DDoS Mitigation

Keeping the Business Open

Tobias Dussa
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Game Plan

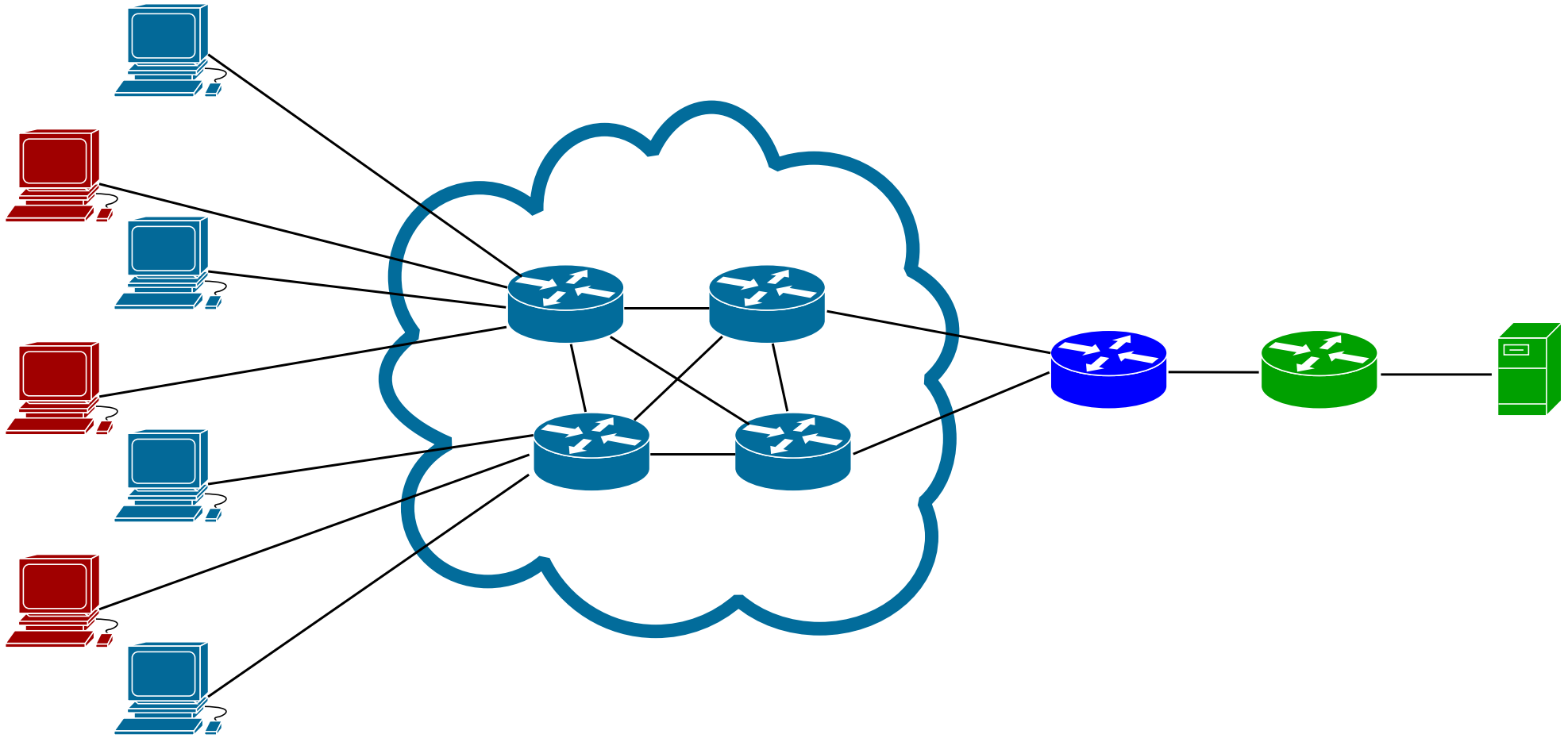
- Things you can do to defend yourself.
- Things others can do to help you.
- Some further musings.
- Questions/discussion/open mike session.

Red Alert, Shields Up!
What You Can Do When Under Attack

Quick Recap

- A Denial-of-Service (DoS) attack **denies** the **normal usage** of a **service**.
- A *Distributed* DoS attack is a DoS attack simultaneously coming from many sources.
- For this talk, we assume **you** are running the victim service.
- … and have decided you are under attack.

