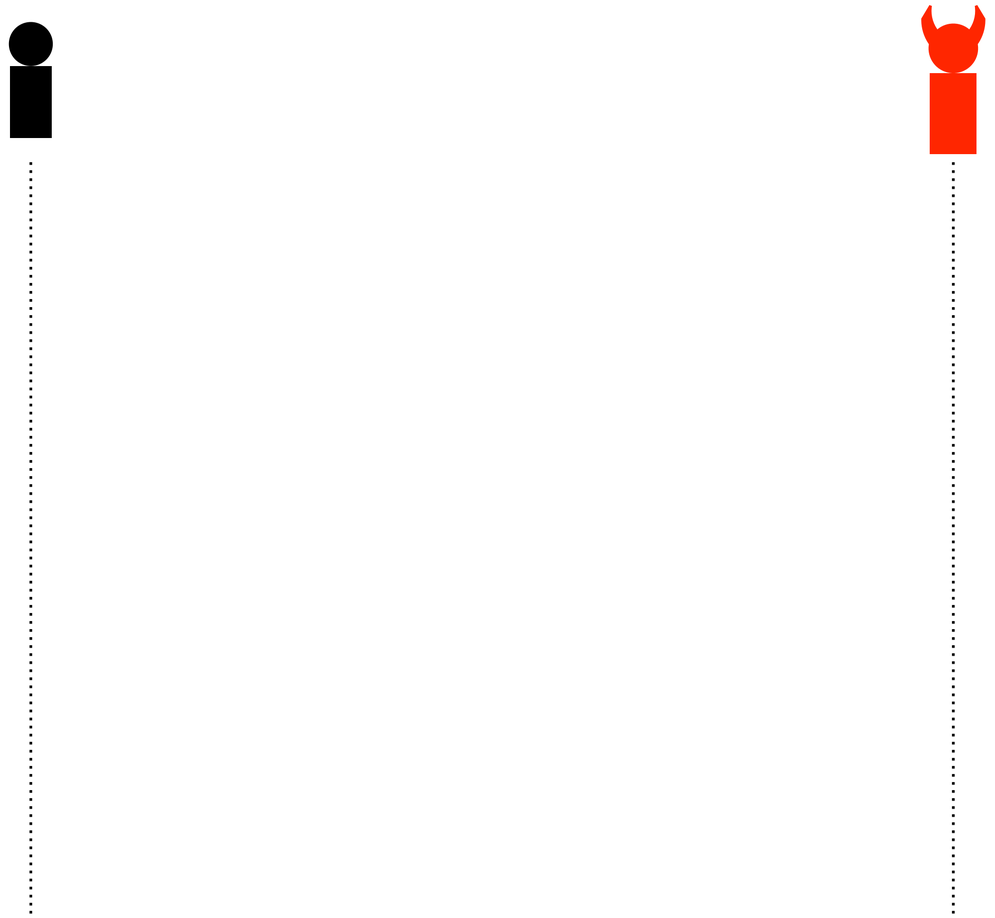

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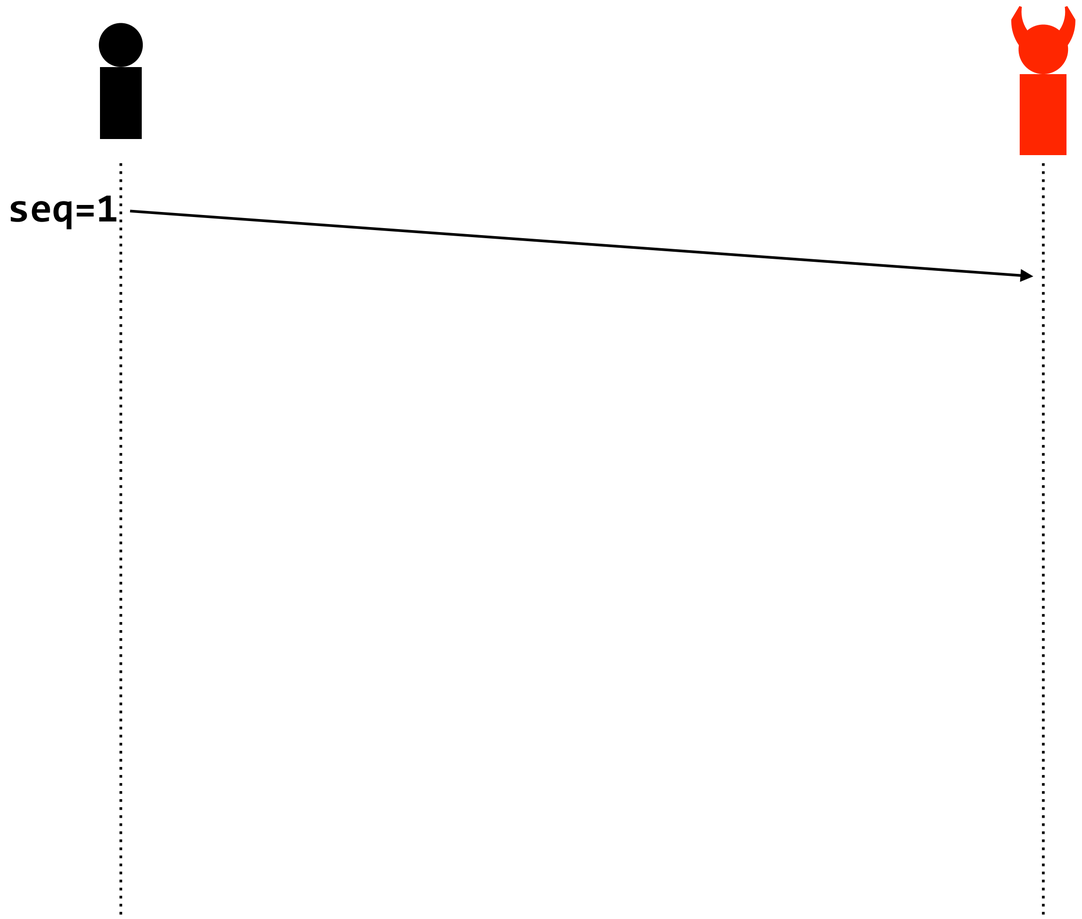

