Geneva + Tunnelbear:
Packet Manipulation Evasion at Scale

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This talk

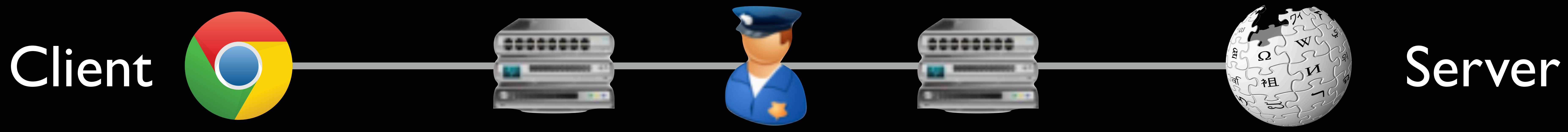
How does Geneva evade censorship?

- Packet manipulation-based censorship evasion
- Leveraging machine learning

Deploying Geneva’s evasion strategies

- Running many strategies simultaneously
- Deployment despite modern networking complexities

In-network censorship by nation-states



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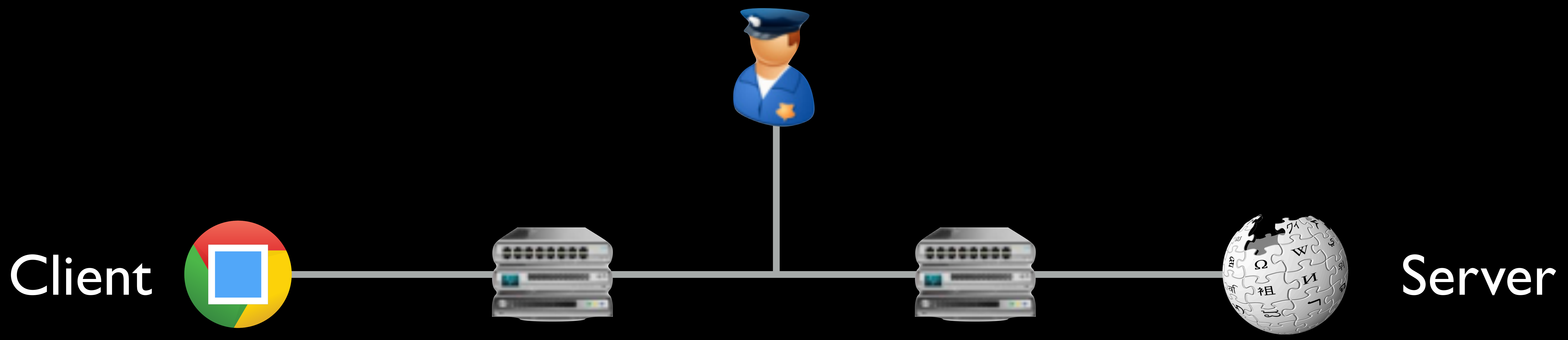

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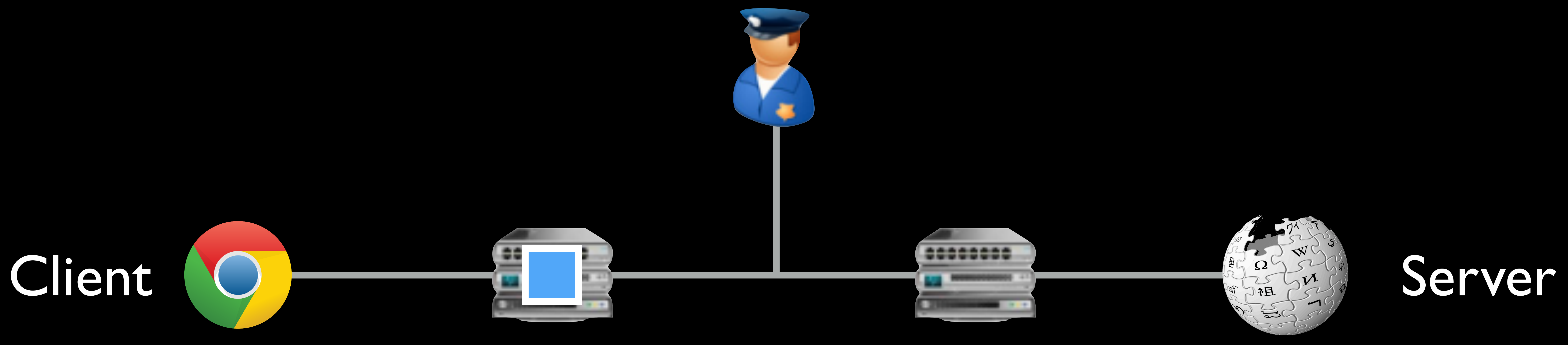

