# STEK Sharing is Not Caring: **Bypassing TLS Authentication in Web Servers using Session Tickets**

**Sven Hebrok** Tim Leonhard Storm Felix Matthias Cramer
Maximilian Radoy Juraj Somorovsky

USENIX Security '25 | August 13–15, 2025

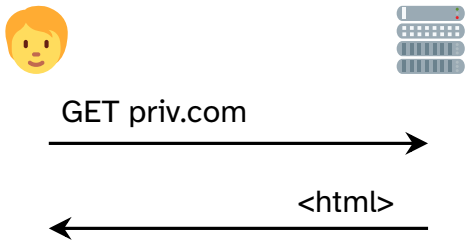
PADERBORN UNIVERSITY

Ministerium für
Kultur und Wissenschaft
des Landes Nordrhein-Westfalen

NERD.NRW

# TLS Protects Web Traffic

- Commonly used in the web



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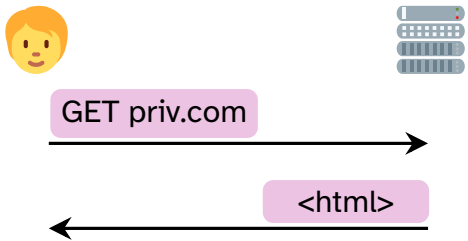

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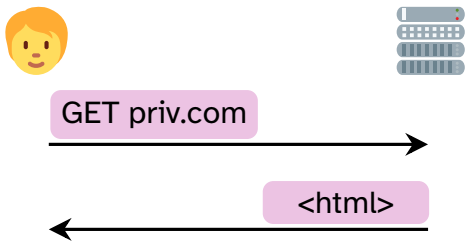

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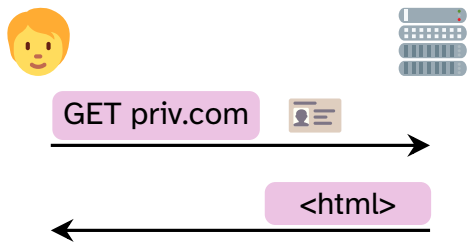

# TLS Protects Web Traffic

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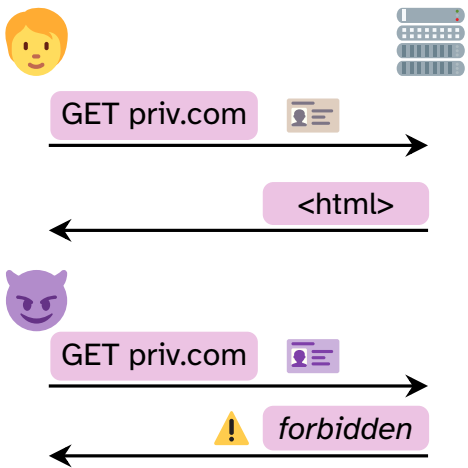
- Can authenticate client
  - Access control



# Bypassing Client Authentication

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vHosting

pub.com

priv.com

GET priv.com



*forbidden*

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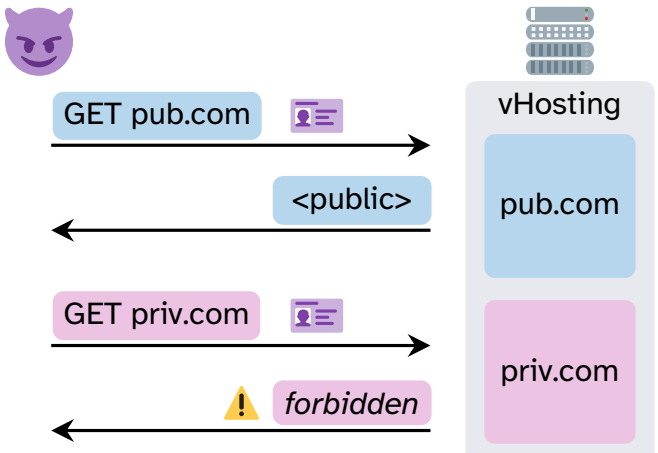

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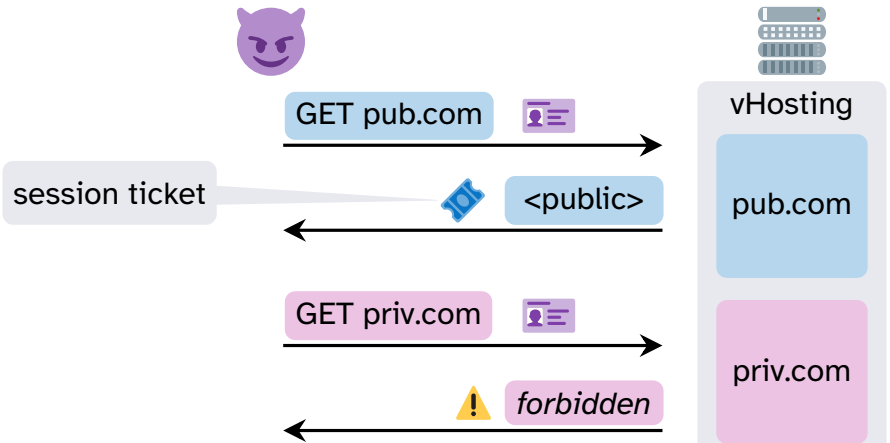