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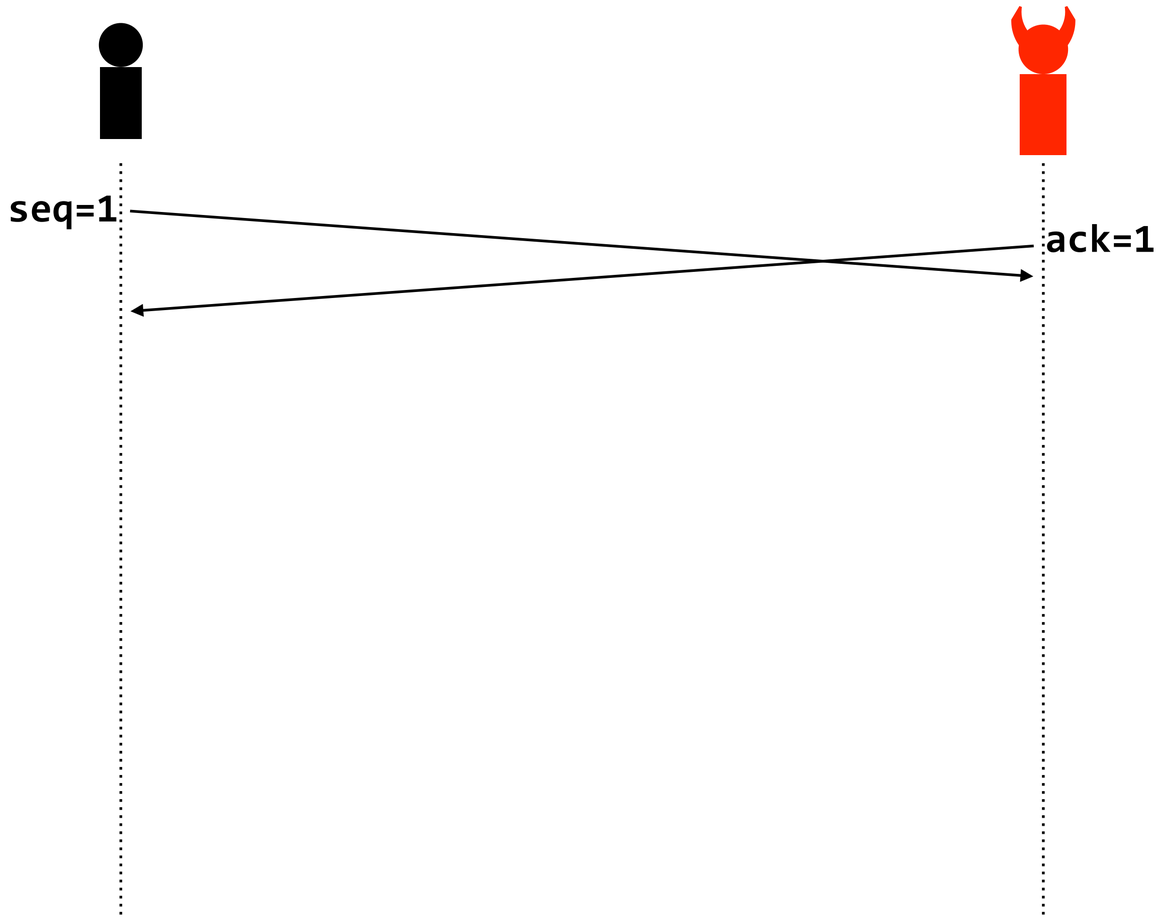