General DDoS Overview



What Exactly Is Attacked?

There are many ways to DoS a service.
Potentially attacked components include:

- Applications and application resources,
- systems and system resources,
- network components and resources,
- network information,
- metadata/prerequisite data.

Note: Many of these are not under your control!

How to Respond?

- In order to apply an effective countermeasure, it is necessary to identify the layer that is actually being attacked!
- For a given attack, there may be a number of effective countermeasures on a variety of levels.
- Most countermeasures require preparation, and all countermeasures are easier to implement with preparation.

Applications and Application Resources

In some ways the easiest to defend against:

- Best chance of truly understanding traffic,
- most targeted attack, therefore little collateral damage in technical terms.

Possible problems:

- Application code not under your control,
- application protocol set in stone,
- legitimate-looking traffic hard to separate.

Applications and Application Resources – Cont'd

Possible courses of action:

- Make sure the service is appropriately sized (number of threads, buffer sizes and so on),
- start additional service instances,
- restrict or rate-limit access,
- restrict the service level.

Systems and System Resources

Require similar, but more generic defense:

- Concepts apply to many target services,
- “only” general systems insight necessary,
- ~~no~~ less need to worry about nitty-gritty service details.

Possible problems:

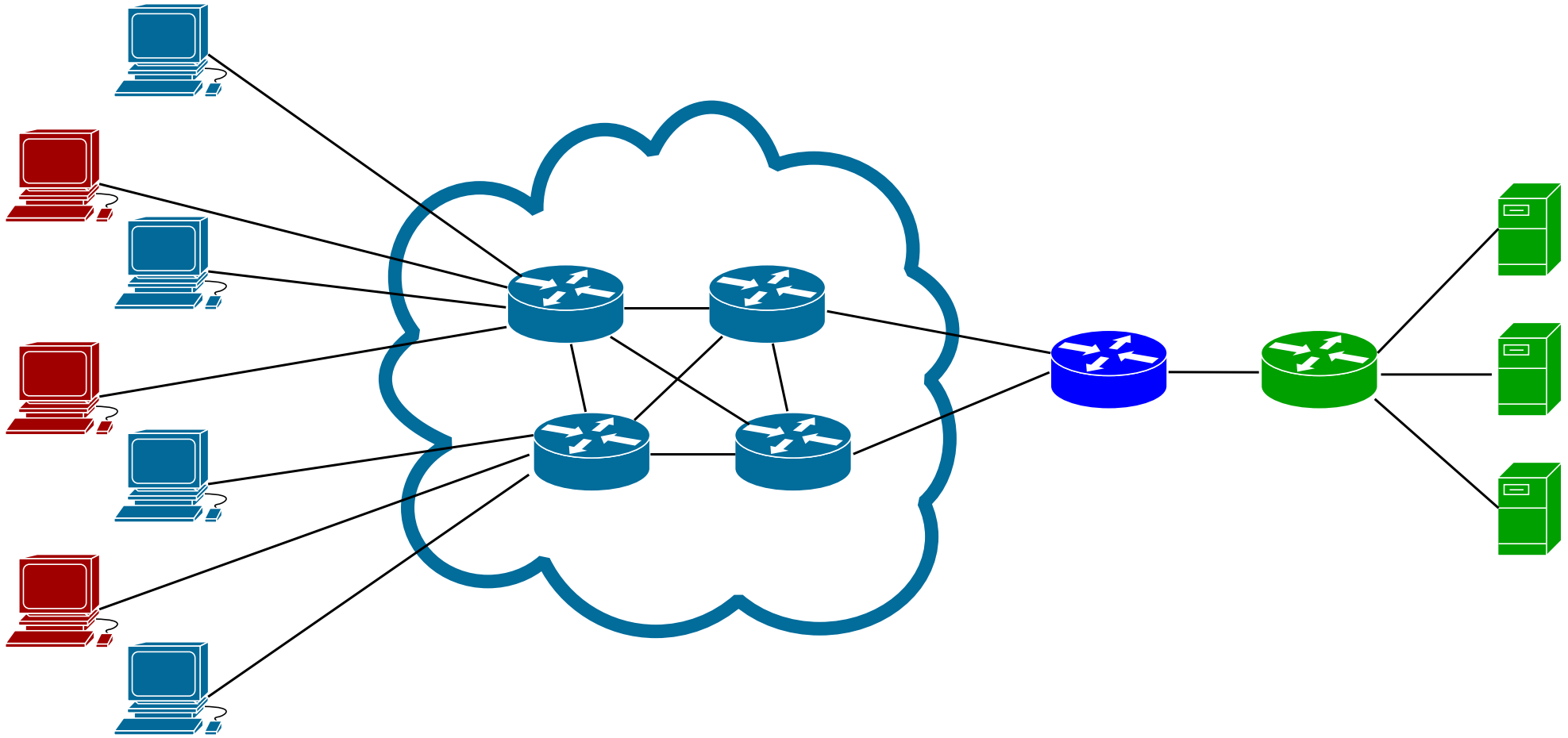
- Less insight into what is happening,
- if systems themselves are hit, deploying countermeasures might be hard.