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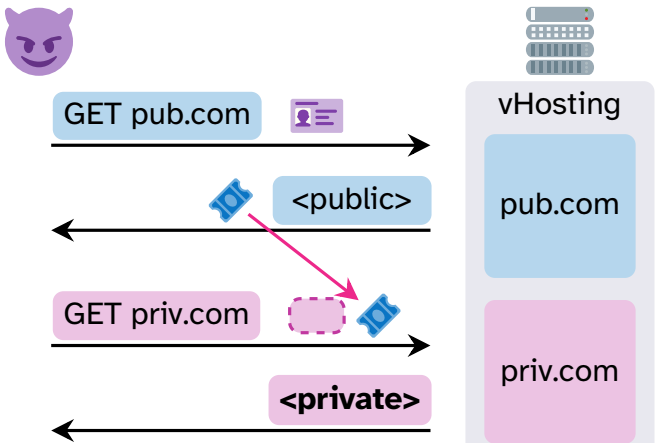
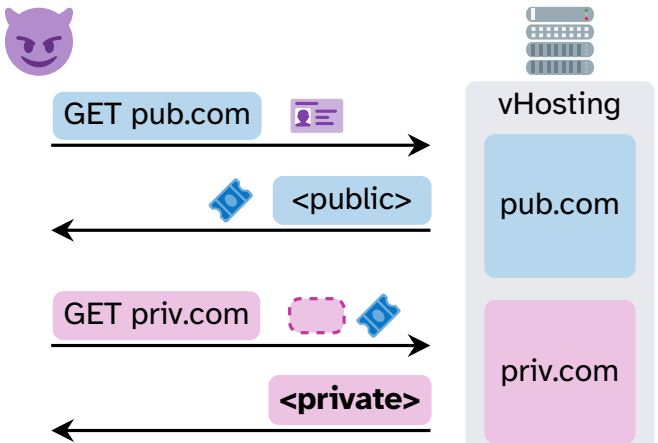


# Bypassing Client Authentication

Automatically tested servers

- Apache
- Caddy
- nginx
- LiteSpeed



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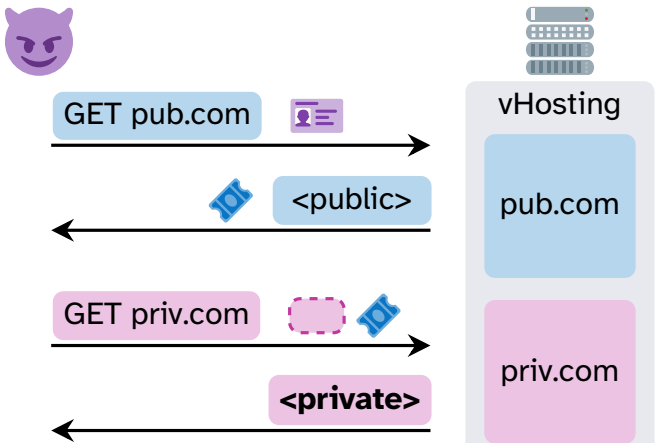

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Manually tested cloud providers

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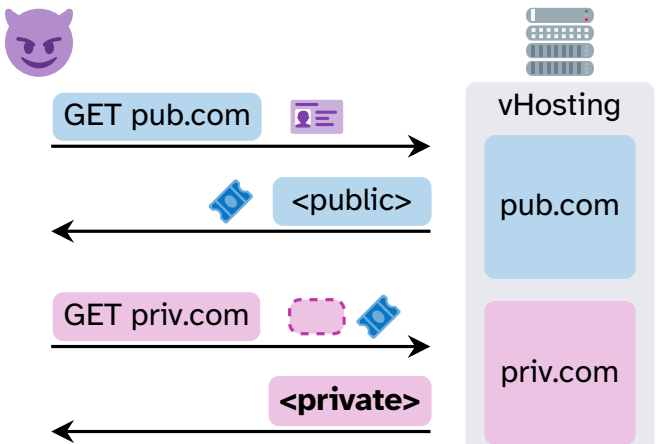
- Cloudflare
- Google Cloud



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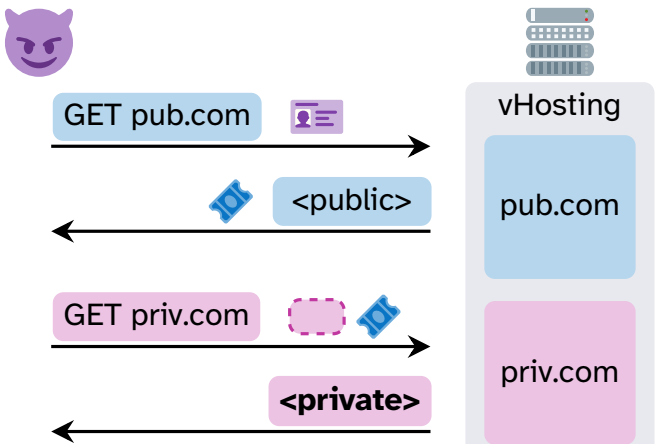