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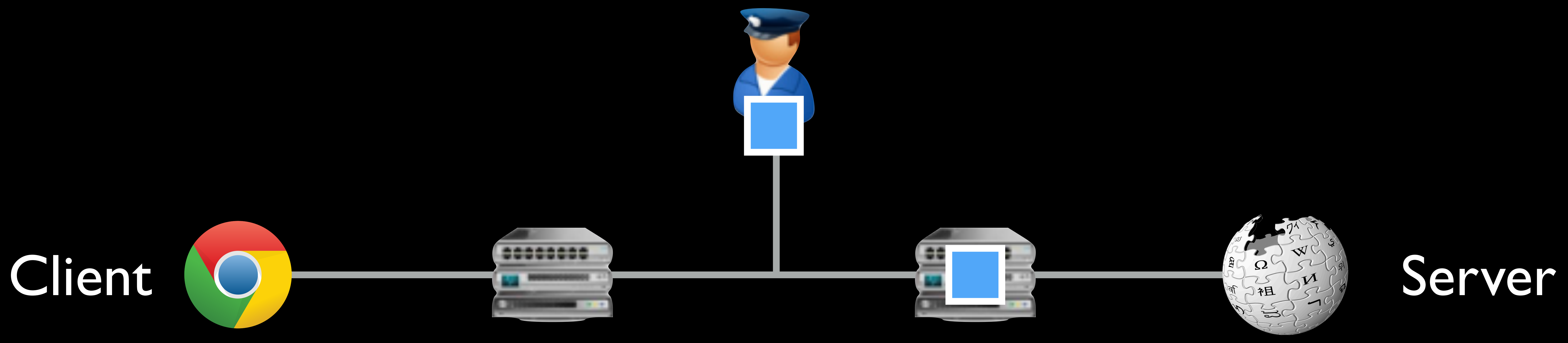

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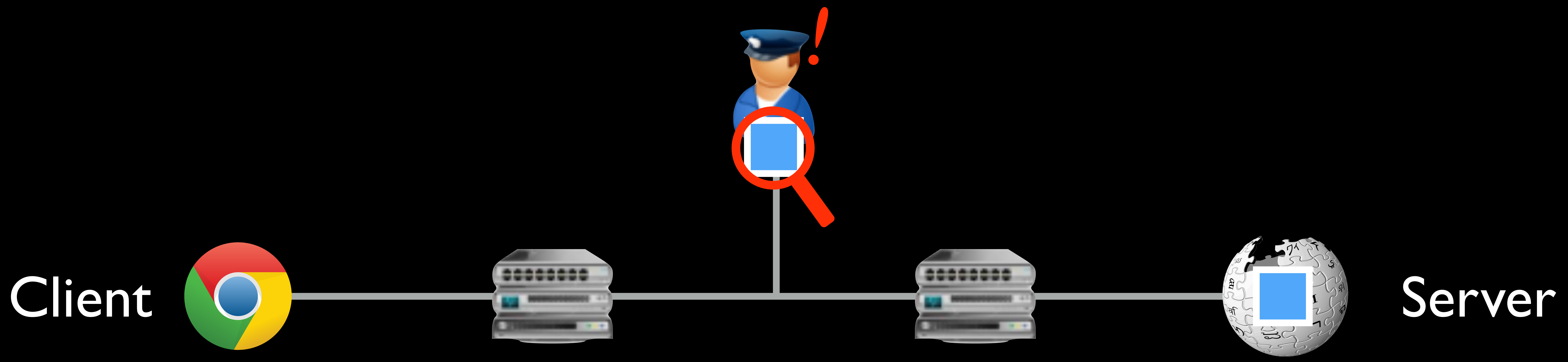