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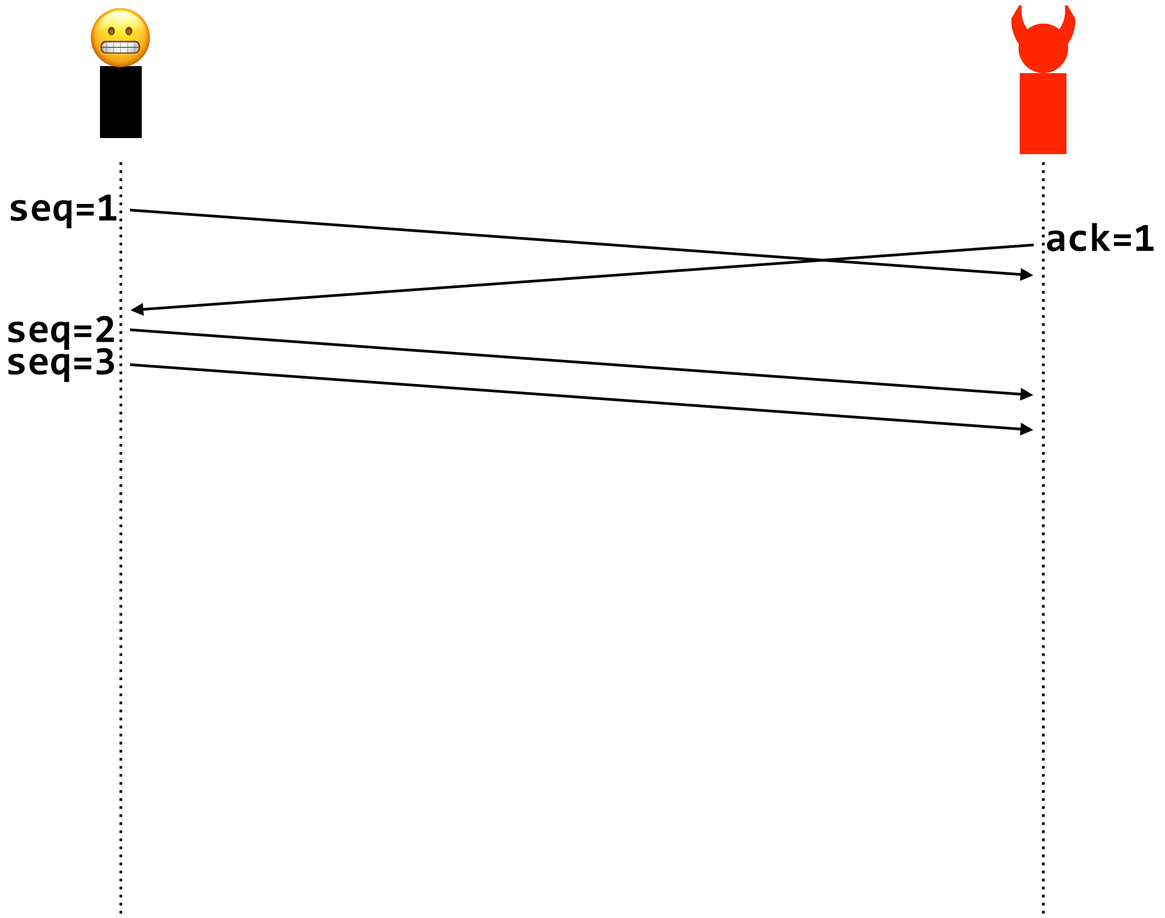

