TVA
:A DoS-limiting Network Architecture*

Xiaowei Yang, David Wetherall, and Tom Anderson
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Presented by
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10 November 2010

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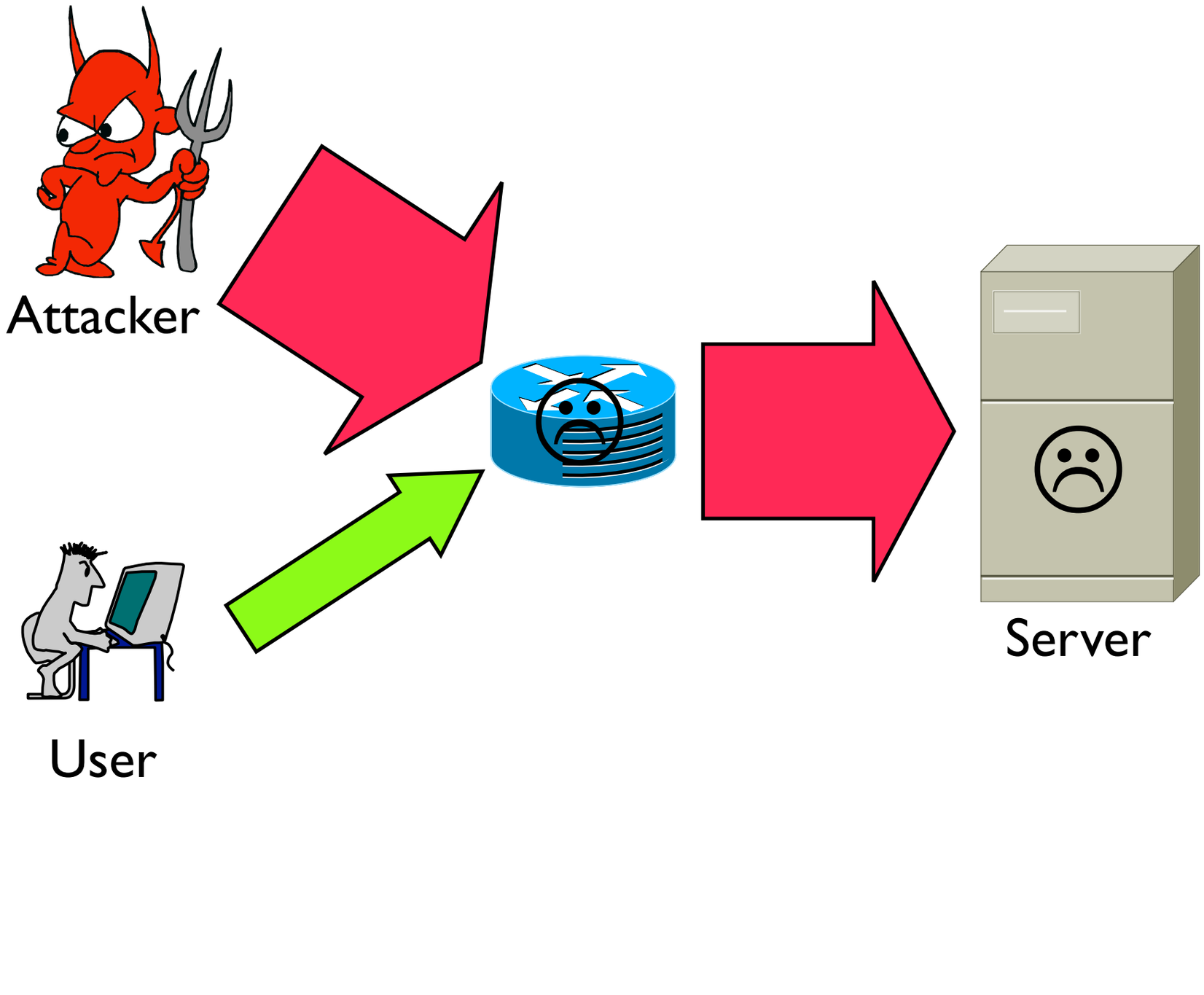
Problem, Goal, and Key Idea

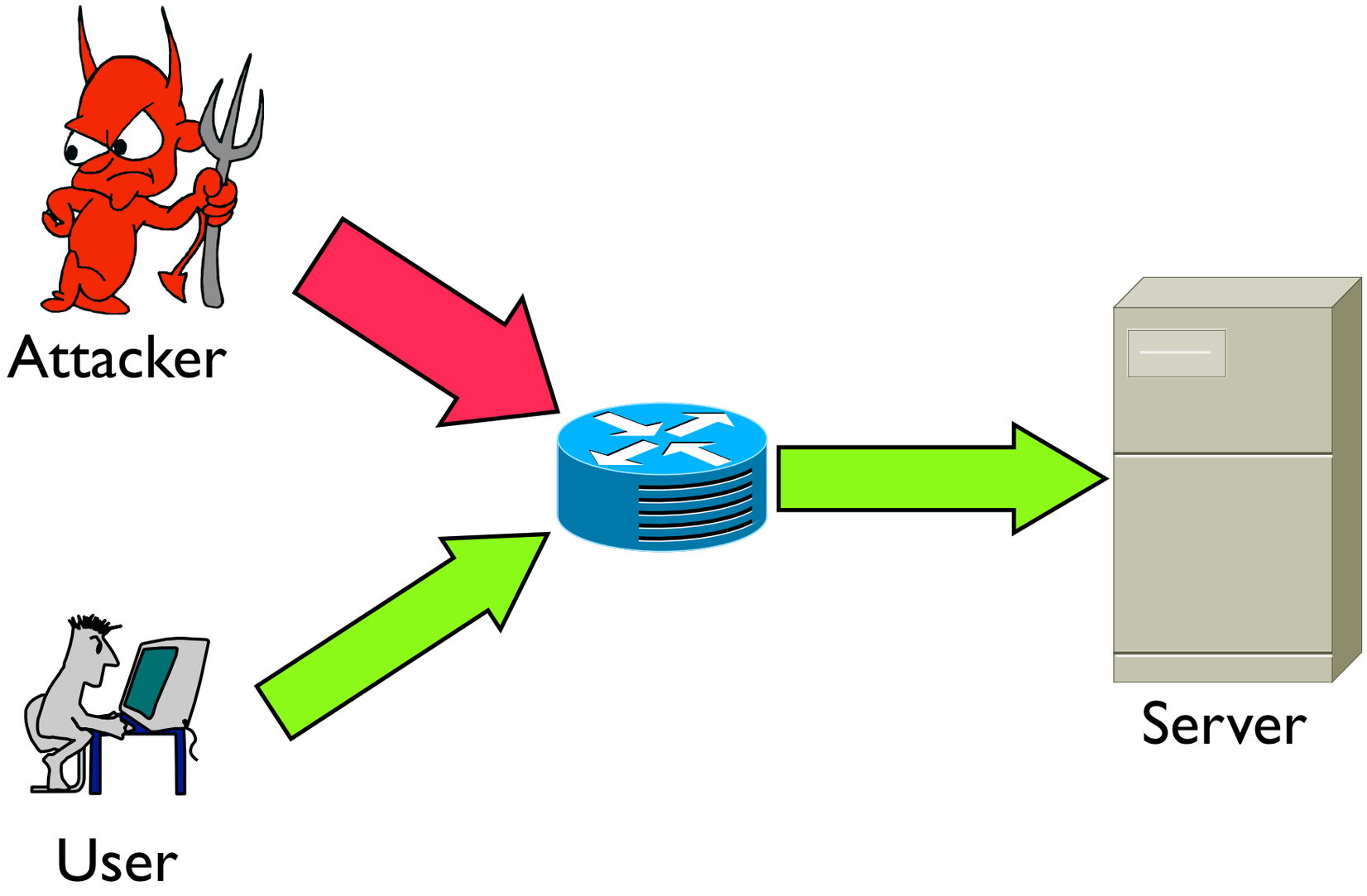
Problem:

DoS(Denial of Service) Attack



Goal:

Effectively Communicate!



Idea: Capability

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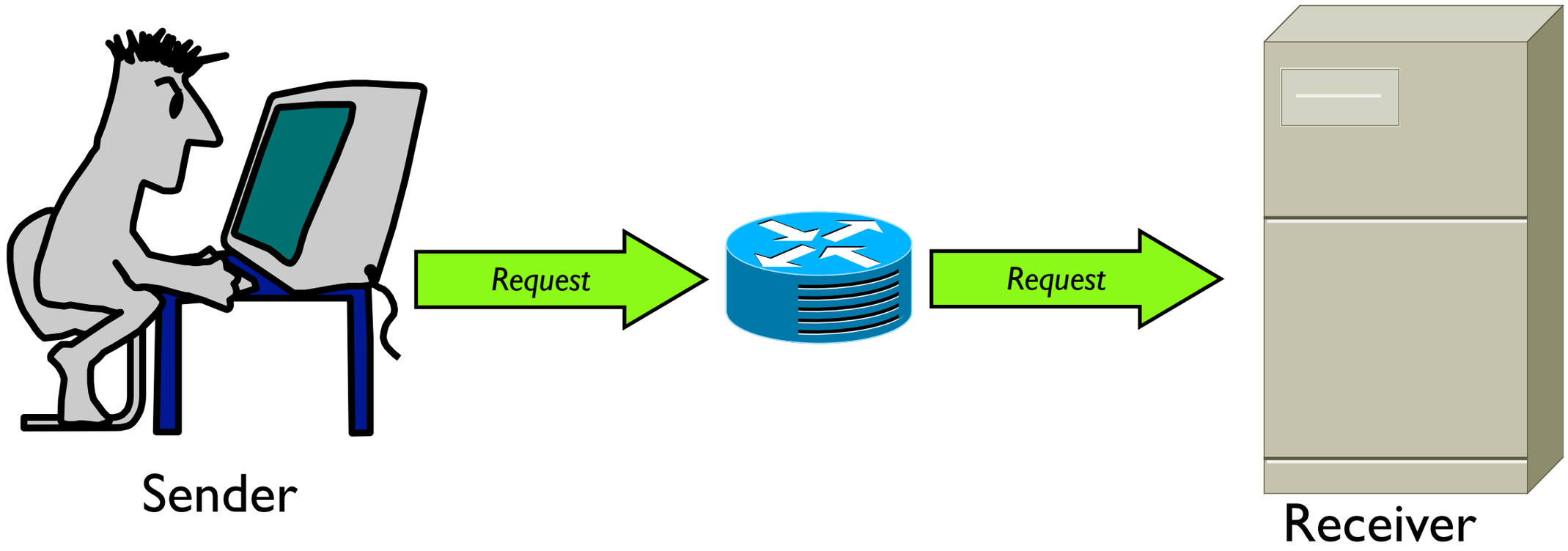
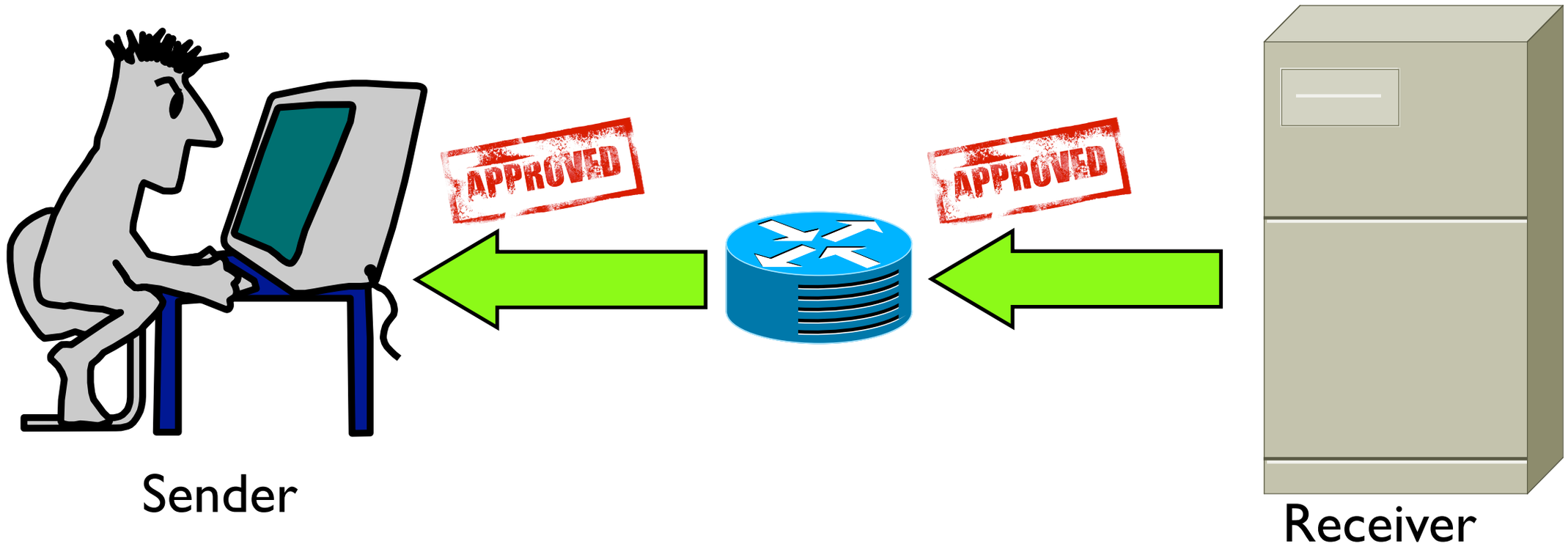