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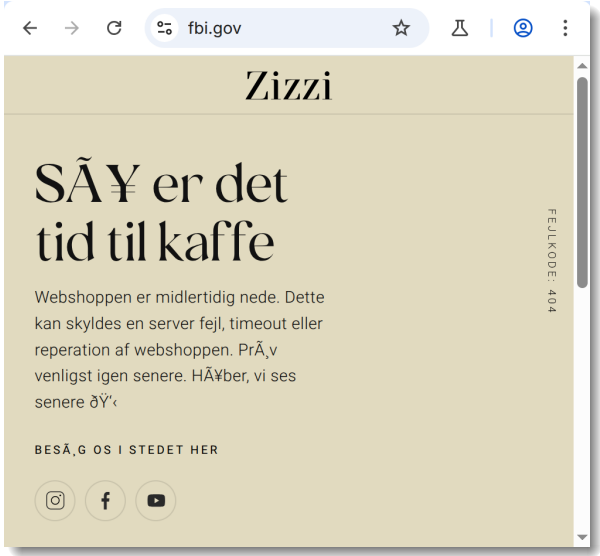
= Complexity

# Visit our Poster




*STEK Sharing is Not Caring:*

## Bypassing TLS Authentication in Web Servers using Session Tickets

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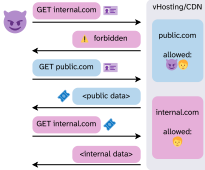
- Skip costly authentication step in resumption
- Virtual hosting uses a single server for multiple domains

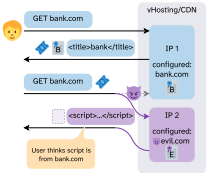
***How do session tickets affect TLS authentication guarantees?***

*Client Authentication*




Privilege Escalation / Authentication Bypass

*Server Authentication*




XSS, MitM

***Do these vulnerabilities exist in the real-world?***

| TLS SNI → / HTTP Host → | | public | | internal | | omitted | |
|---|---|---|---|---|---|---|---|
| | | public | internal | public | internal | public | internal |
| Apache | TLS 1.2 / TLS 1.3 | public | 421 | not resumed | | public | 421 internal |
| Apache (strict) | TLS 1.2 | public | 421 | not resumed | | public | 421 |
| | TLS 1.3 | | | | | 400 | 400 |
| Caddy | TLS 1.2 / TLS 1.3 | public | 421 | 421 | internal | not resumed | |
| nginx | TLS 1.2 | public | 421 | public | 421 | public | 421 |
| | TLS 1.3 | | | 421 | internal | | internal |
| nginx (strict SNI) | TLS 1.2 | public | 421 | public | 421 | public | 421 |
| | TLS 1.3 | | | 421 | internal | | internal |
| LiteSpeed | TLS 1.2 / TLS 1.3 | public | internal | not resumed | | public | internal |

Manually found affected provider: Cloudflare

Performed large-scale scan
Found 3 affected CDNs/providers:
Fastly, DDoS-Guard, Variti
Discovered routing issue in Cloudflare allowing MitM

Reasons for these vulnerabilities:
- Easy to misuse APIs in TLS libraries
- Standards vague about interaction of
  - Session resumption
  - Virtual hosting (SNI, Host header)

Read the Paper

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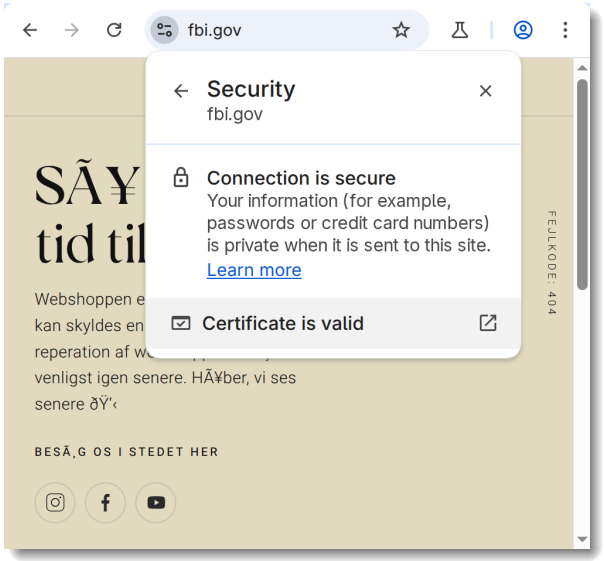


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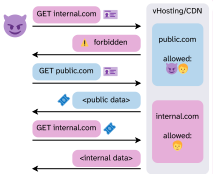


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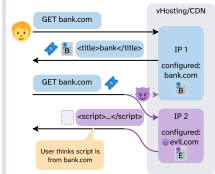


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