Systems and System Resources – Cont’d

Possible courses of action:

- Make sure the system is properly sized (CPU, RAM, HDD, sockets),
- start additional system instances (potentially at backup site),
- restrict or rate-limit traffic (e. g., the number of TCP connections),
- restrict service level.

Local Mitigation



Network Components and Resources

Defense on this level is a different game and very problematic:

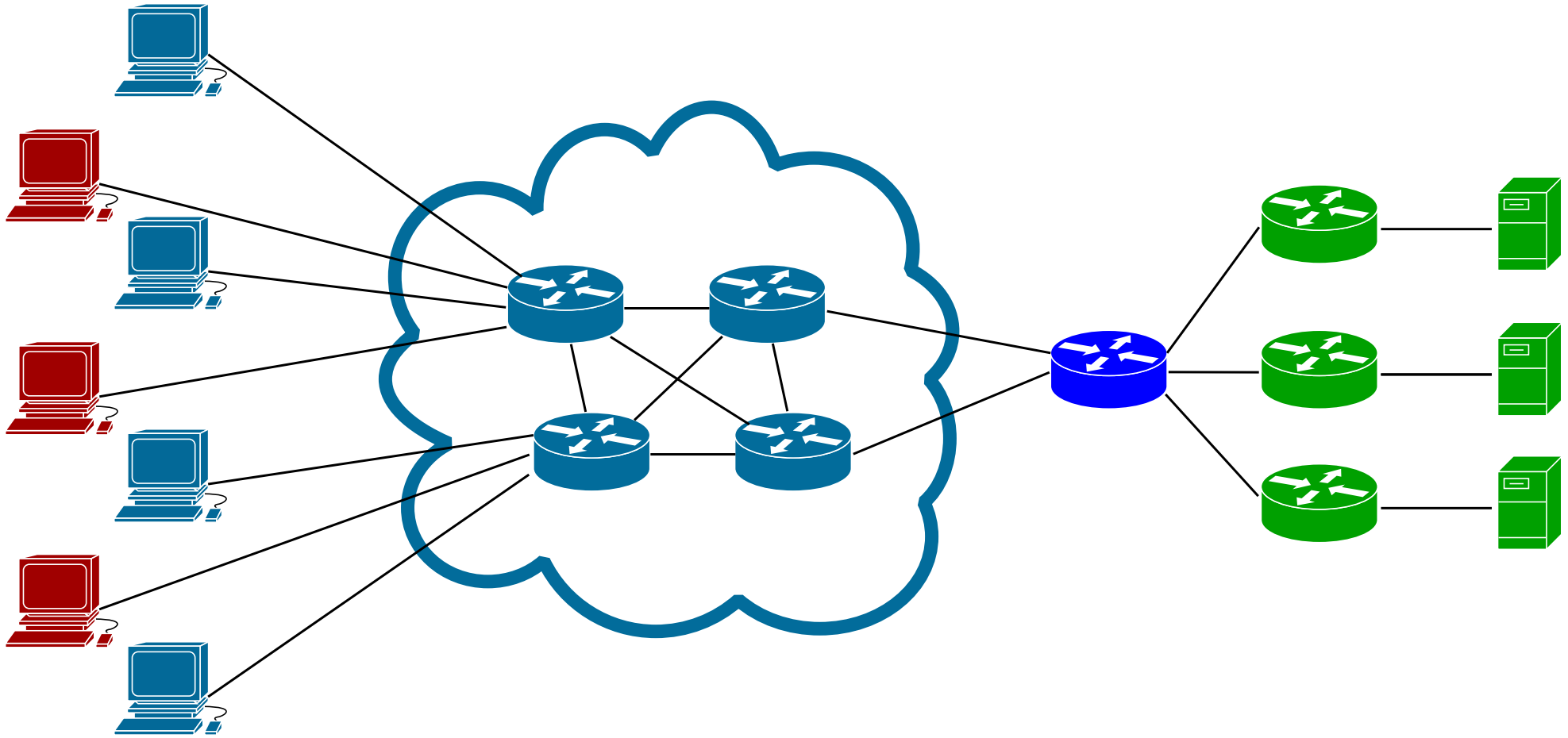
- Adding networking resources or components ad-hoc is often very hard or impossible,
- attacks often take down entire sites, severely limiting response capabilities,
- collateral damage is often substantial,
- affected components or resources only partially under your control, if at all!