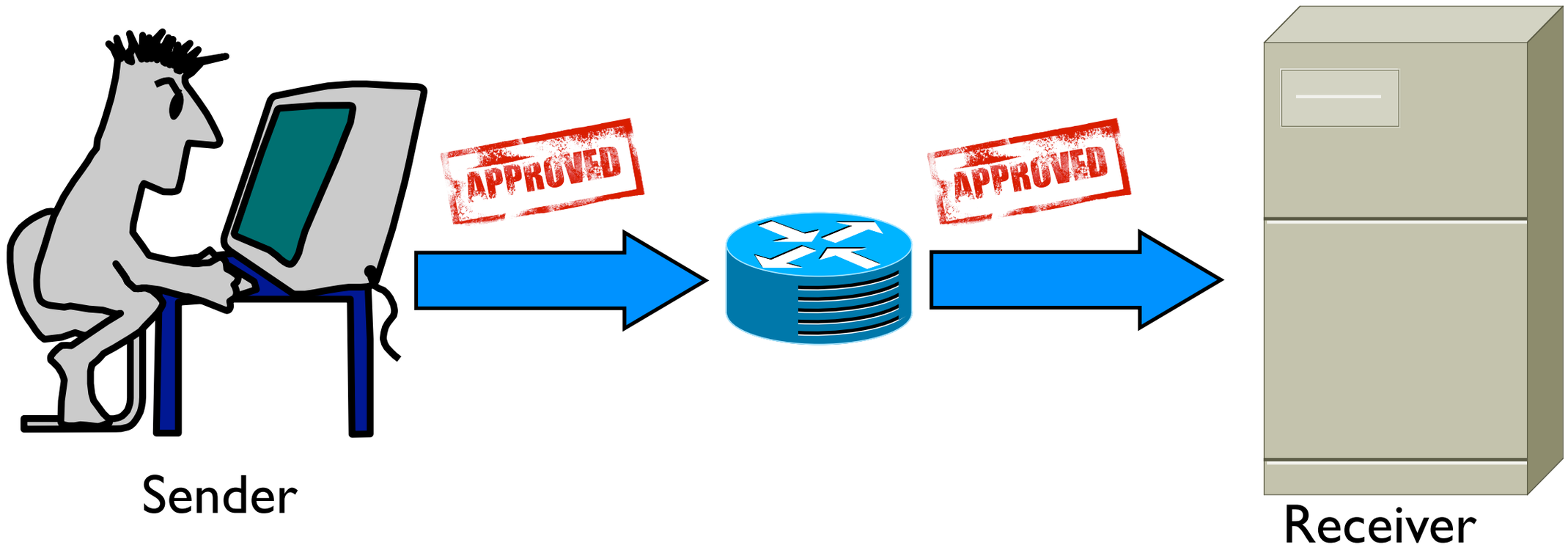
1 Request Capabilities

Idea: Capability



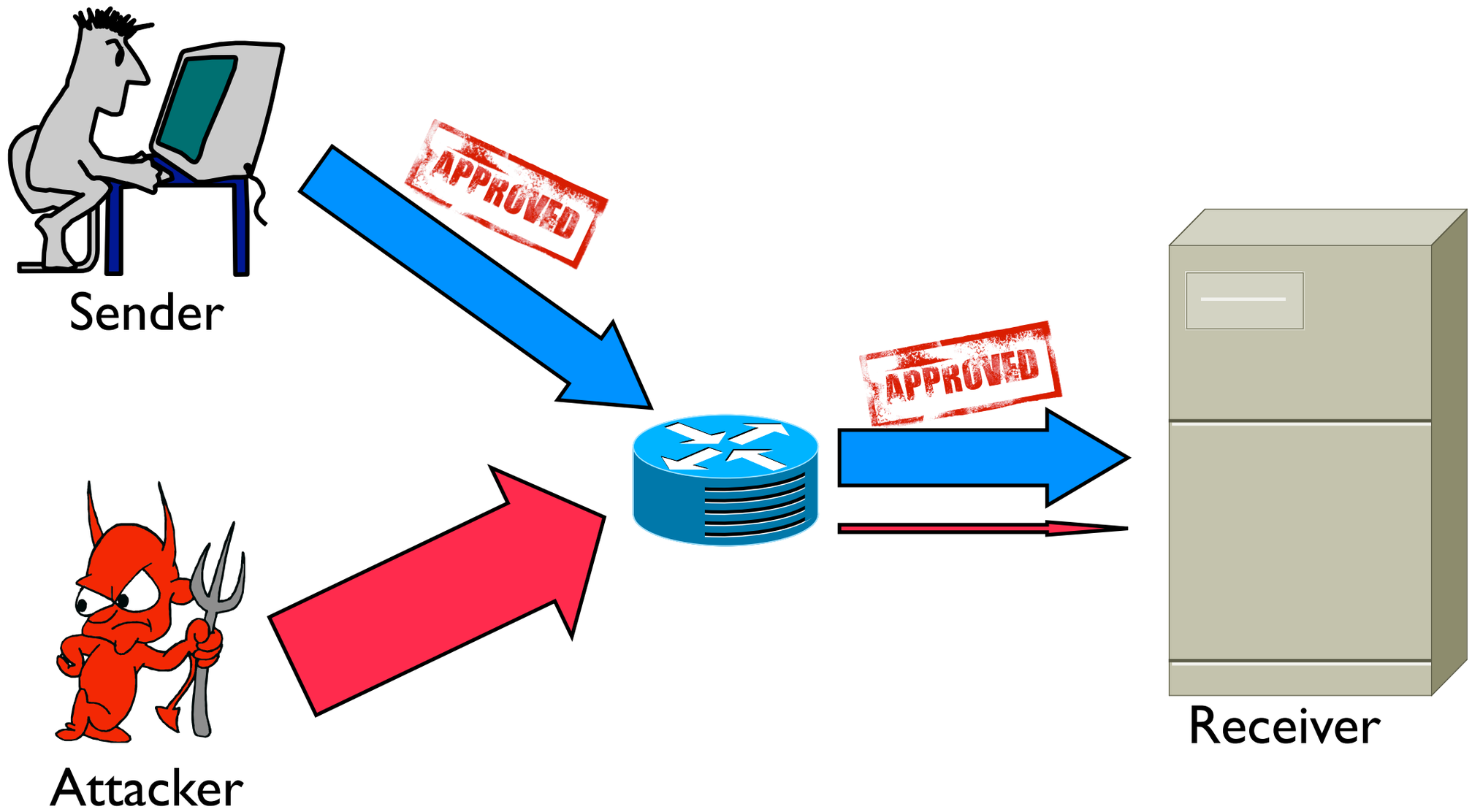
2 Send Capabilities

Idea: Capability



3 Send Packets with Capabilities

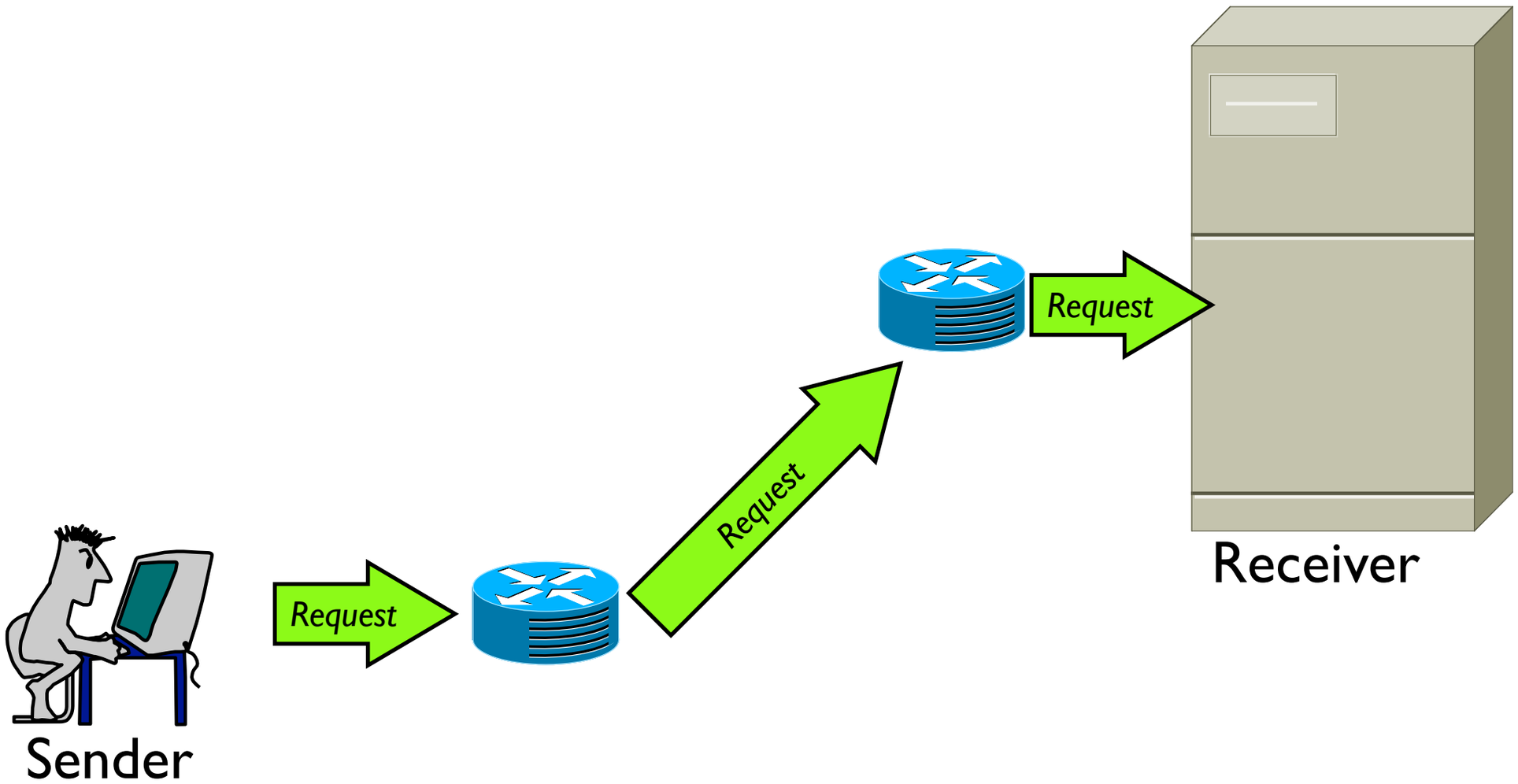
Idea: Capability



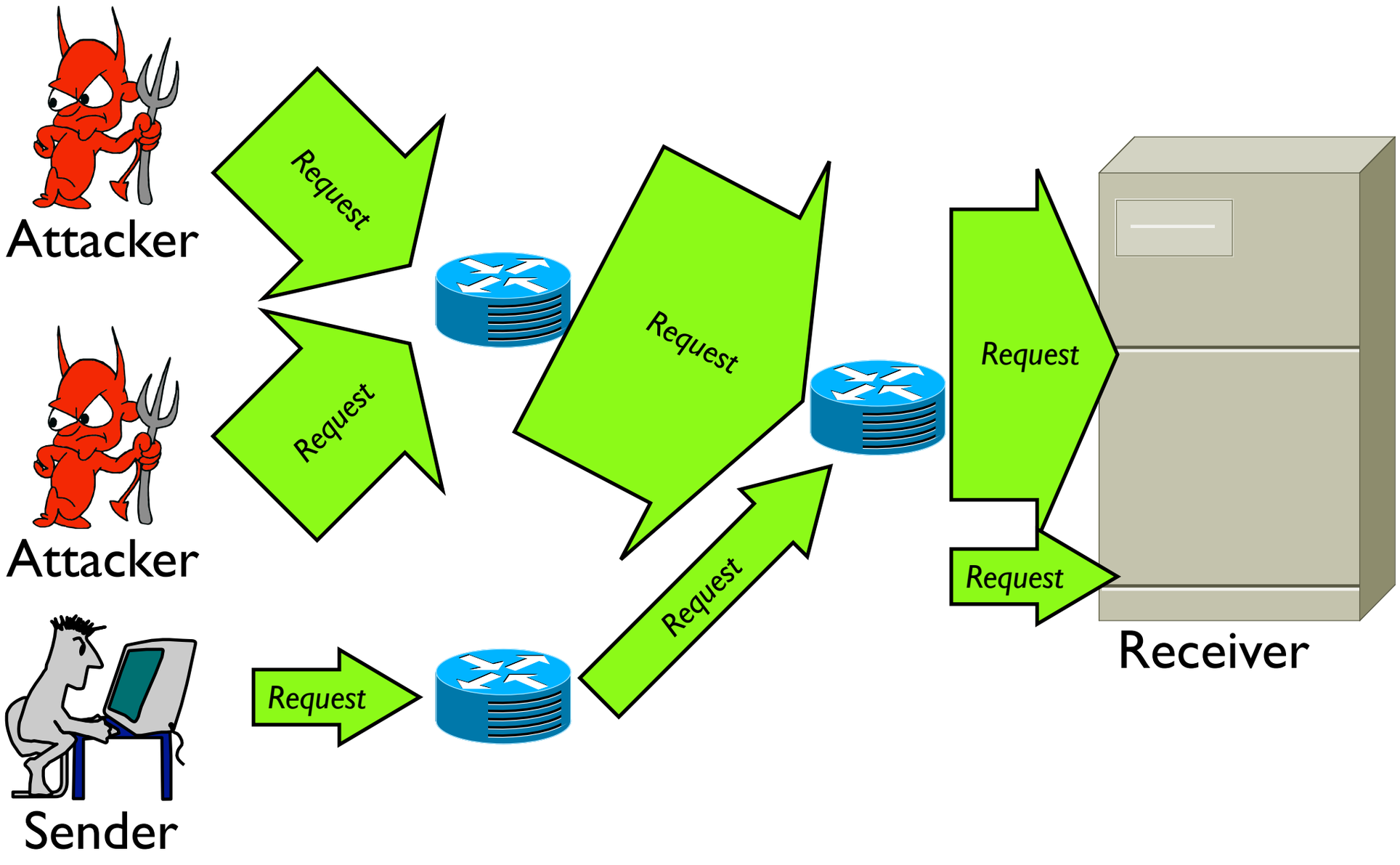
2

Key Challenges and Their Solutions

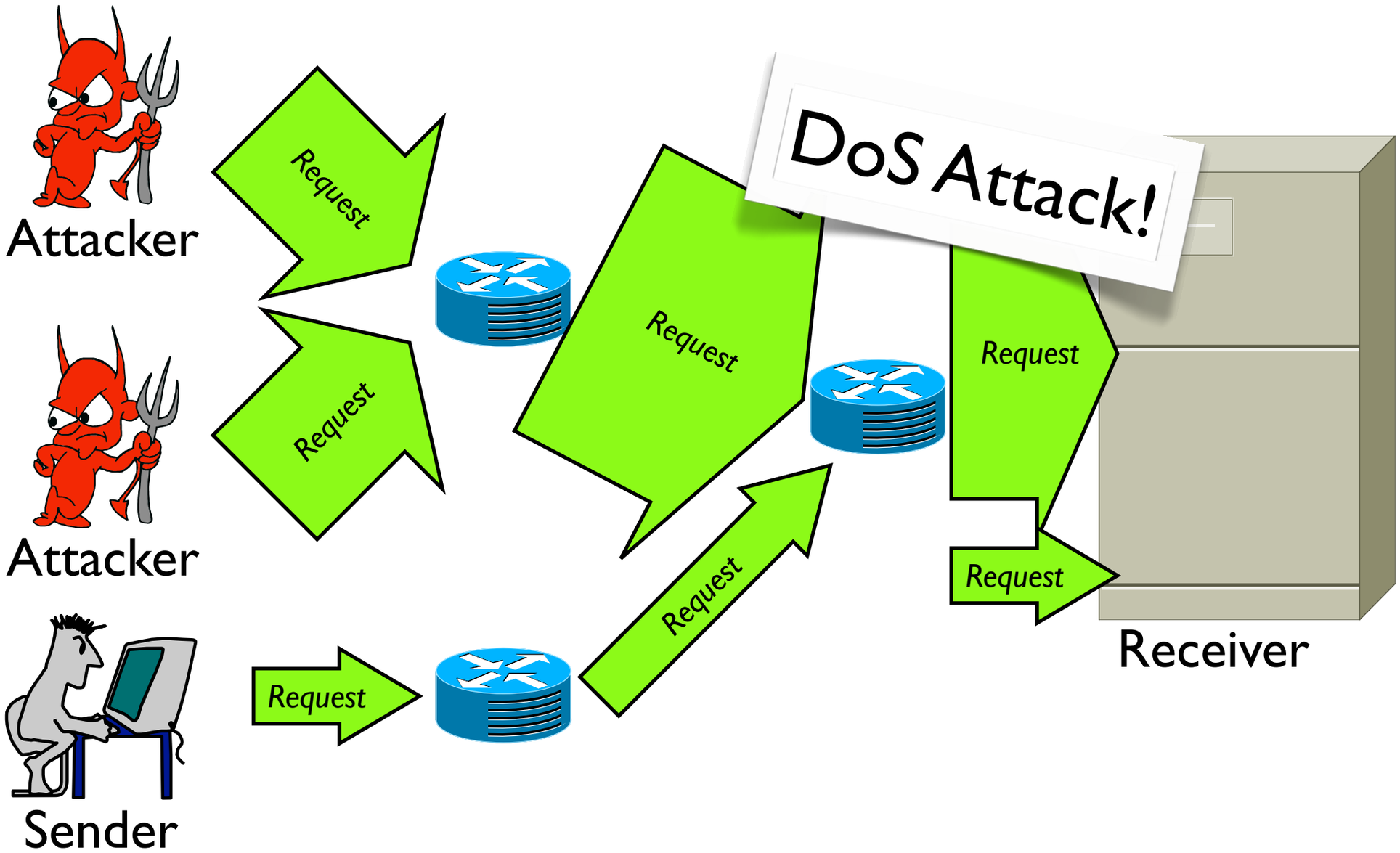
Challenge:
Request Flood



Challenge:
Request Flood

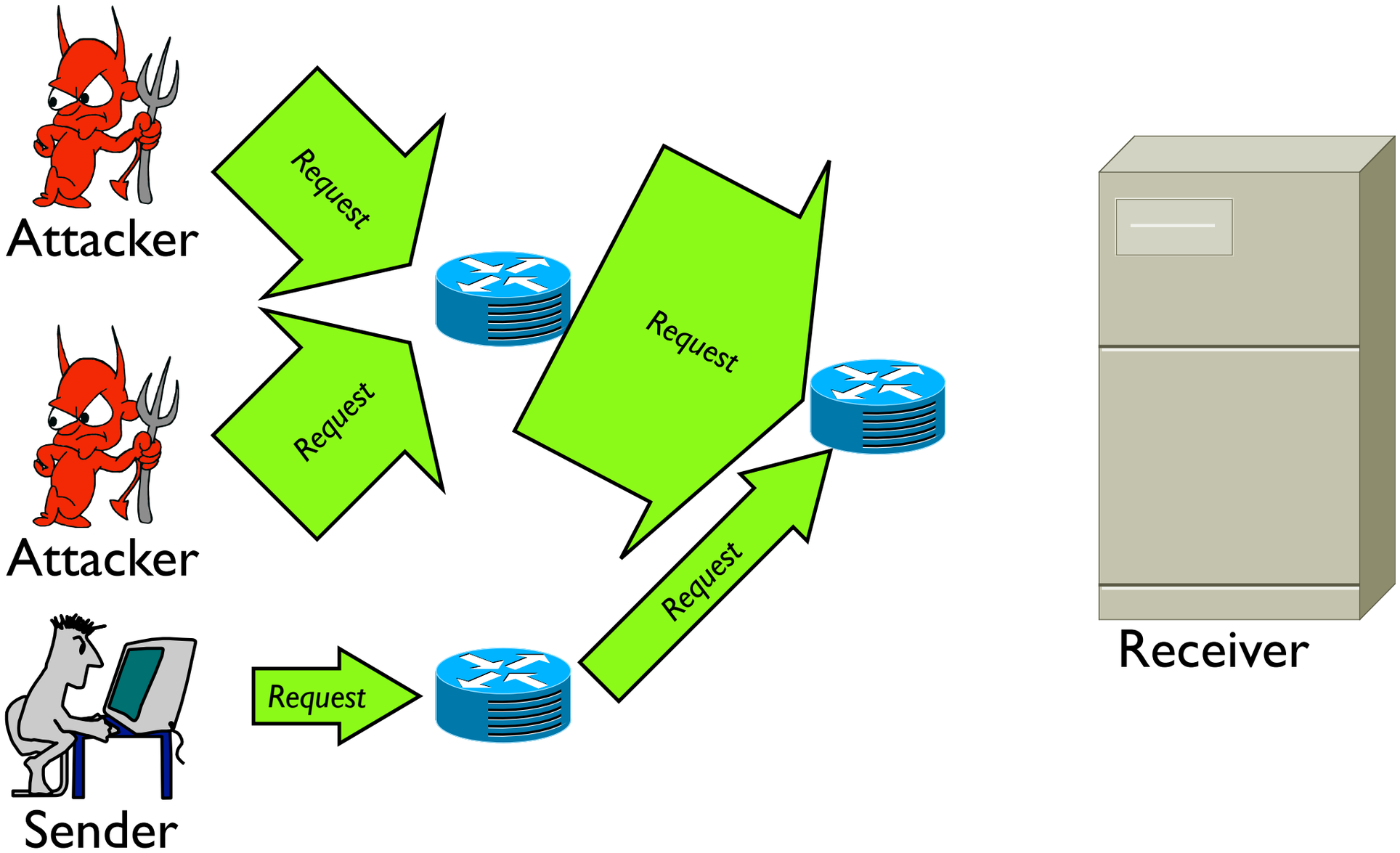