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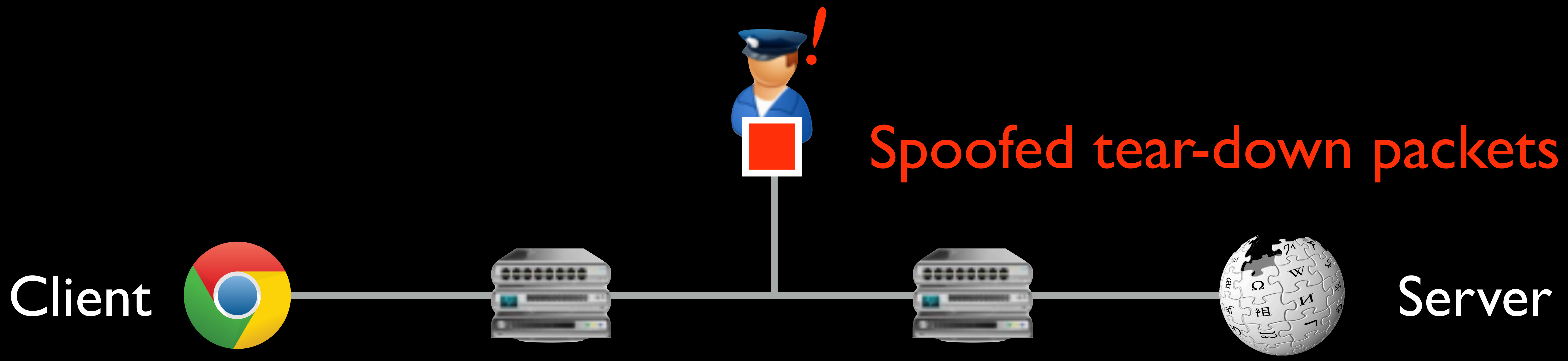

Spoofed tear-down packets

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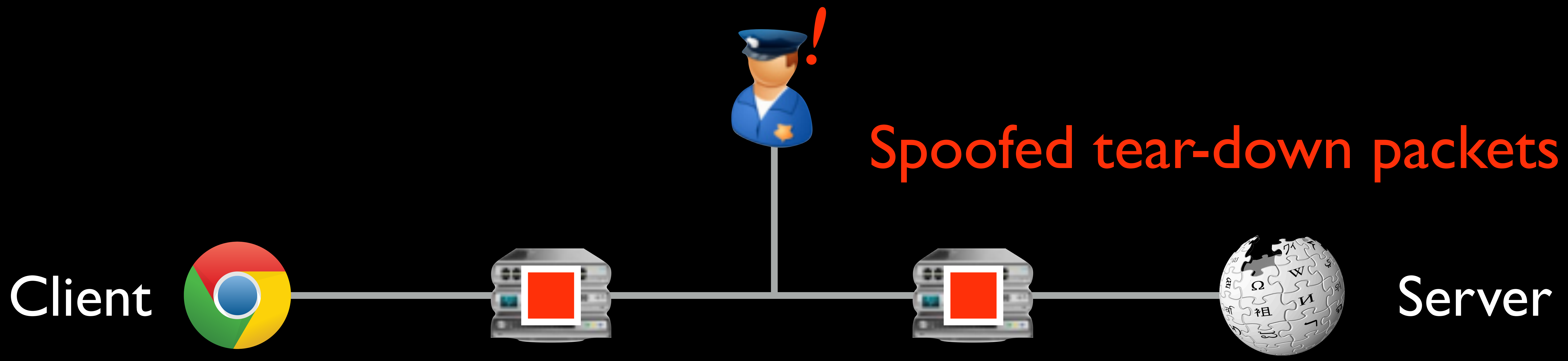

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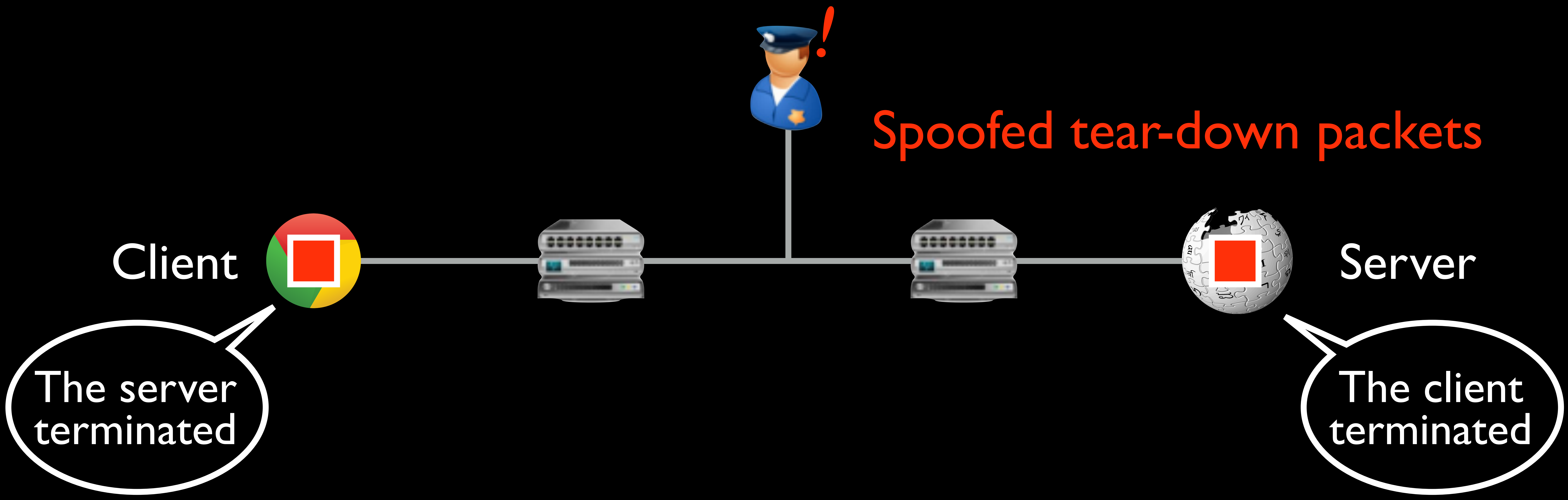