Network Components and Resources – Cont'd

Possible courses of action:

- Restrict or rate-limit traffic (e. g., the rate of inbound ICMP packets),
- move service to backup site with different address and update DNS etc.,
- ask your ISP (or upstream entity) for help.

Off-Site Mitigation



Network Components and Resources – Cont'd Cont'd

What if you **are** the ISP/upstream entity?

- Blackhole traffic as far upstream as possible.
- If possible, based on traffic sources; if necessary, based on traffic destination.

Network Information

If someone manages to attack this successfully, there is almost certainly not a whole lot you can do about it:

- Routing and peering information is done outside of your control.
- … unless you are running your own Autonomous System, in which case you should already know what to do.

Network Information – Cont’d

Possibly courses of action:

- Contact your ISP or upstream entity for help.

If you are the ISP/upstream entity: Fix/reclaim your BGP advertisements and peering info.

Metadata/Prerequisite Data

This is somewhat of a “catch-all” category. What you can sensibly do depends a lot on what exactly has been attacked:

- Services you depend on but that are outside your control (e. g., most of DNS, OCSP, NTP) or
- services you depend on that *are* under your control (e. g., some DNS, LDAP, Kerberos).

Metadata/Prerequisite Data – Cont'd

Possible courses of action:

- If the service that is not available is outside of your control: Contact the service provider and tell them they have a problem. (Although they will likely know this already.)
- Otherwise, go fix your own service.
- Or, indeed, **have** your own service – for instance, a local NTP server.