Challenge:
Request Flood



Solution:

Rate-limiting Request + per-identifier Fair-Queuing



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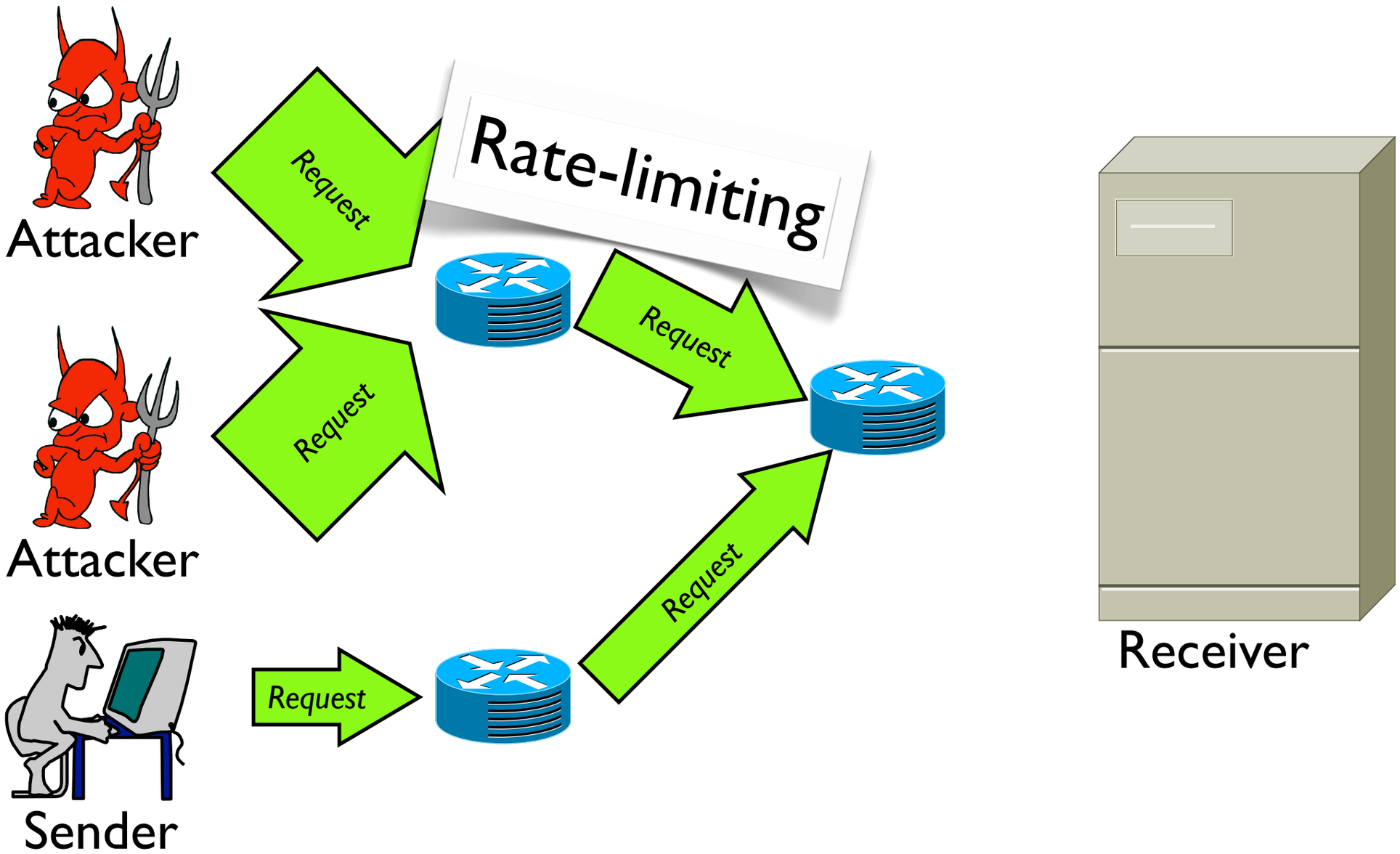

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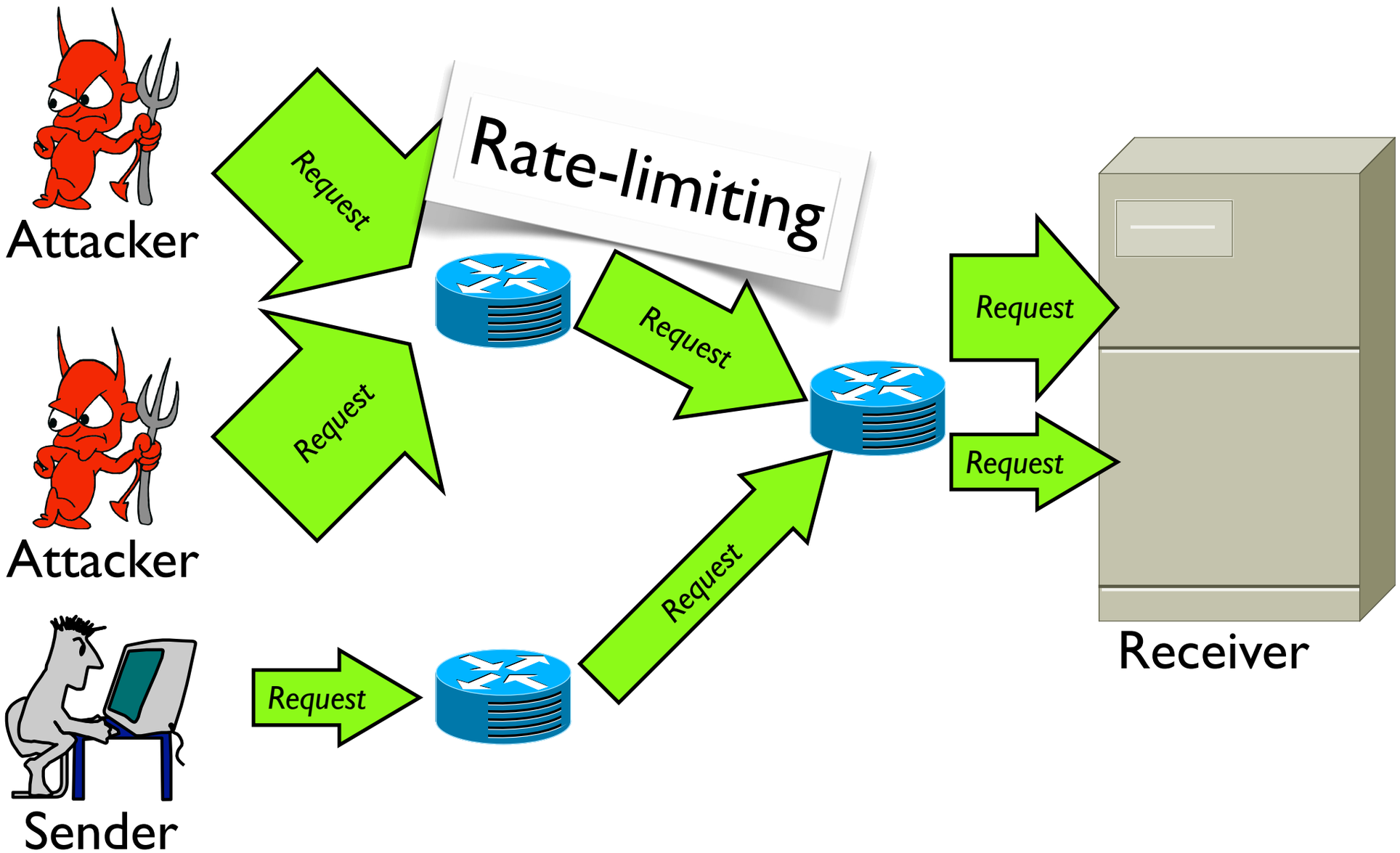

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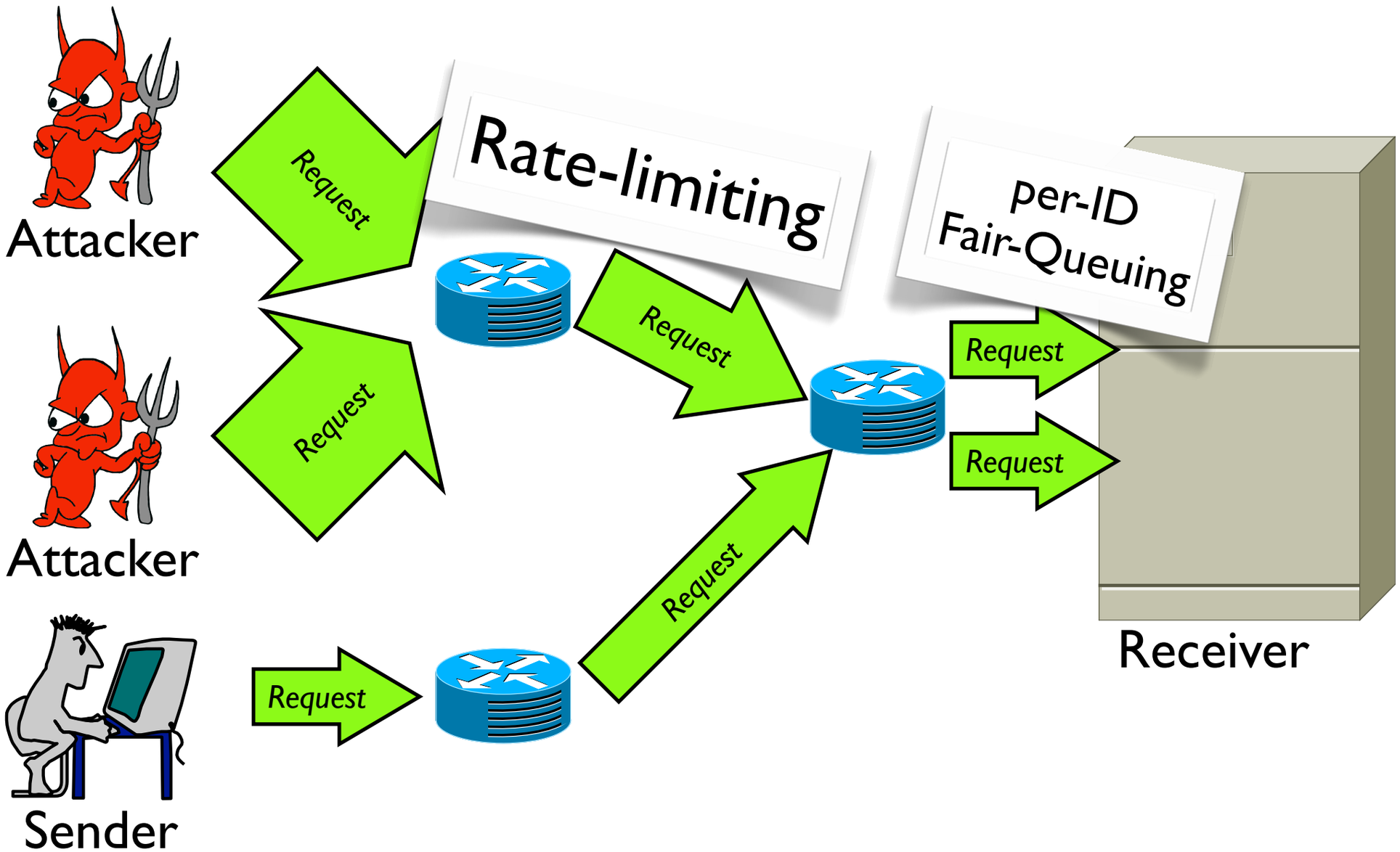
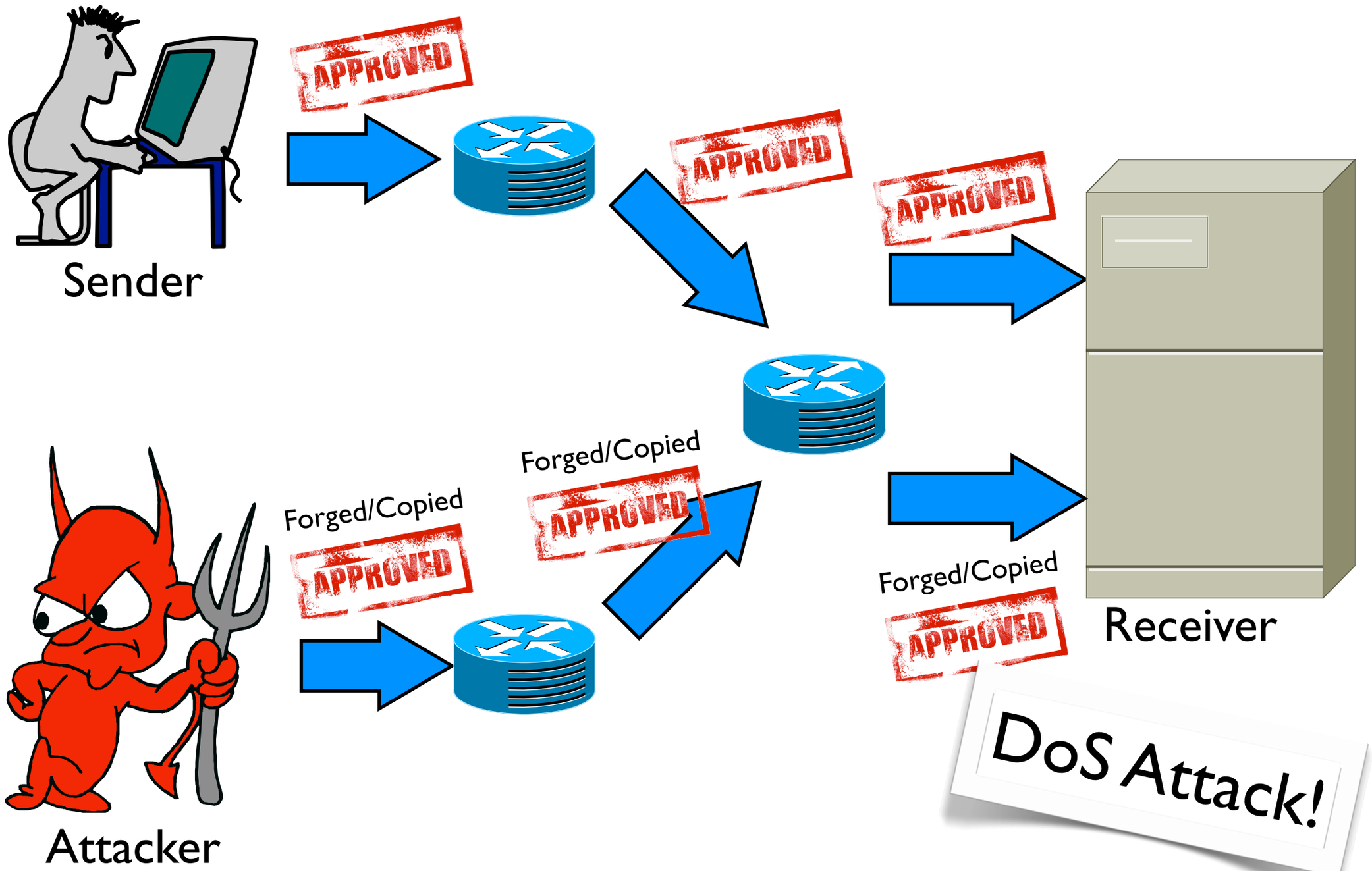
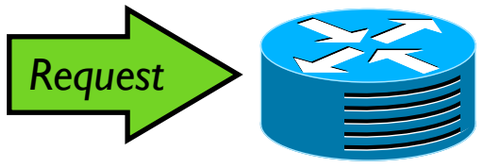