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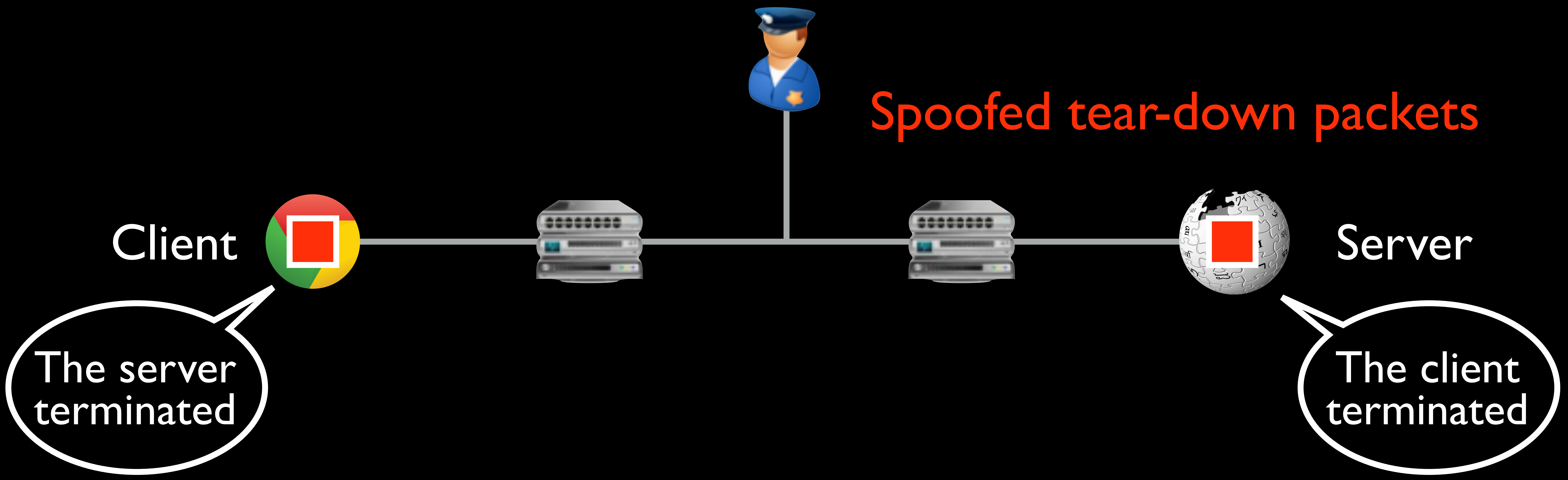