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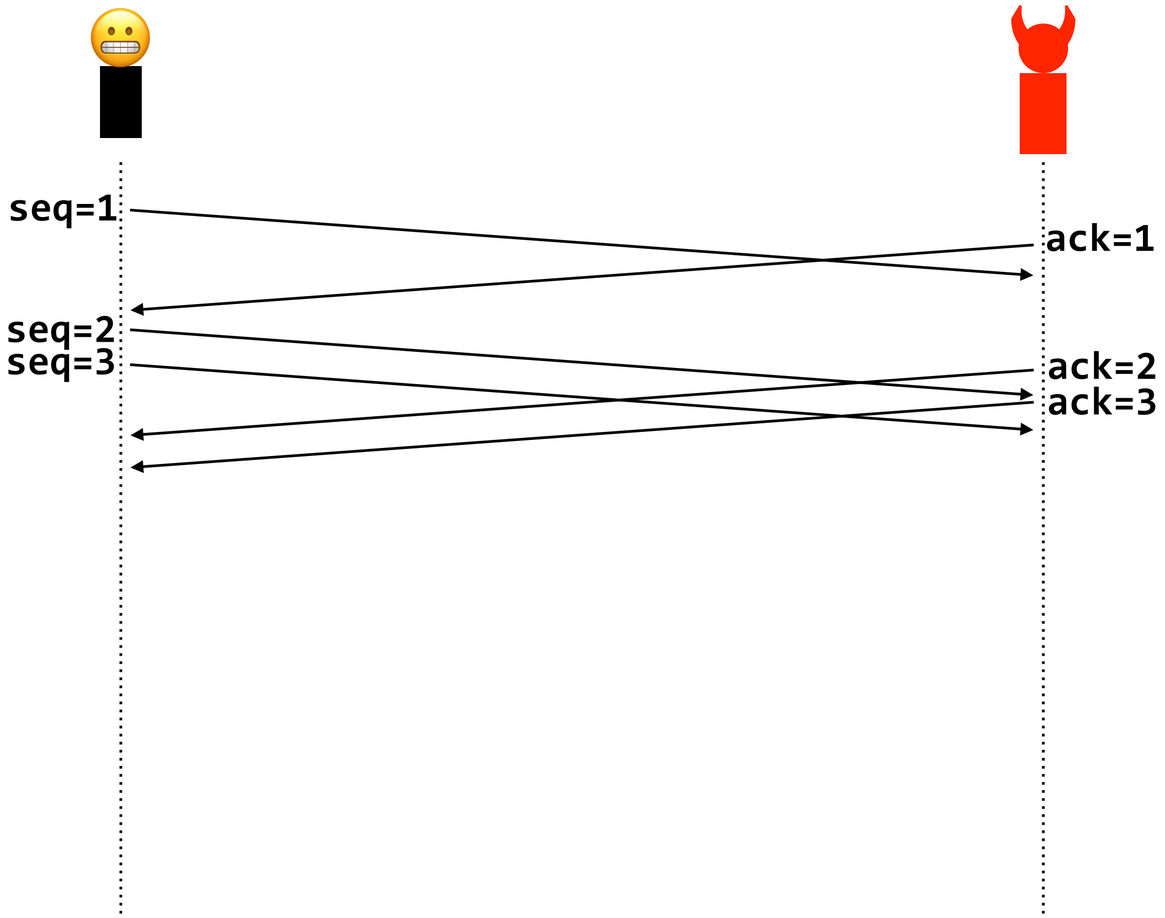

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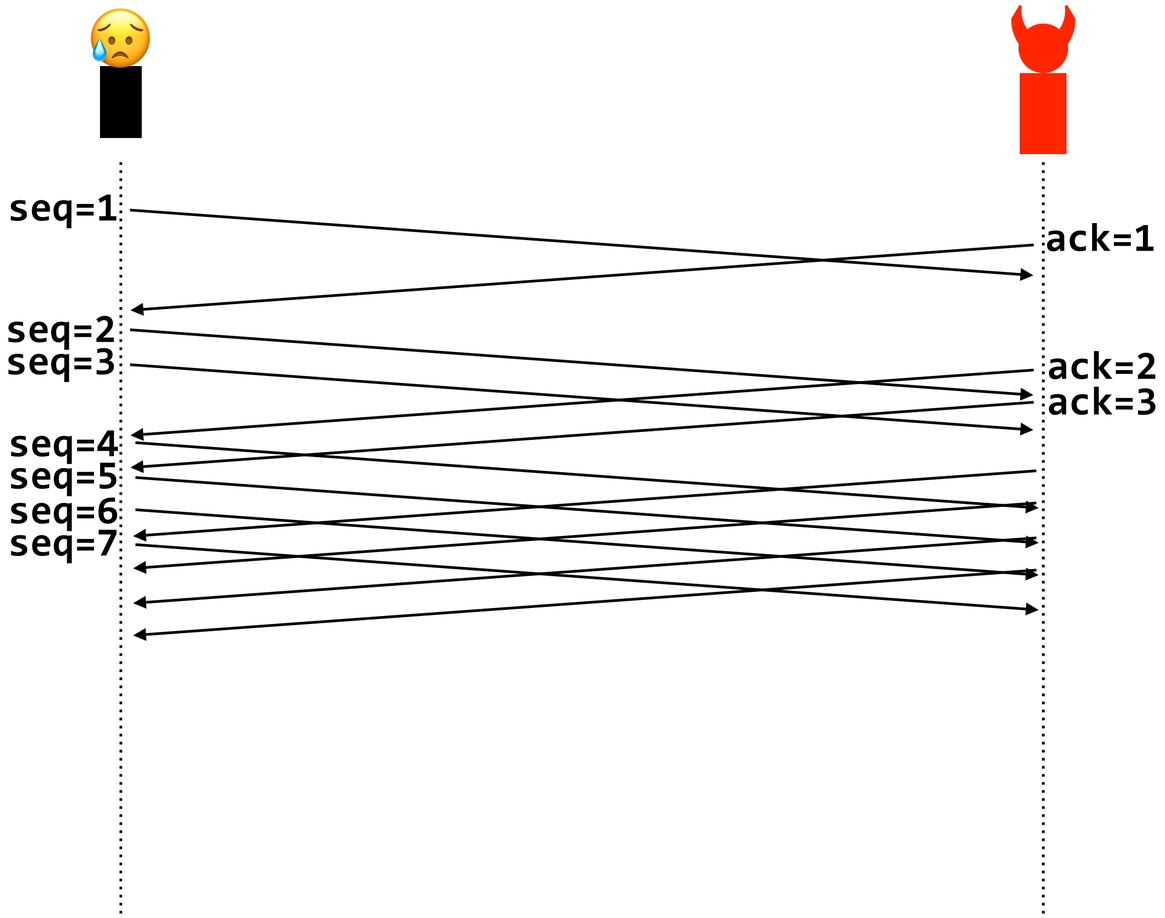