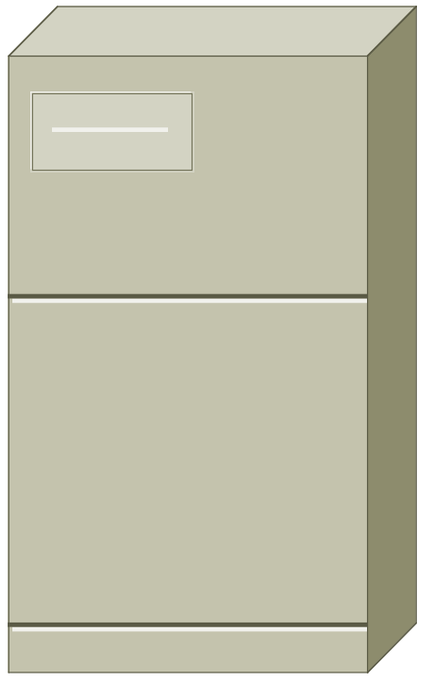
Challenge:
Secure Capabilities



Solution:
Cryptographic Hash

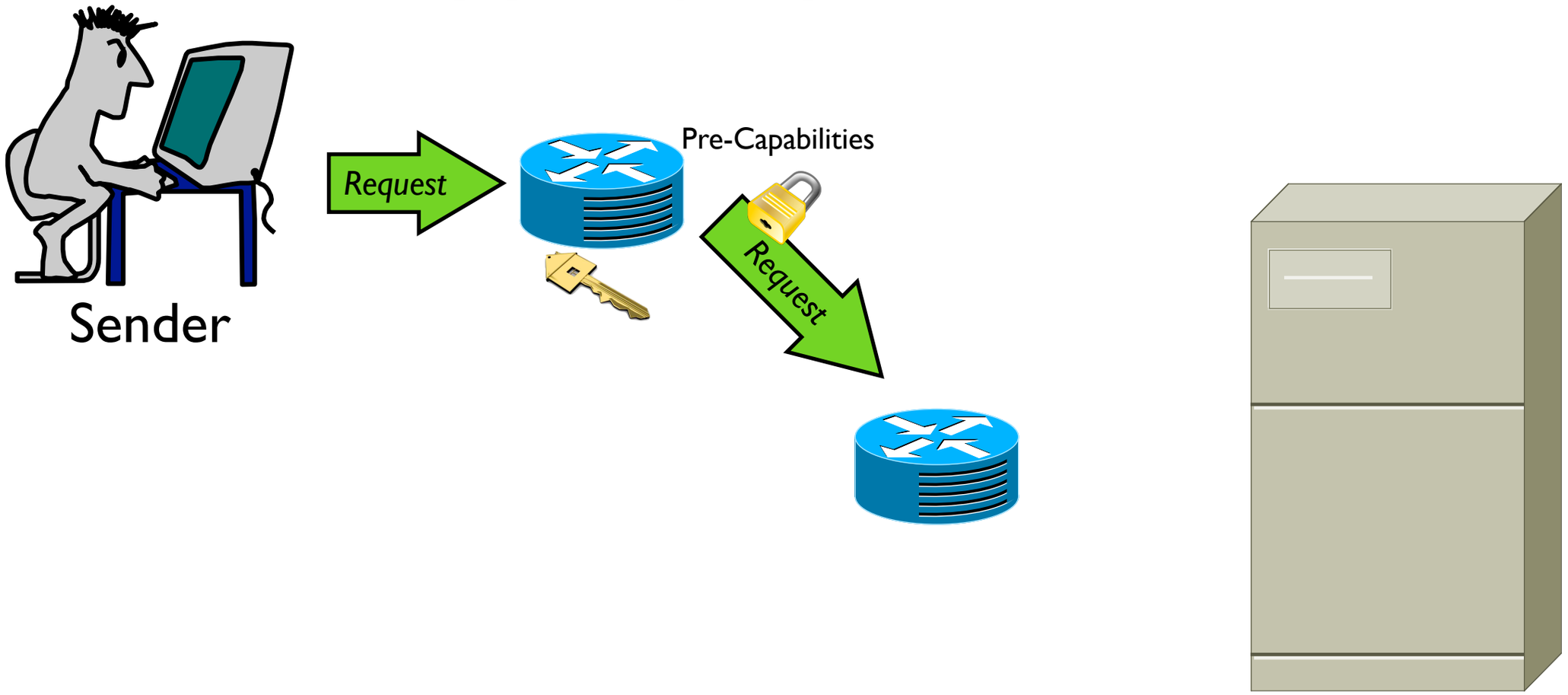
Sender





Receiver

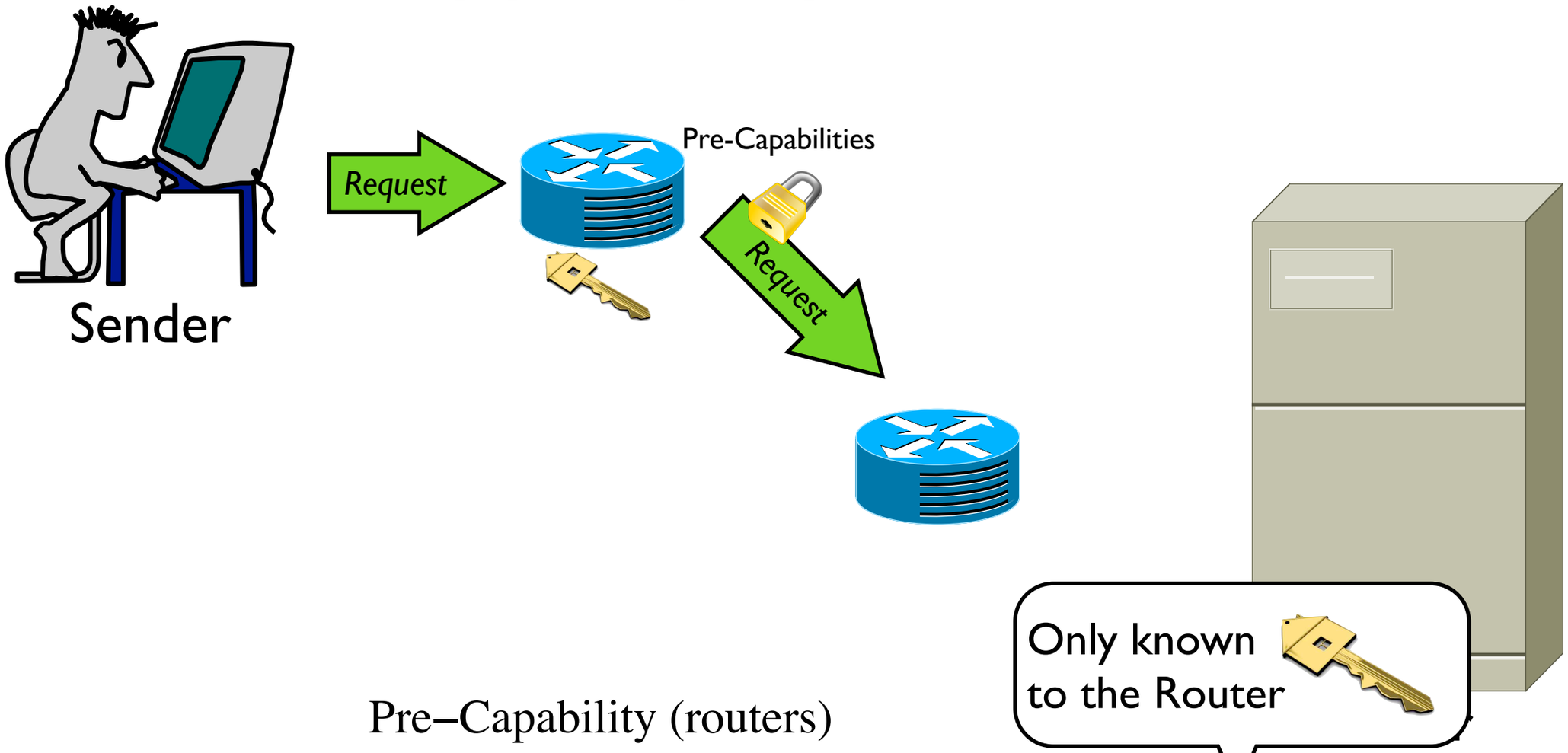
Solution:
Cryptographic Hash



Pre–Capability (routers)

timestamp (8 bits)	hash(src IP, dest IP, in iface, out iface,time, secret) (56 bits)

Solution:
Cryptographic Hash



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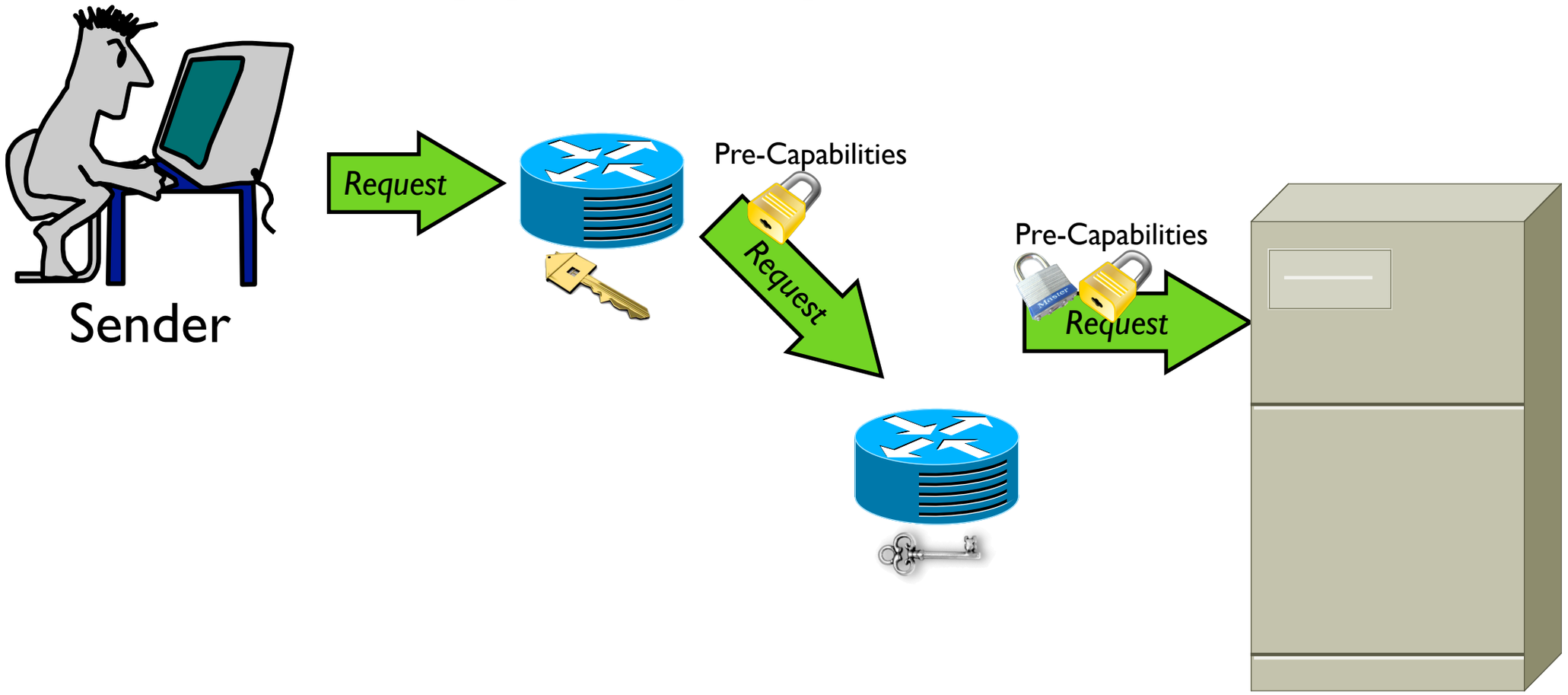