Radio for Backup:
How Others Can Help You

ISP/Upstream Entity

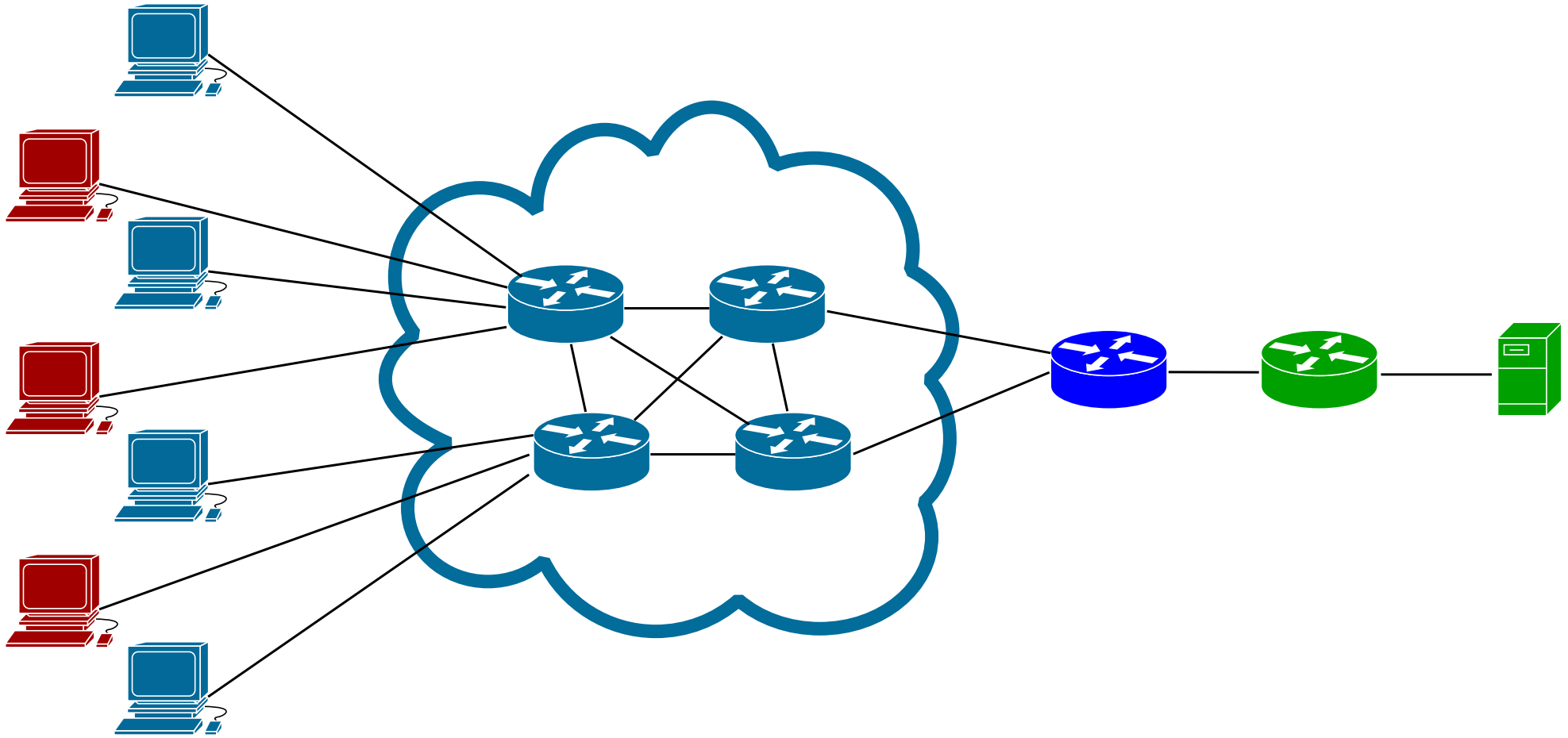
Uniquely, your ISP can blackhole traffic **before** it becomes a problem for your uplink.

- Blackhole routing is the name of the game.
- Preferably as much upstream as possible.
- This will likely take the victim service offline.
- … from the outside, that is.
- Furthermore, key connections might even be kept “open” with static explicit routing.

ISP/Upstream Entity – Cont'd

- Much easier if you have discussed this beforehand with your ISP.
- Having a prepared emergency backup instance of the victim service off-site also helps.

Blackhole Routing



DDoS Mitigation Providers

Commercial companies that offer “cleaning” of network traffic. Two flavors: Always-on and On-demand.

- Always-on: All traffic is permanently routed through the mitigation provider resources. Adds latency because of longer routes.
- On-demand: Traffic is re-routed through mitigation provider resources when an attack is detected. Takes a bit of time to switch over, and mitigation provider might be bypassed by a clever attacker.

Either flavor must be established beforehand.

Content Delivery Networks

Content Delivery Networks (CDNs) provide decentralized service delivery.