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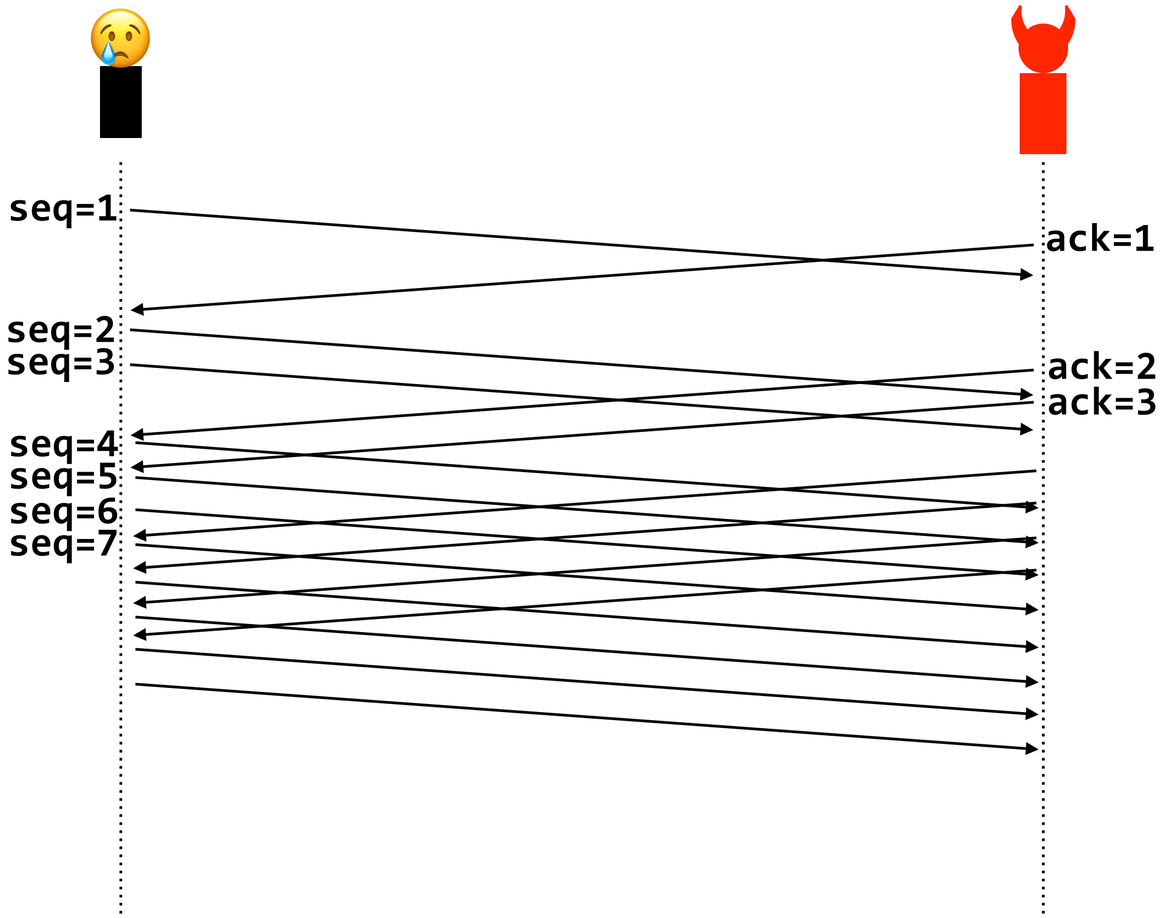