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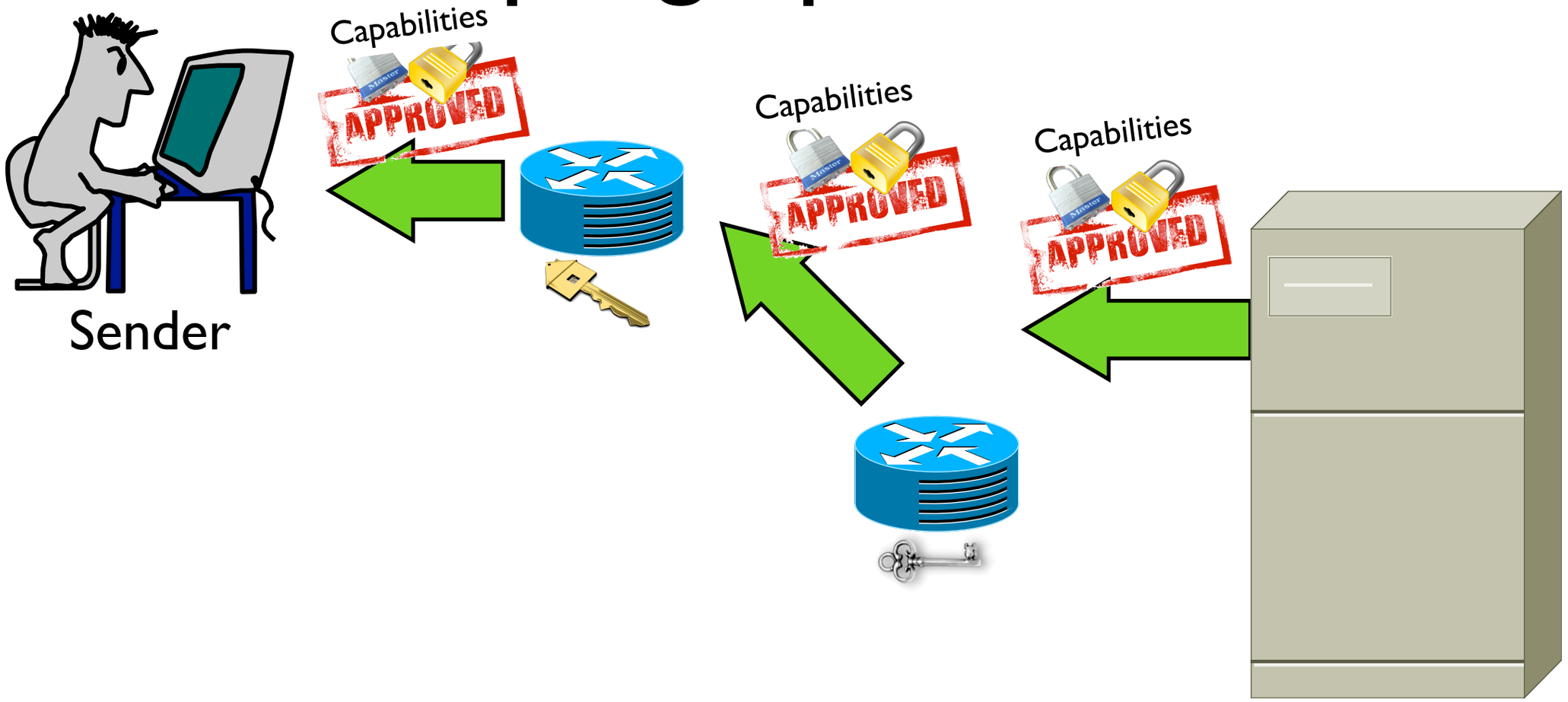

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Capability (hosts)

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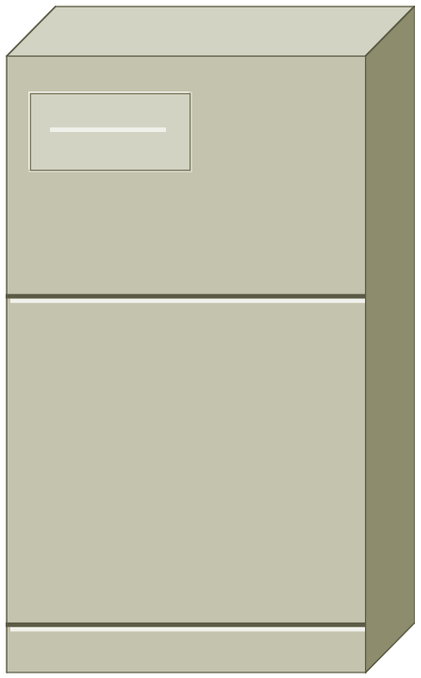

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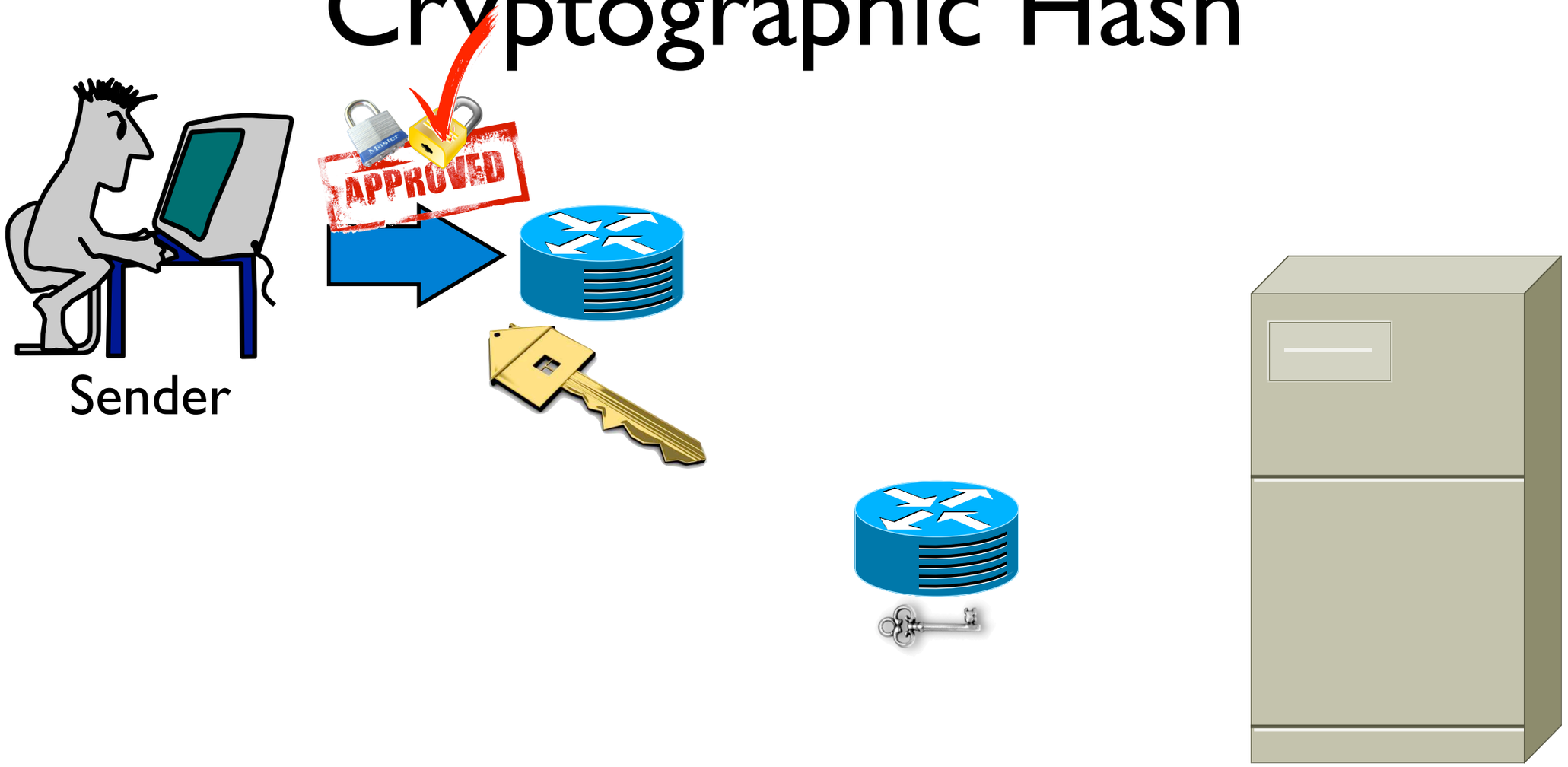

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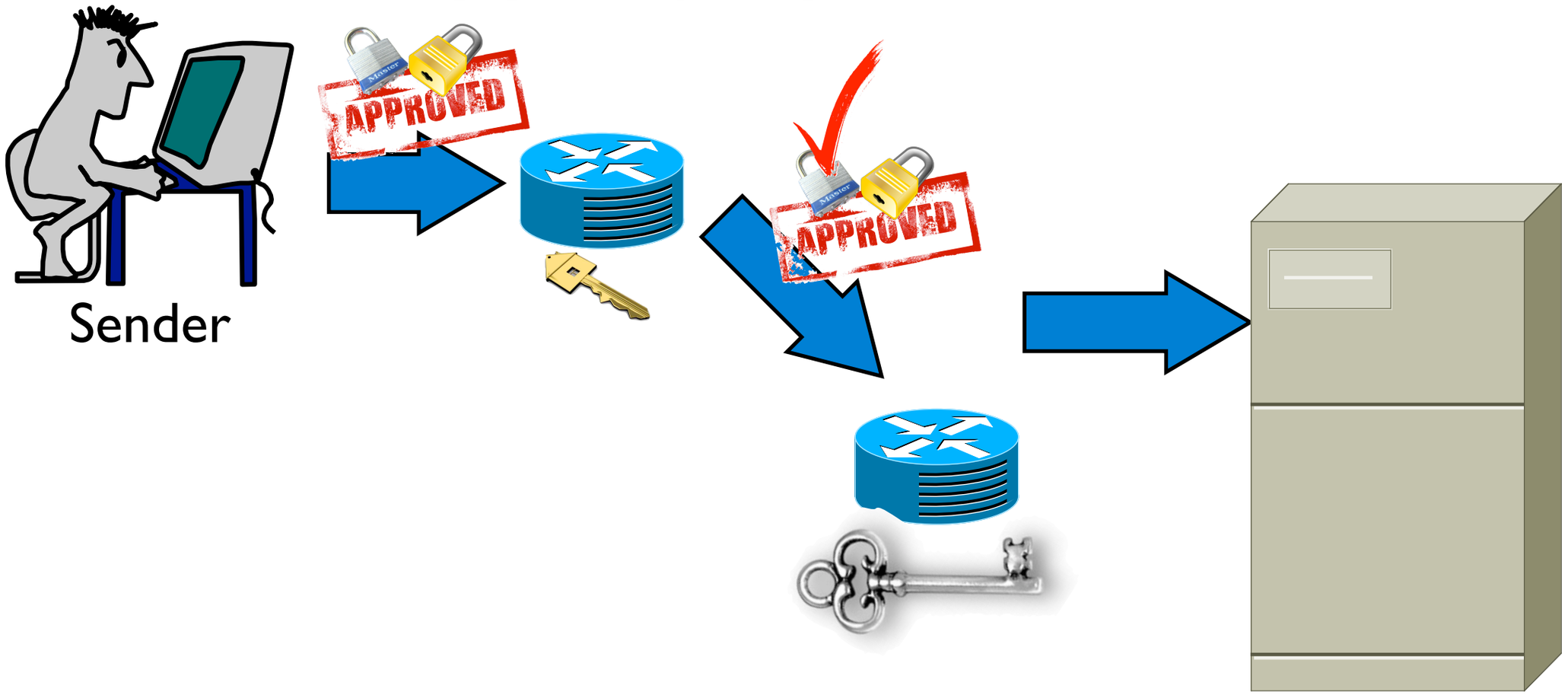

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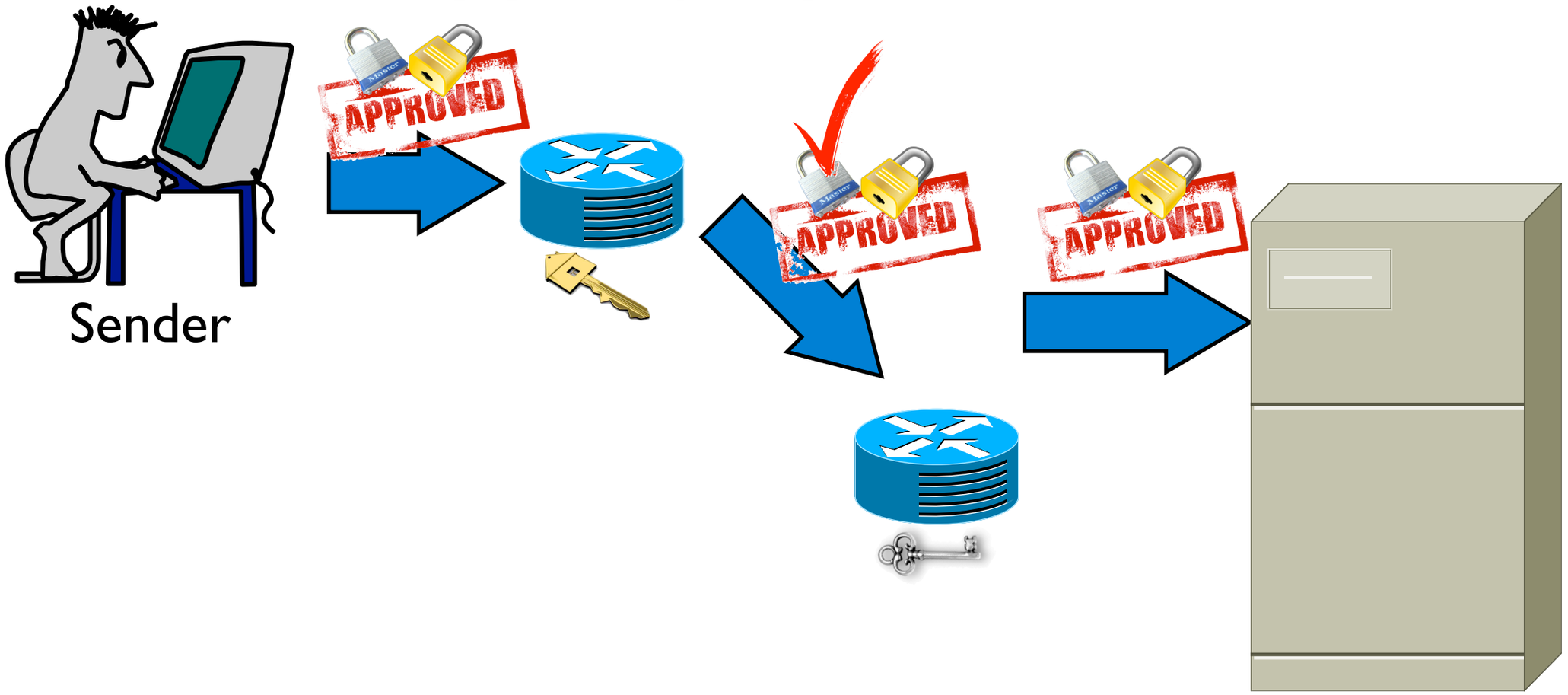