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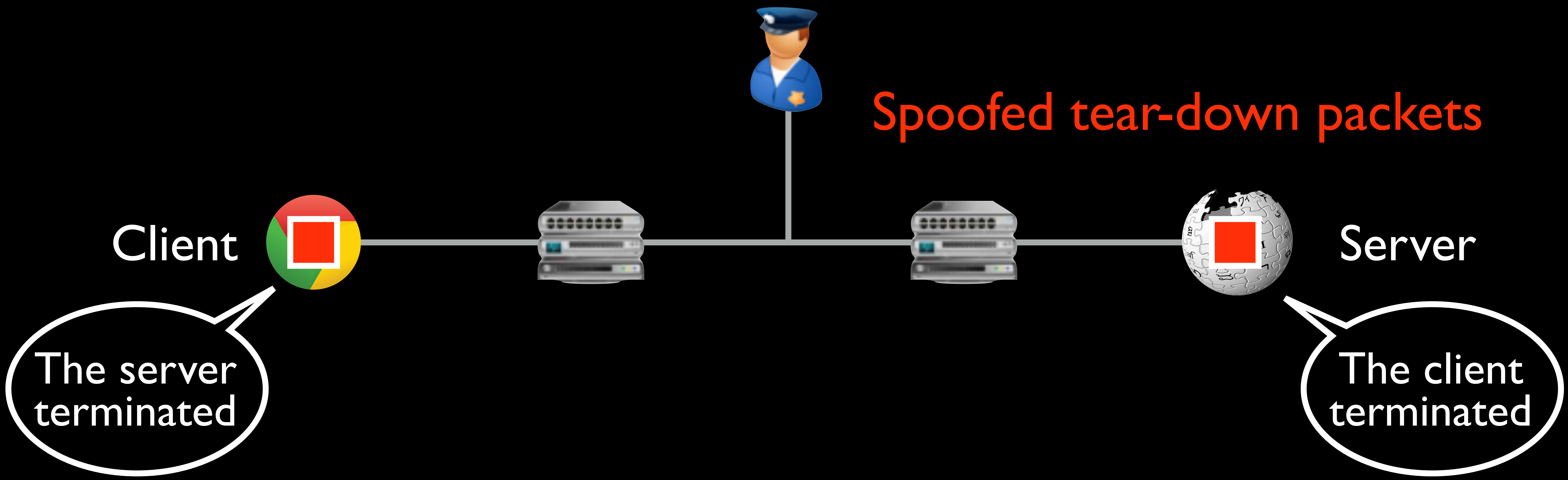