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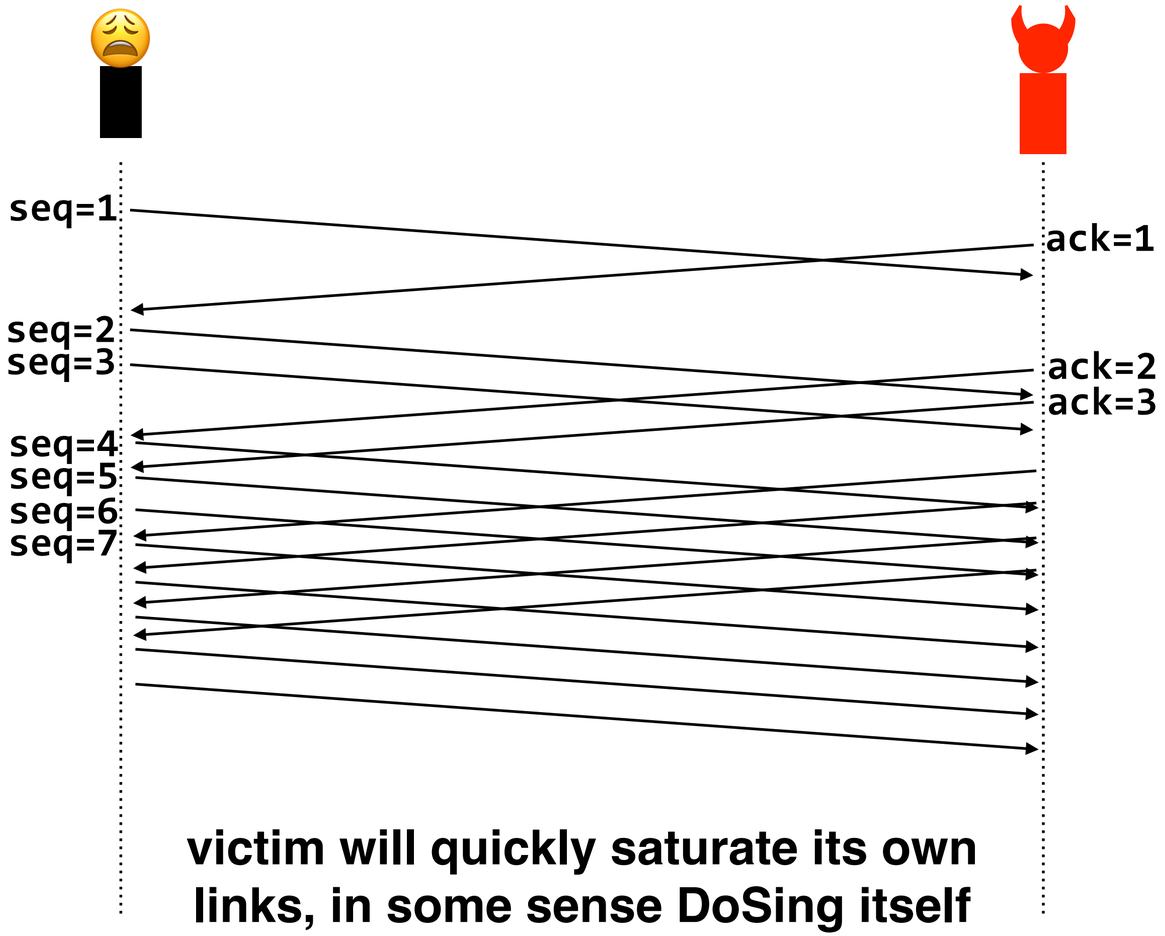

victim will quickly saturate its own links, in some sense DoSing itself

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victim's IP:
1.2.3.4

this is known as a DNS amplification (or sometimes DNS reflection) attack

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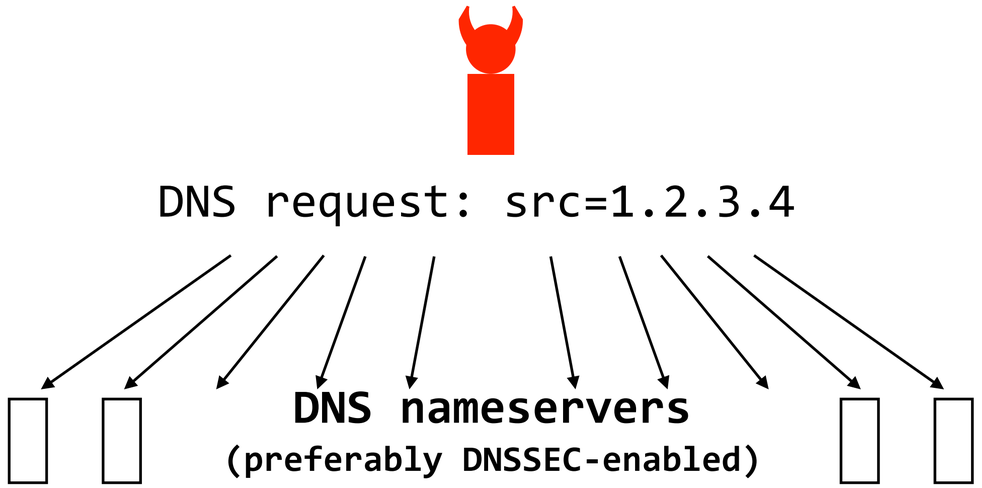