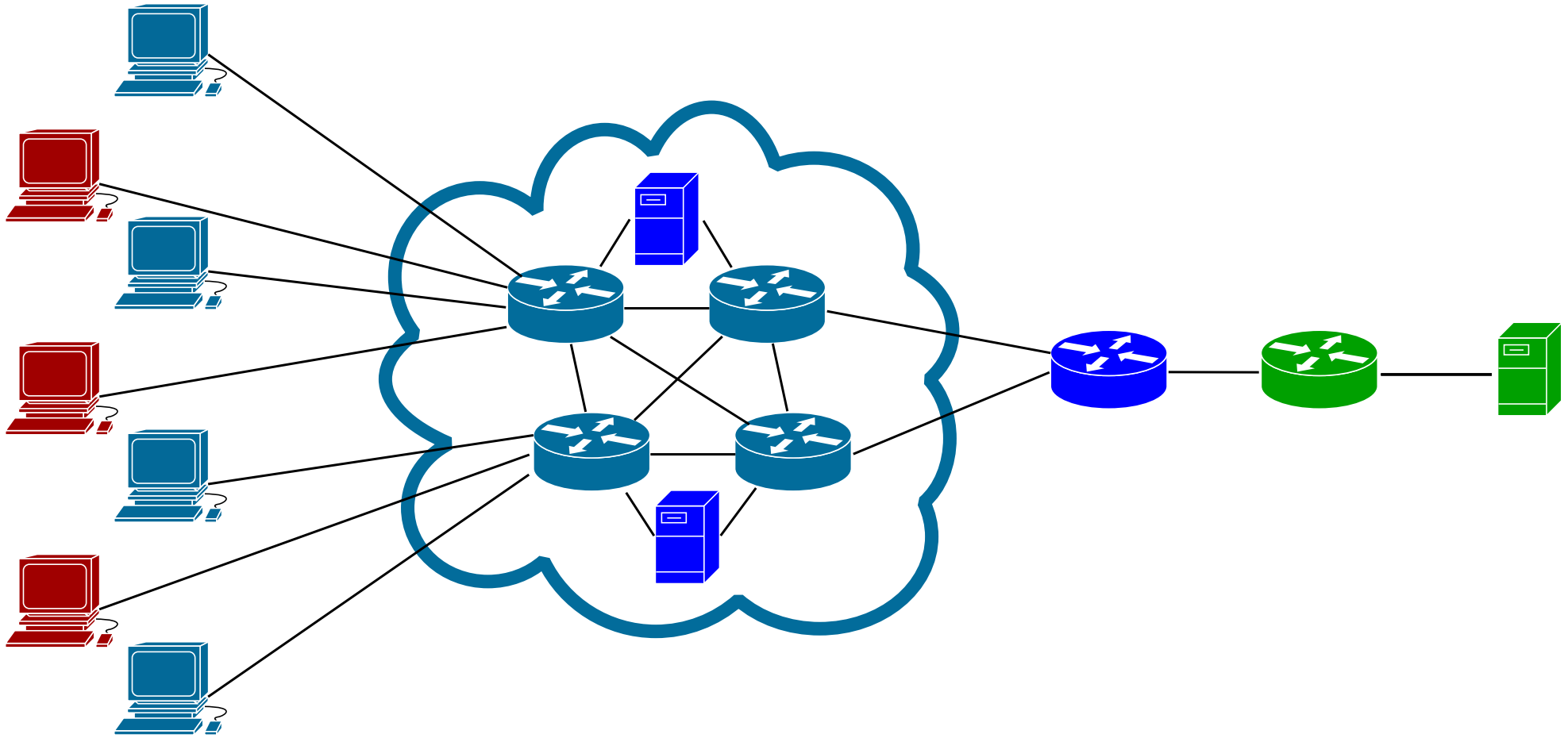
- Primary benefit are quicker deliveries because the CDN servers are “closer” to the client, topologically speaking.
- But this also means that it is very hard to attack the service as a whole because there are a lot of delivery endpoints.
- Only helps if deployed beforehand.

Security Teams

Depending on the context and attack details, external security teams might be able to help:

- Insight into botnet operations,
- ability to contact third parties,
- assistance in incident coordination.

DDoS Mitigation Provider/CDN



Miscellaneous Observations

Every Bit Helps

- It is crucial to be able to start working again. Working with your ISP/upstream entity to restore connectivity to your most important communications partners goes a long way.
- So does restoring local basic service so that people can start working again internally.
- Also realize that losing internet connectivity means losing VoIP telephony!

Be a Good Neighbor

Successfully defending yourself on your own is **very** hard, if not impossible. It is key that everybody keeps their own turfs clean, especially when not under attack, so that DDoS attacks are made as difficult as possible.

- Monitor outbound traffic for bots.
- Be sure not to be a reflector/amplifier.
- Consider rate-limiting outbound ICMP traffic.

Keep the Right People in the Loop

Remember that one of the goals of a DDoS attack is likely to make the target (presumably you) look bad.

If you are attacked, your public reaction is key.

- This means that your PR people should probably be briefed on what is happening.
- Also consider informing users of the problem so they do not have to guess what is wrong.

Collaborative Effort

- Successful DDoS mitigation is a team effort that cannot be pulled off by the victim alone.
- The deliberate distribution and dislocation of the attack means that many players are potentially involved.

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Thank you

Any questions?

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