Spoofed tear-down packets

Client

Server

The server terminated

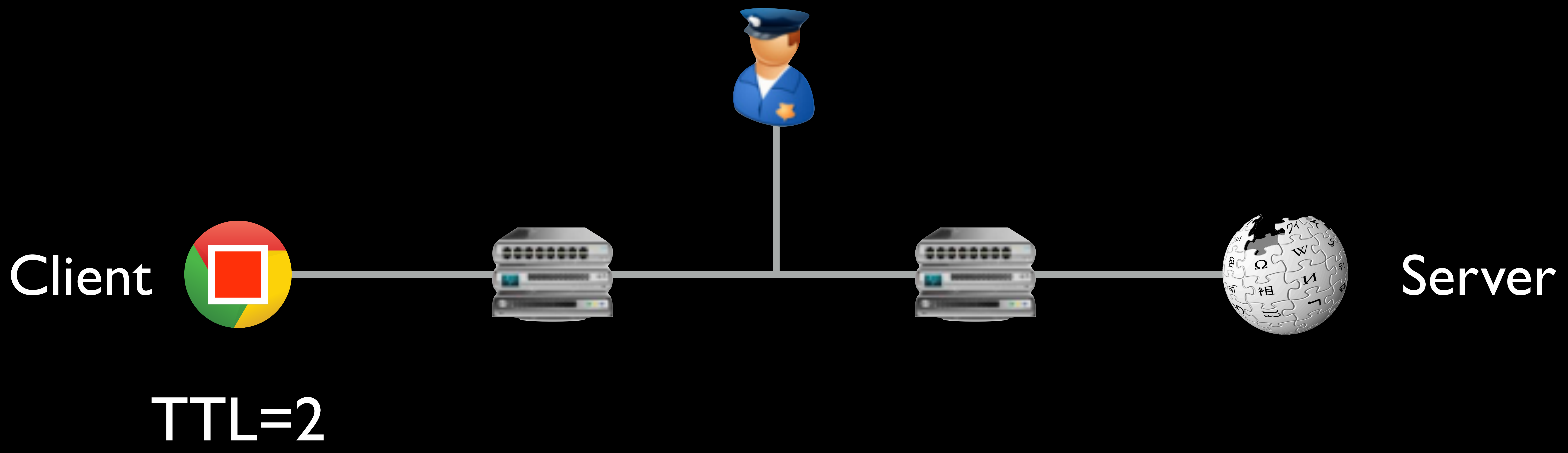
The client terminated

Injecting tear-down packets

Requires *per-flow state*

Censors necessarily *take shortcuts*

In-network censorship by nation-states



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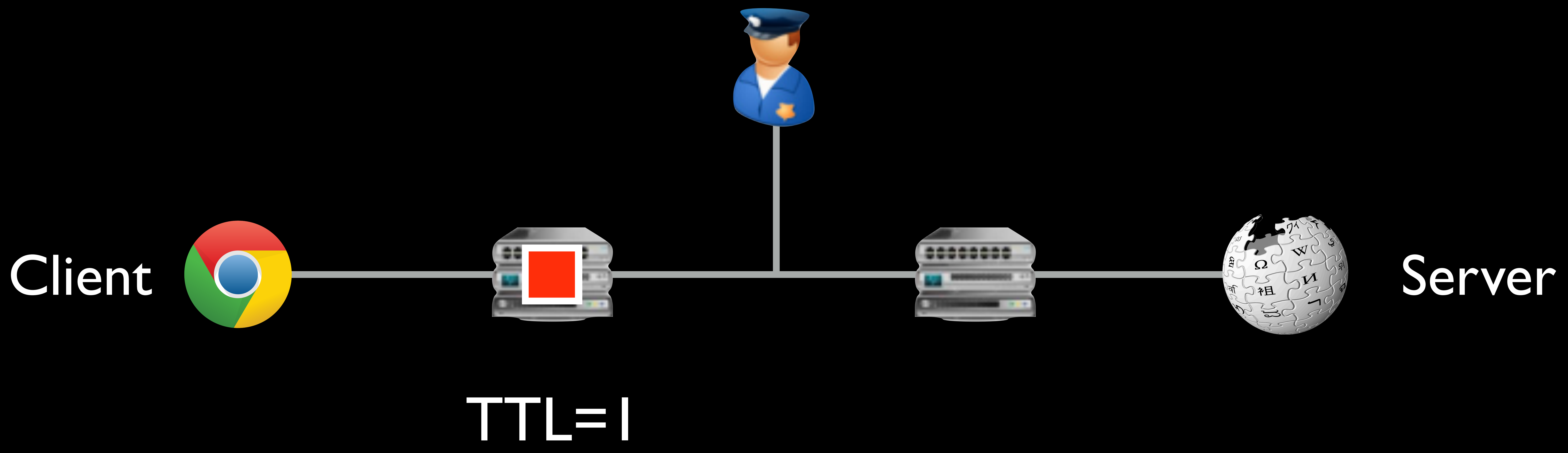
Evasion can take advantage of these shortcuts

In-network censorship by nation-states



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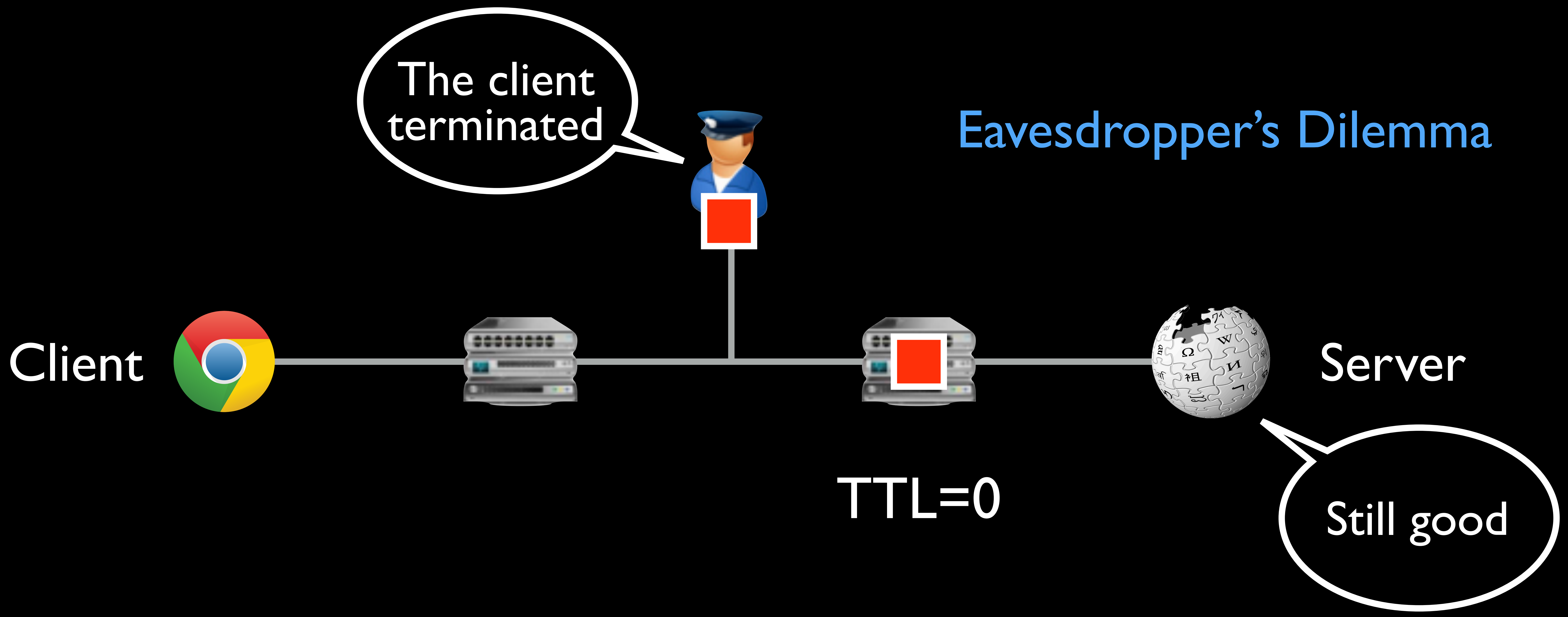