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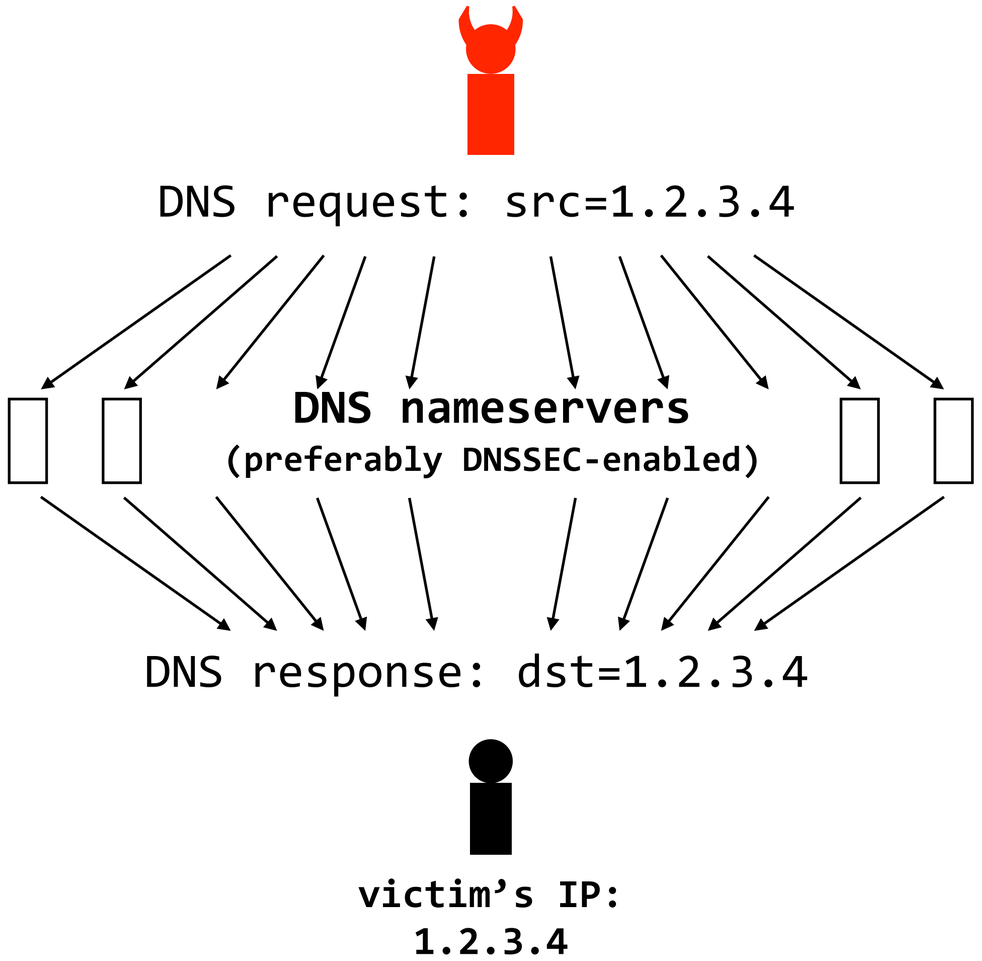

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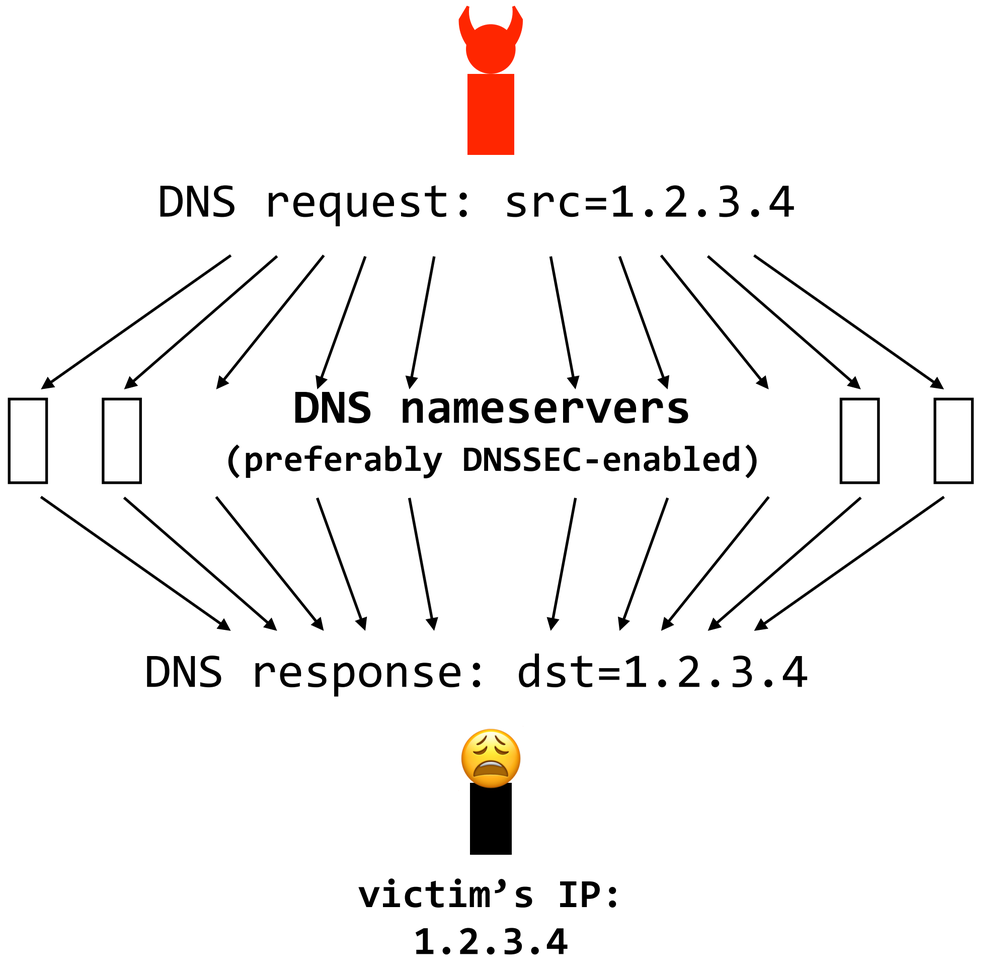