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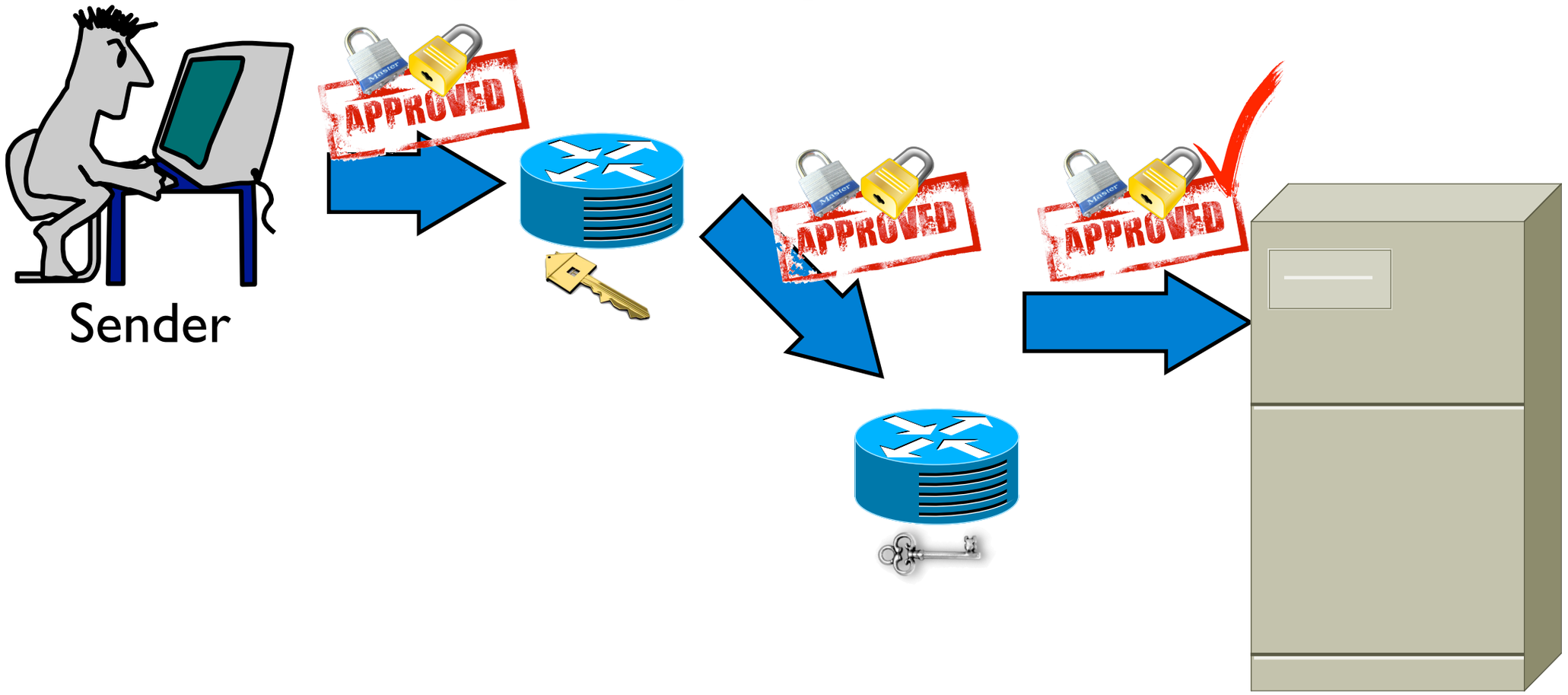

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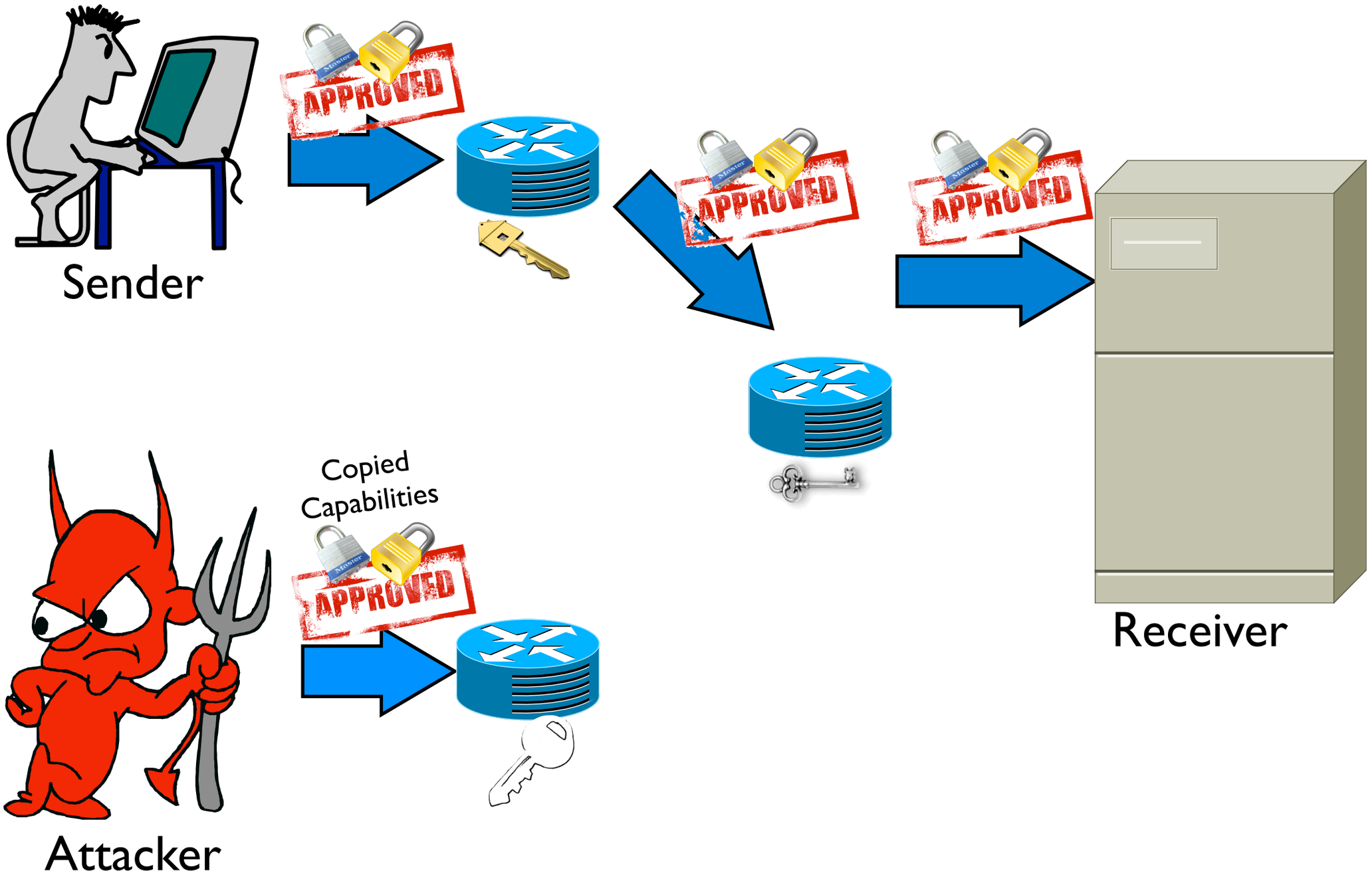

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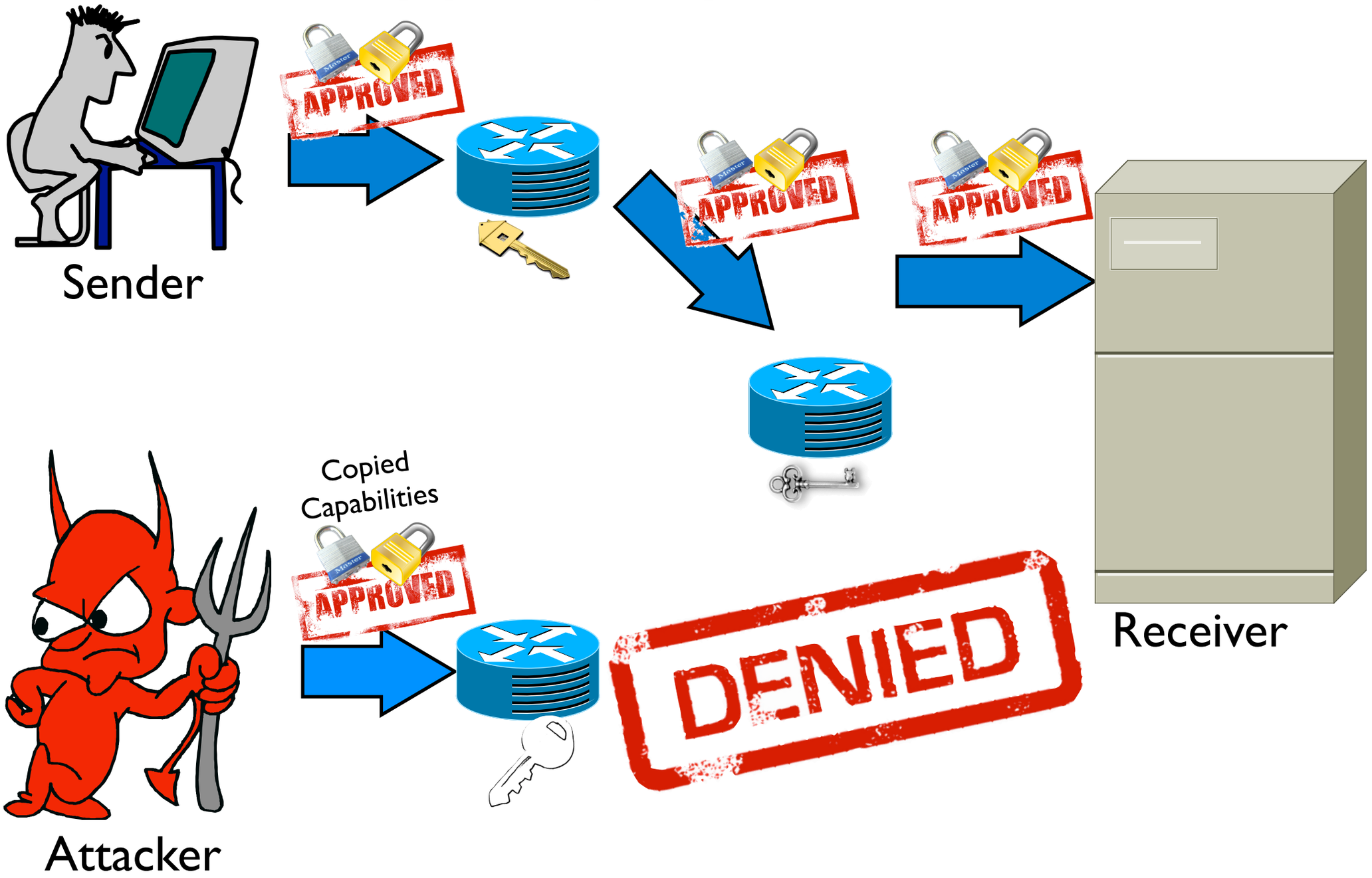
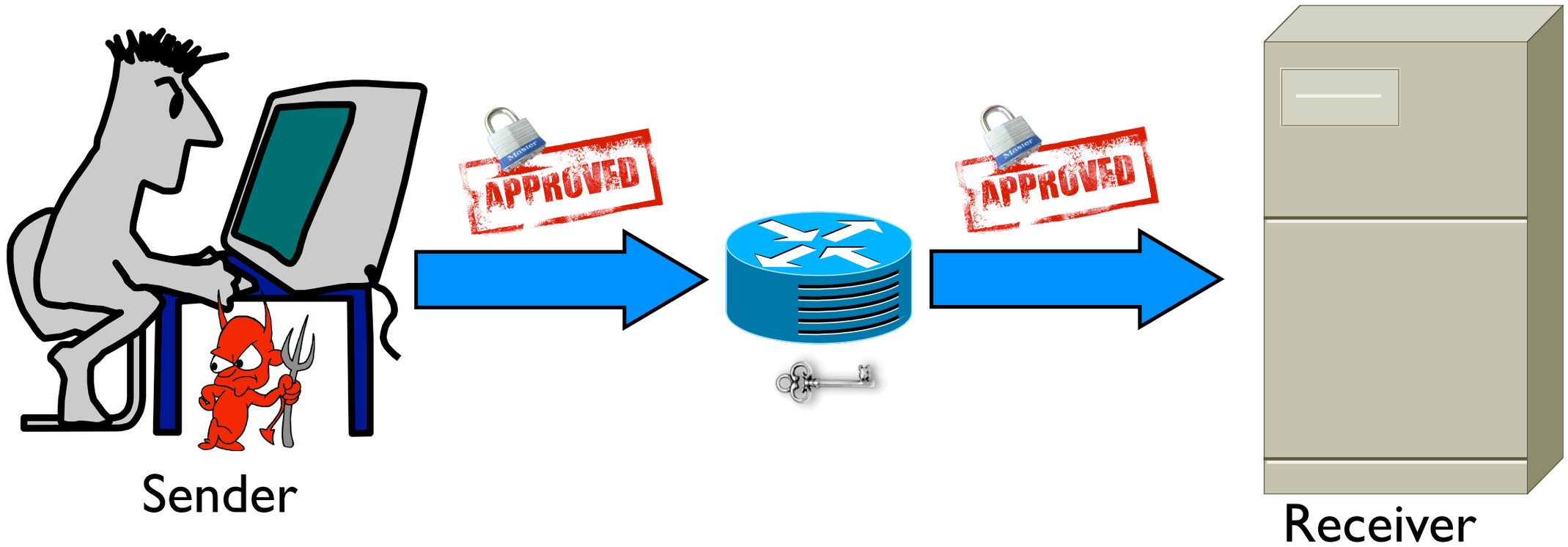
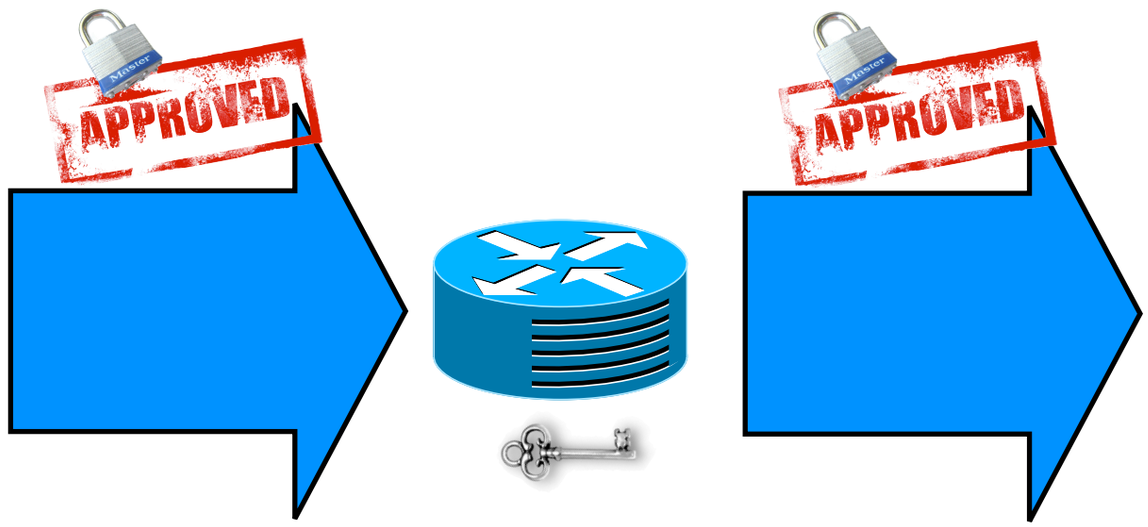