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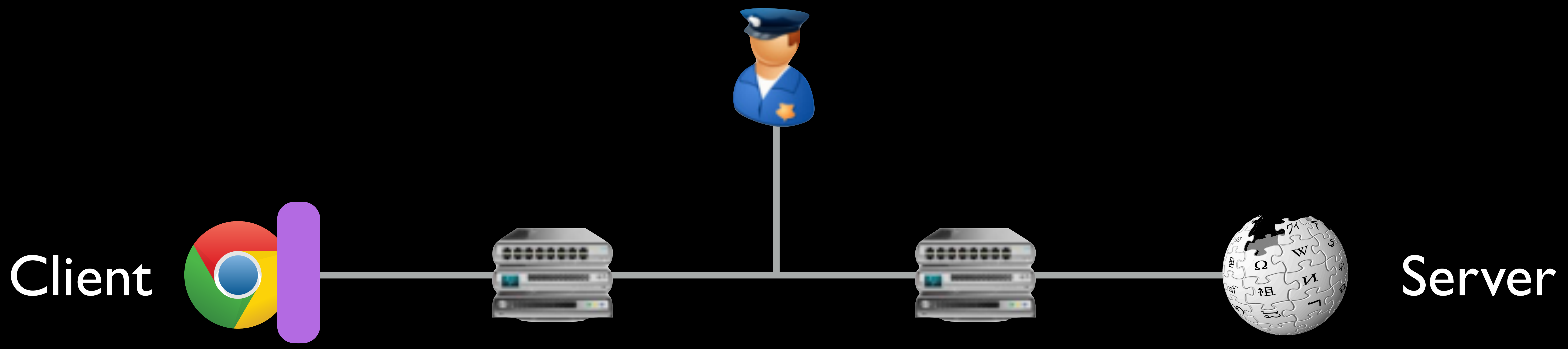
Geneva