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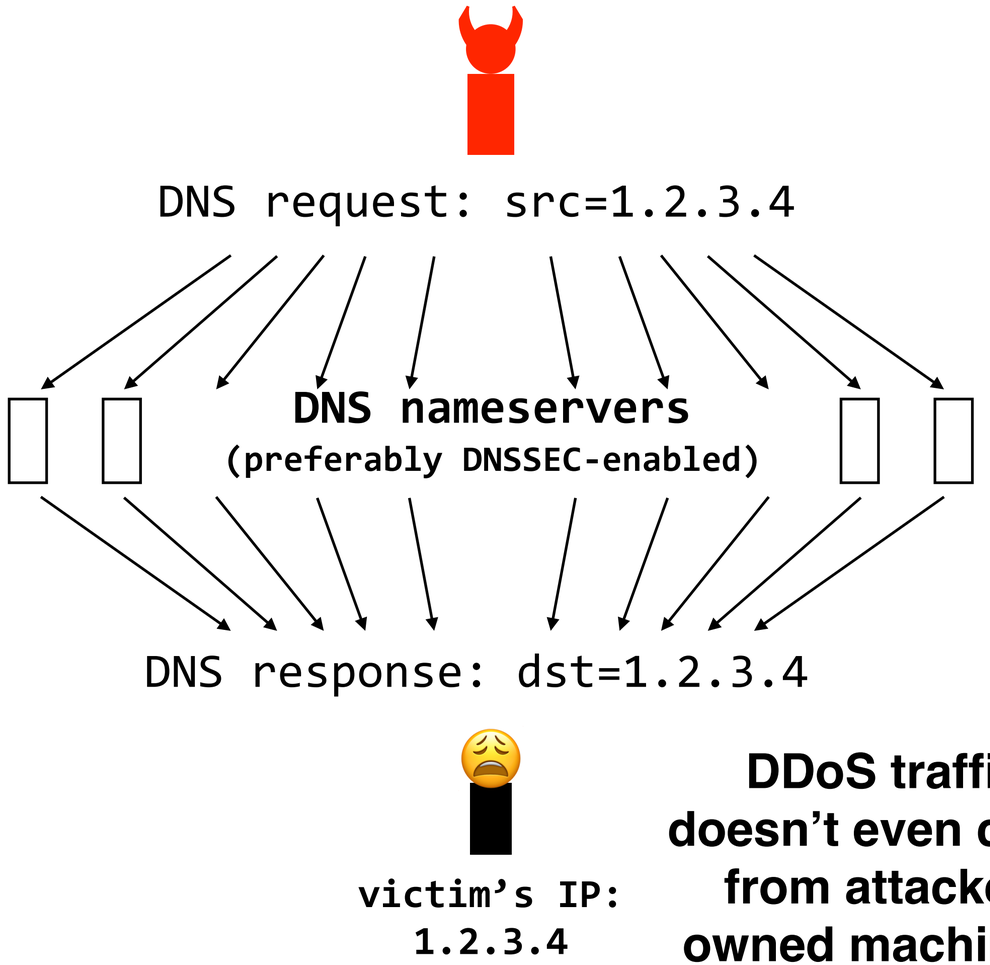

DDoS traffic doesn't even come from attacker-owned machines!

this is known as a DNS amplification (or sometimes DNS reflection) attack

DDoS attacks prevent legitimate access to internet services. secure channels won't help us here, and **botnets** make DDoS attacks relatively easy to mount

DDoS attacks are difficult to prevent because they are sophisticated and can mimic legitimate traffic; **network-intrusion detection systems** help, but they're not perfect

robust, distributed systems are a good defense against DDoS attacks

network attacks are particularly devastating when they attack parts of the **network infrastructure** (e.g., DDoSing the DNS root zone, making fake BGP announcements)

these attacks are possible in part because the internet was not designed with them in mind