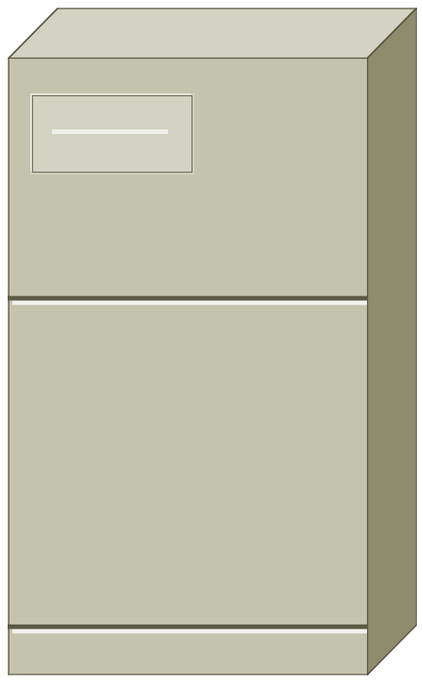
Challenge:
Abuse Capabilities



Challenge:
Abuse Capabilities

Attacker



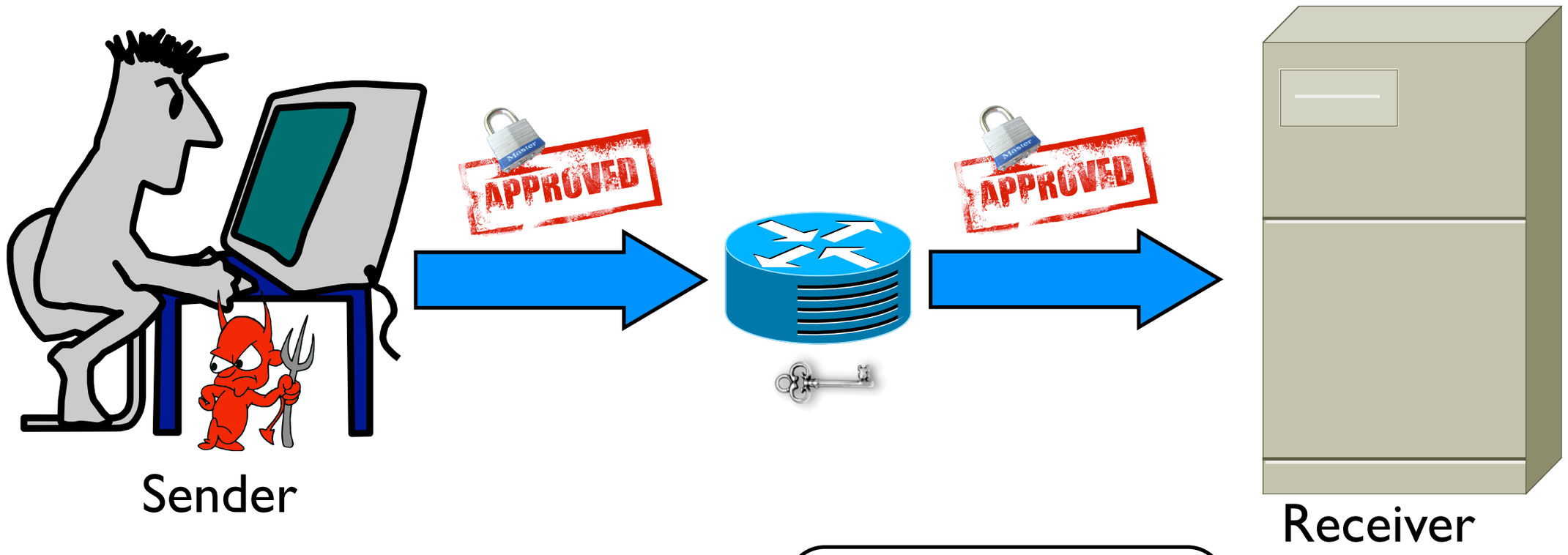


Receiver

DoS Attack!

Solution:

Limit the Amount of Data & Period of Validity



Capability (hosts)

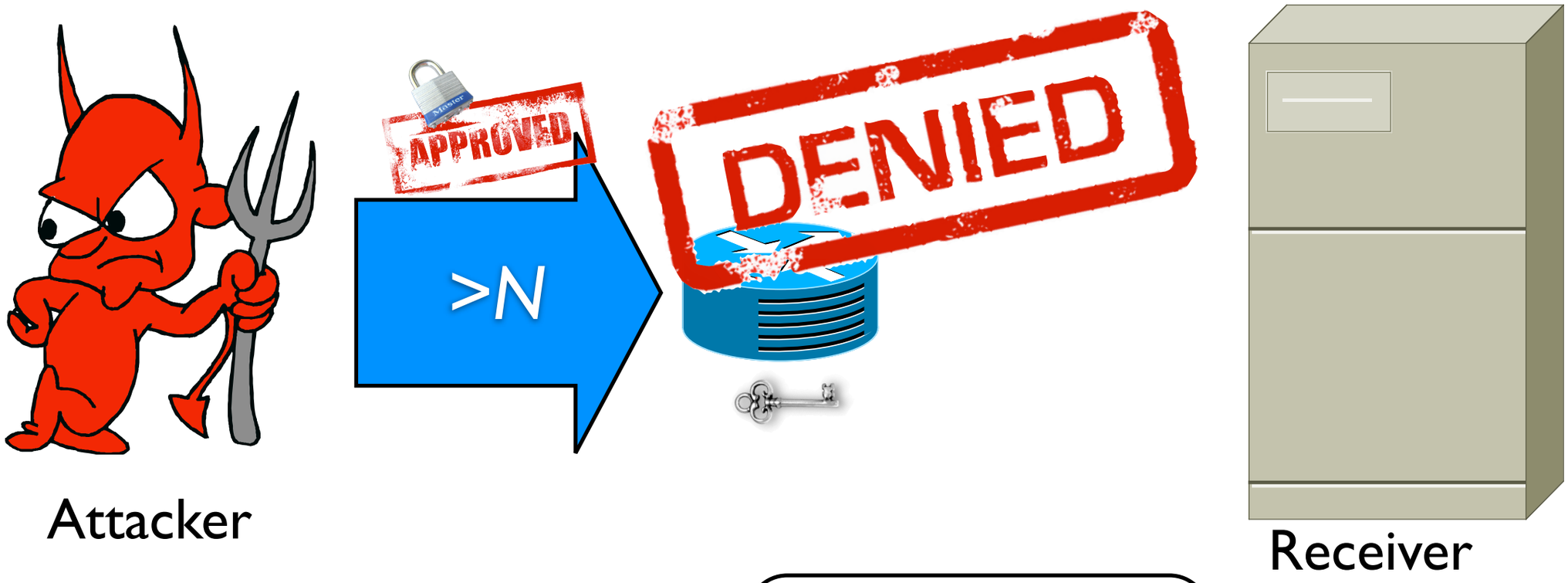
the Amount of Data

timestamp (8 bits)	hash(pre−capability, N, T) (56 bits)

the Period of Validity

Solution:

Limit the Amount of Data & Period of Validity



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Solution:

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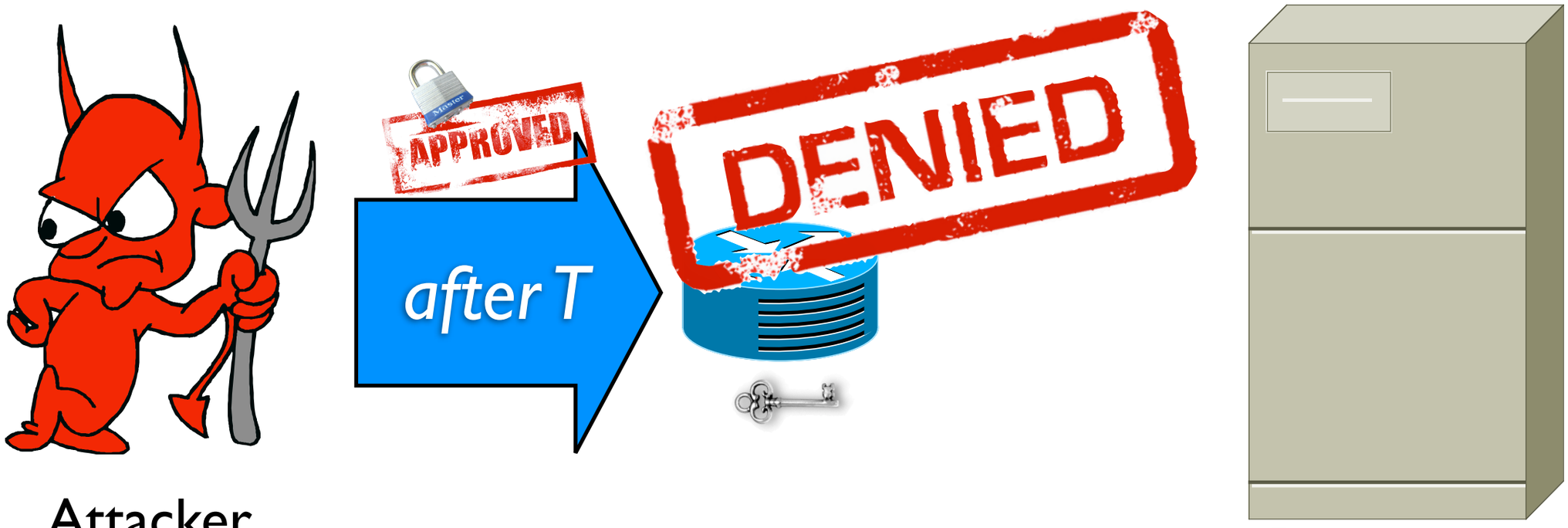
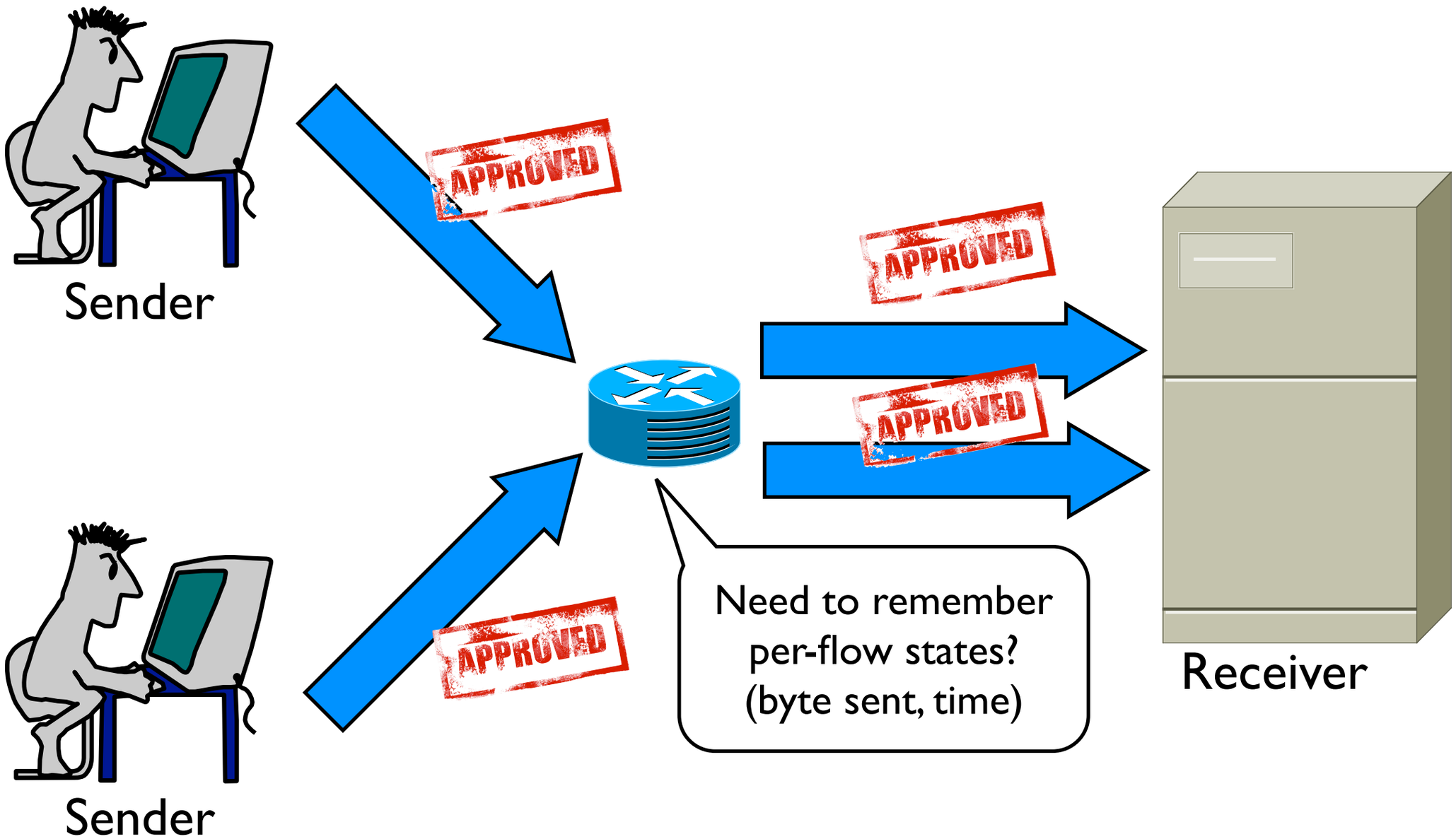


Capability (hosts)

timestamp (8 bits)	hash(pre–capability, N, T) (56 bits)

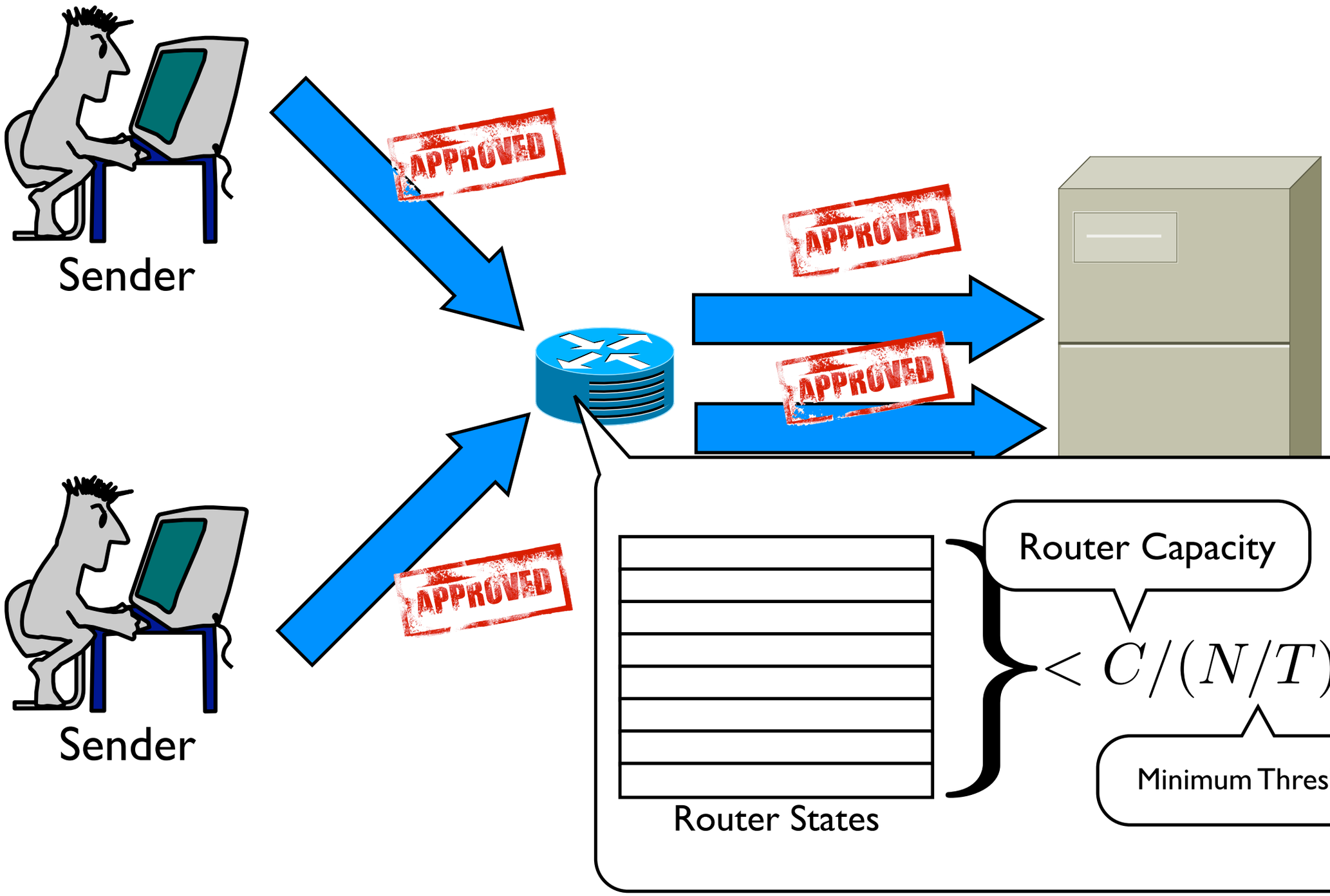
the Period of Validity

Challenge:
Router States



Solution:

Keep state only for flows that send >N/T



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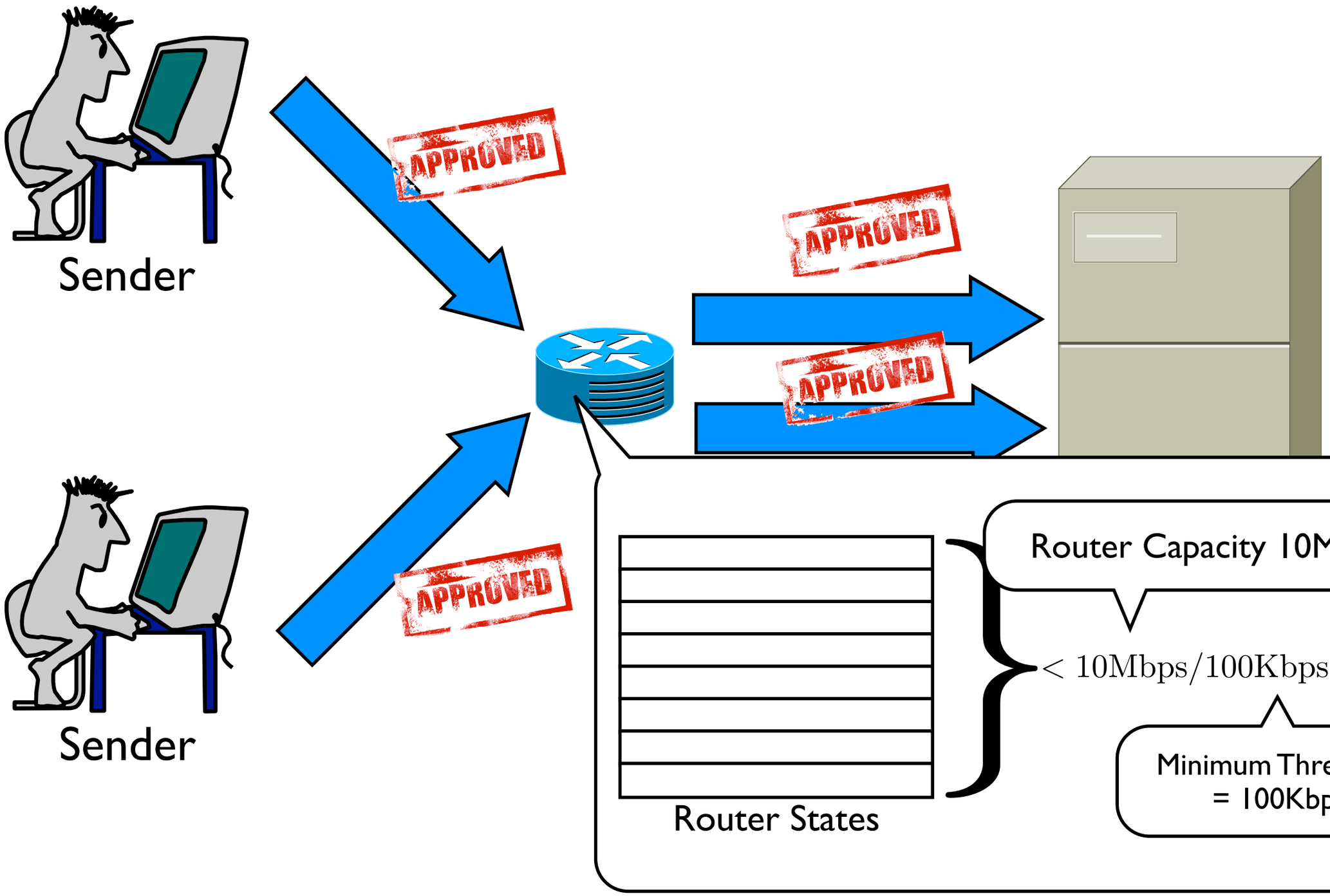
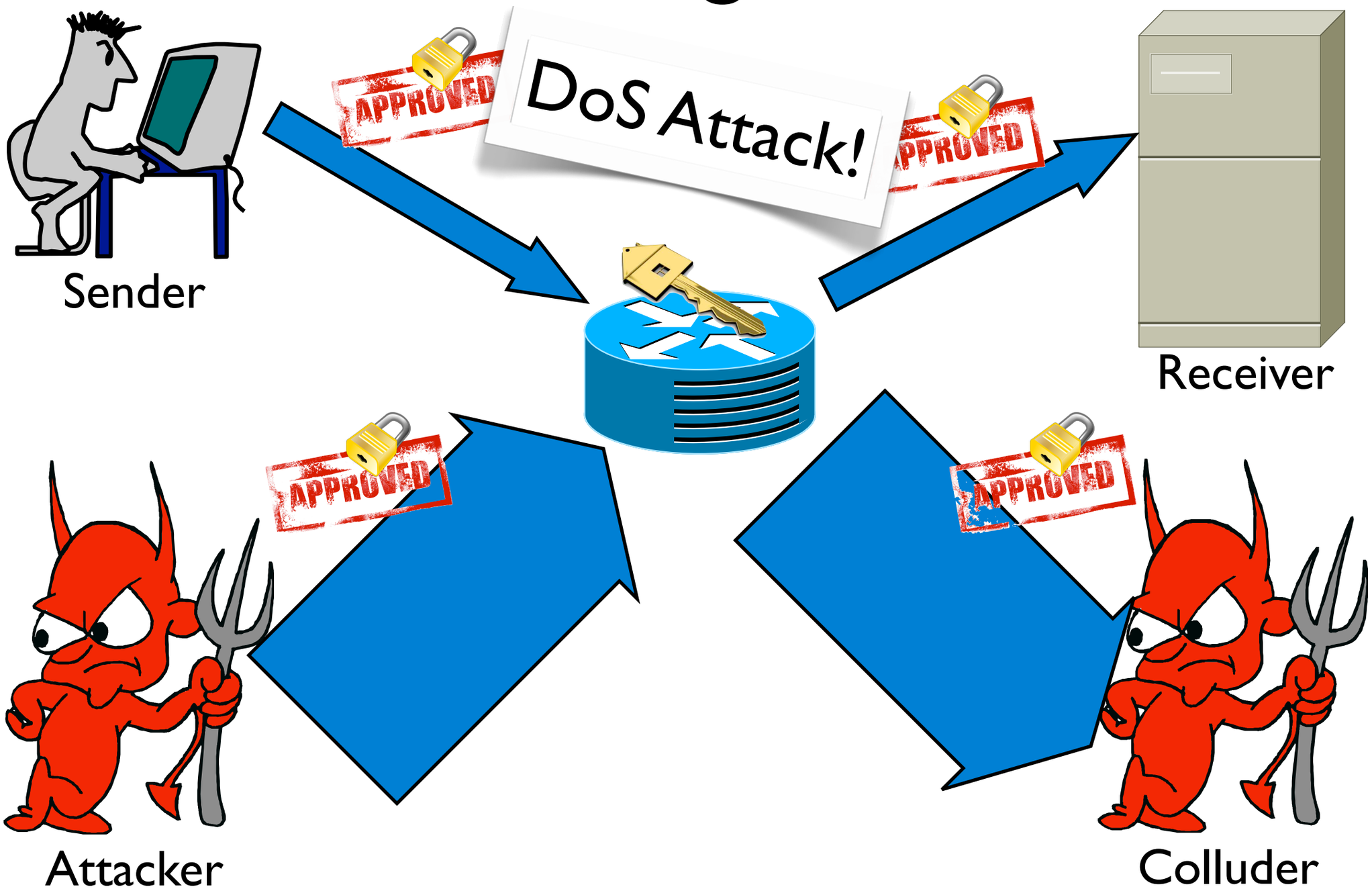
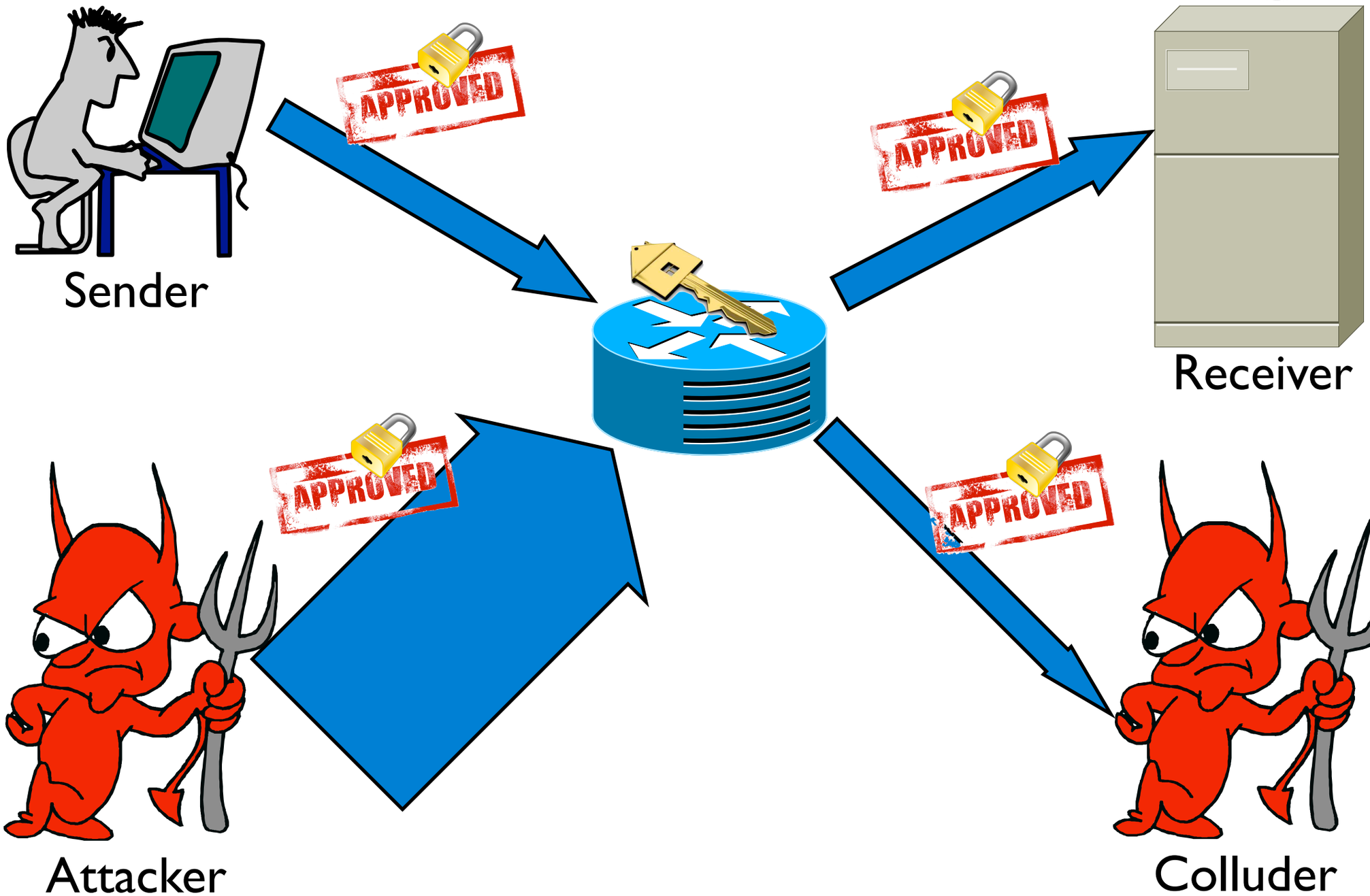


Challenge:
Colluding Attack



Solution:

Per-Destination Fair-Queuing



Summary:
Fair-Queuing of TVA Router

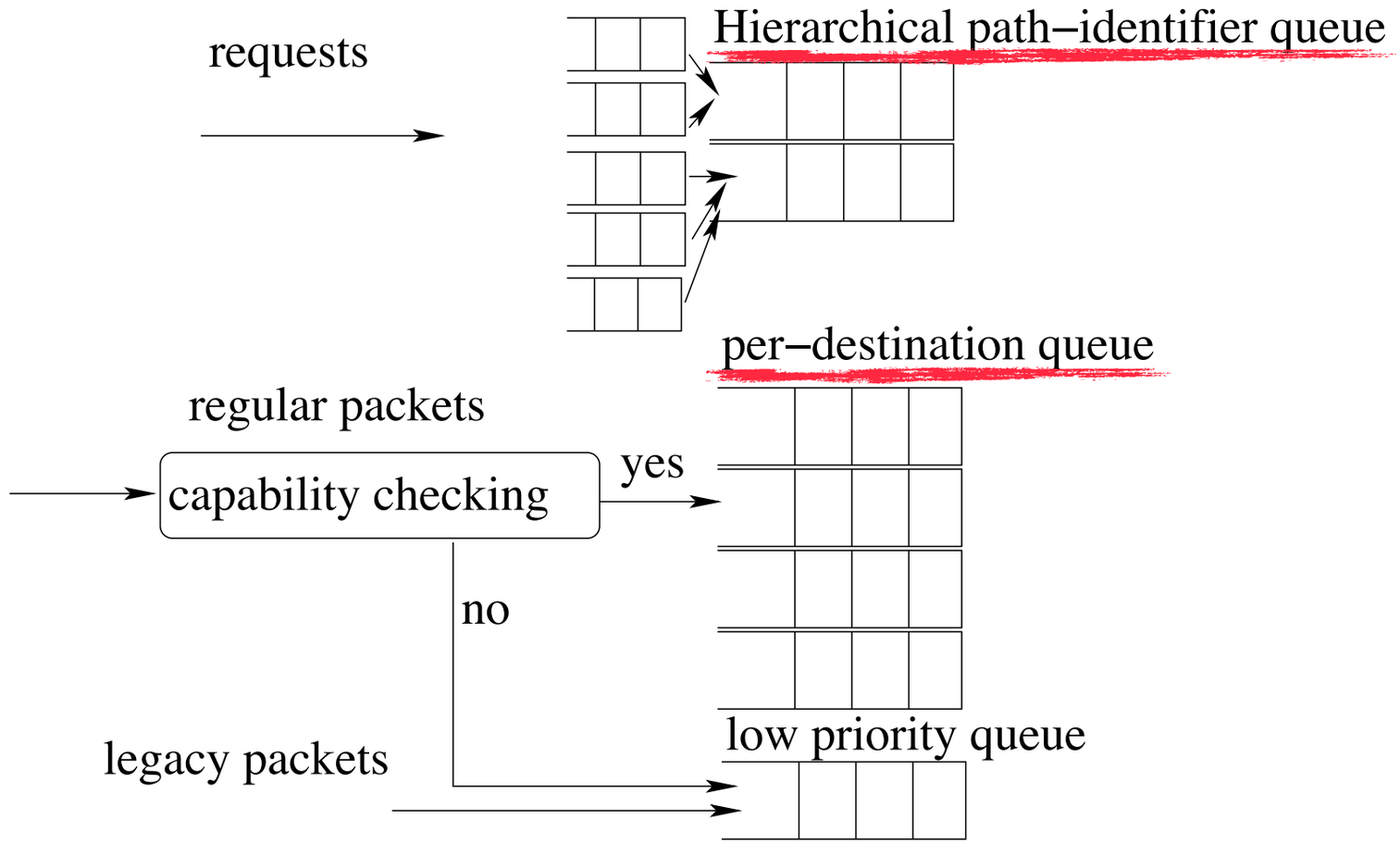


Fig. 2. **Queue management at a capability router. There are three types of traffic: requests that are rate-limited; regular packets with associated capabilities that receive preferential forwarding; and legacy traffic that competes for any remaining bandwidth.**

3

Discussions

Discussion

- Possible alternative End-to-End solutions?
- Incremental deployment issue when considering legacy internet traffic as low-priority?
- Work for DDoS attacks as well?
- Work well in the Internet-scale topology?