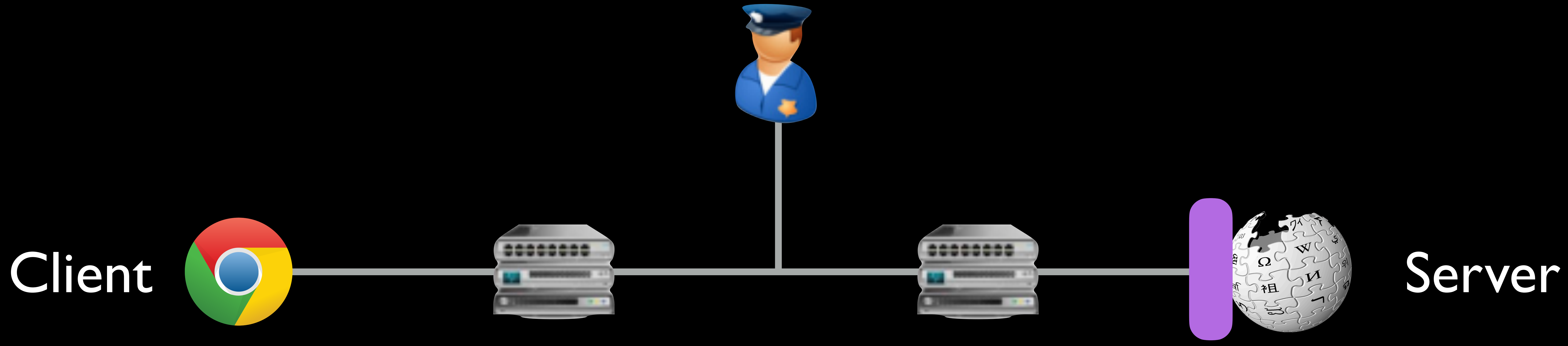
Genetic Evasion



Geneva runs strictly at one side

Geneva

Genetic Evasion



Geneva runs strictly at one side

Manipulates packets as they enter and leave

Geneva code and website censorship.ai

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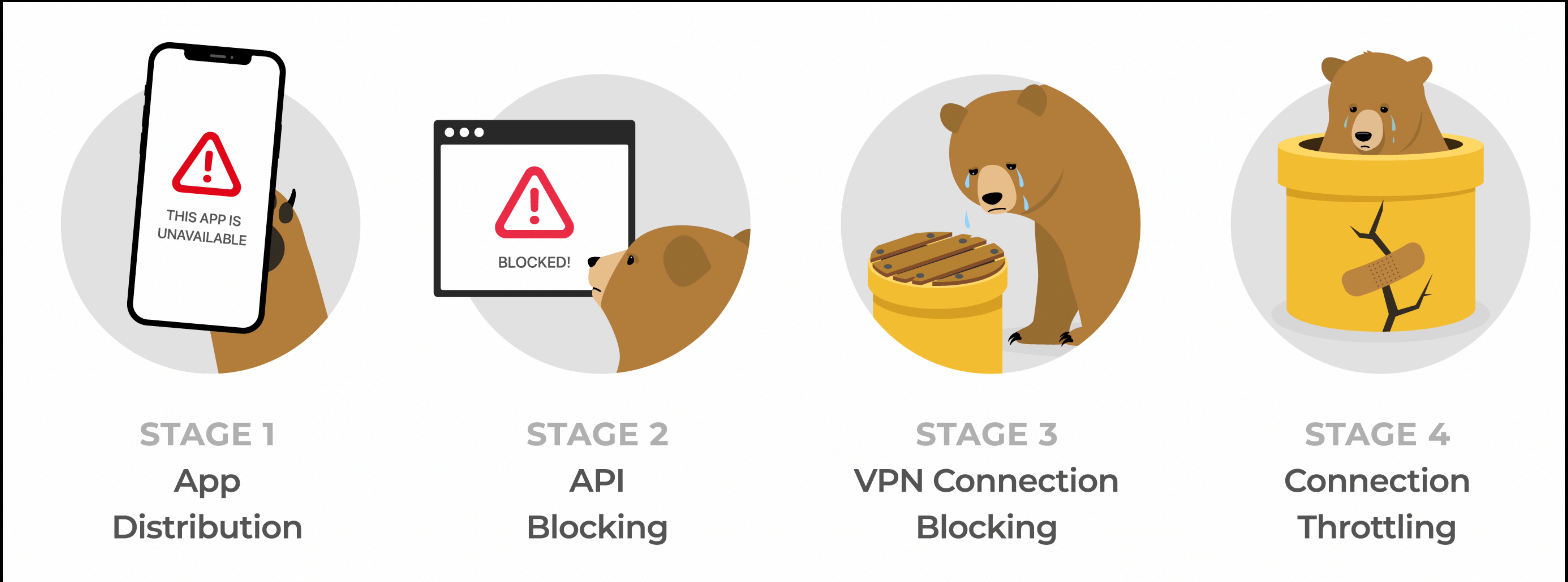
Geneva at Tunnelbear



STAGE 1
App Distribution

STAGE 2
API Blocking

STAGE 3
VPN Connection Blocking

STAGE 4
Connection Throttling

Deploying Geneva and its challenges

- Work started in fall 2020 with a refactor of the Python project
- Most of the work has been around deployment strategies
  - Terraform
  - Dockerization
  - Deployment tests
- We hit many edge and corner cases in AWS and ECS along the way

What's next for Geneva at Tunnelbear

- Performance measurements and iteration from there
- Suspected hot sections of code have been instrumented
- Bottlenecks will dictate if and how parts of it should be rewritten
- Options being considered:
    - Cython
    - `iptables` extension
    - Kernel module

Packet Manipulation Evasion at Scale

Geneva

Genetic Evasion

+

TunnelBear

Large scale deployment at server-side

Rapid deployment of new strategies

Protects and enables bootstrapping

Geneva code and website censorship.ai