



TechEX · October 2026

Load balancing FreeRADIUS

Keeping EAP sessions together, and a sneak peek at the tools we're building.

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IN THE BEGINNING...

there was RADIUS.

Then came FreeRADIUS.

25+ YEARS OF DEVELOPMENT

It can do almost anything

...and this is a partial list.



SO EVERYONE USES IT

**But only a few high priests really
understand it.**

WHY IT'S HARD

It's a RADIUS engine, not a “shrink wrapped” product

What we ship

Multiple protocols, multiple backends, multiple combinations, and a policy language to wire them all together.

What most people want

One button which says “do what I want”.

That's why there's a lot to learn.

Me trying to connect my FreeRADIUS server to LDAP



You can get help.

WHO WE ARE

We wrote FreeRADIUS.
We still maintain it.
And we help people run it.

InkBridge Networks · building FreeRADIUS since 1999

TODAY

Topics we'll cover

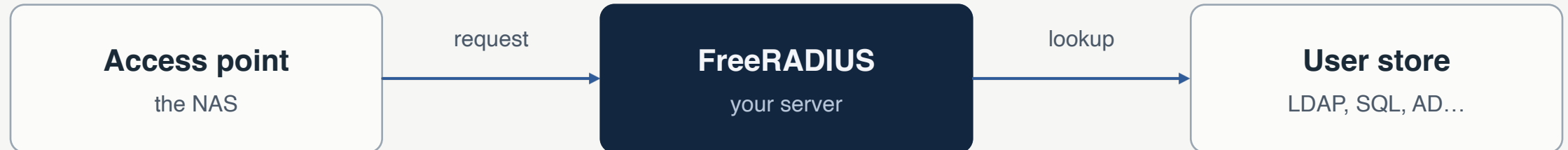
01 Load balancing RADIUS, and keeping EAP sessions together

02 A sneak peek at the new tools we're working on

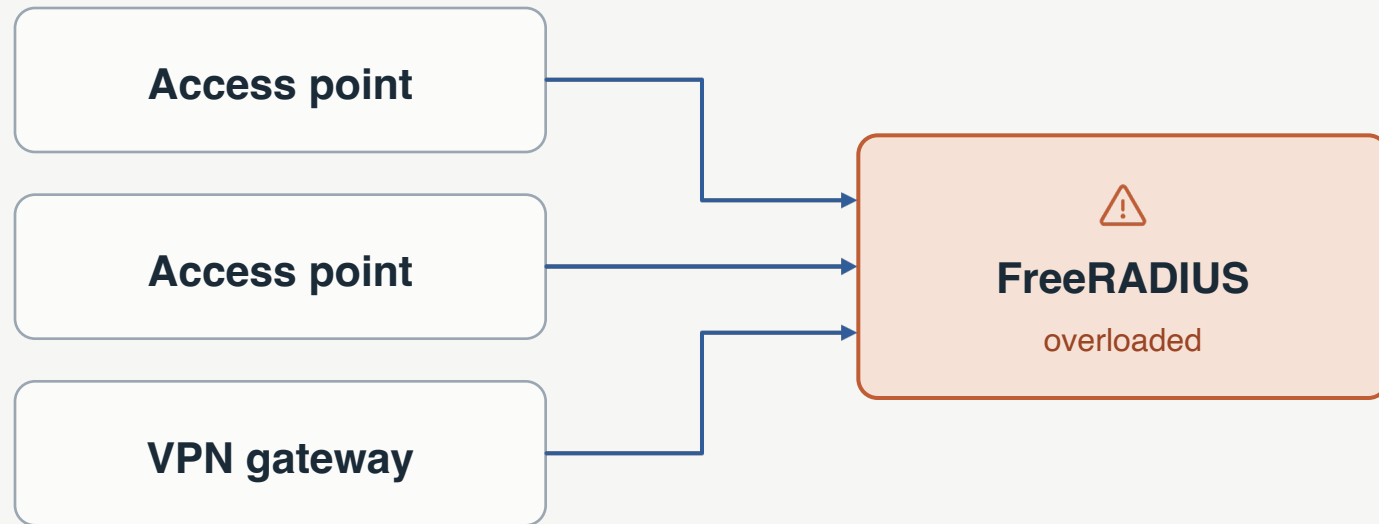
01 · LOAD BALANCING · SHOW OF HANDS

Who here runs a load balancer in front of their RADIUS servers?

You want to use RADIUS for network auth



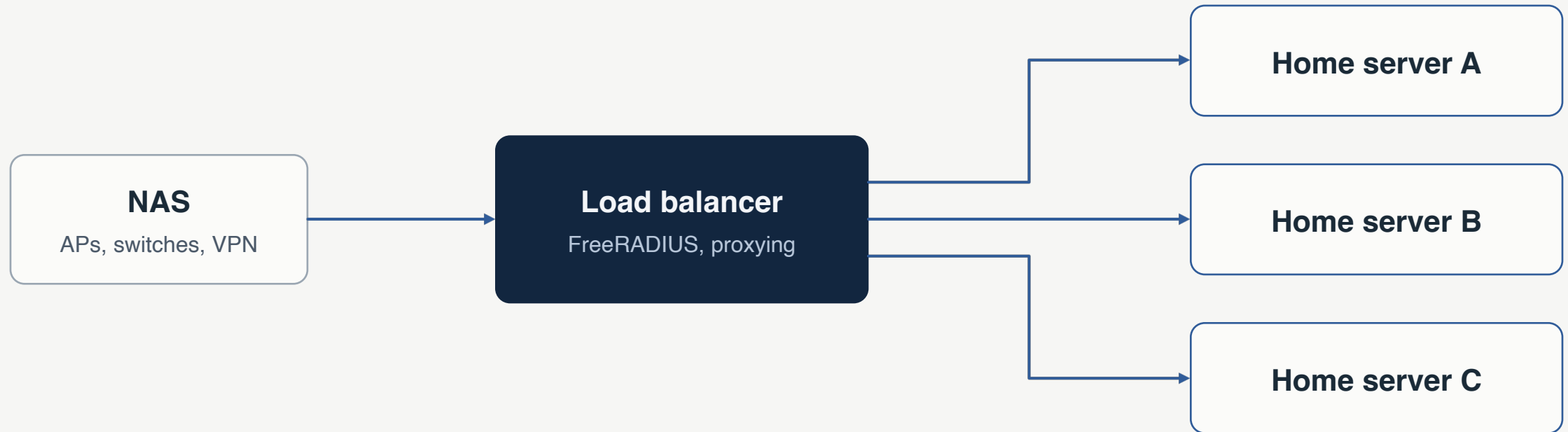
Then, your server gets overloaded



Timeouts. Retransmits. Users who can't get online.

So you add servers, and a load balancer

But load balancing is hard. **How do you split the load?**



What do the RFCs say?

Clearly there is guidance, right?

Retry and fallback algorithms are the topic of current research and are not specified in detail in this document.

RFC 2865 (June, 2000)

Three ways to split the load

OPTION 1

Round robin

Each request goes to the next server in line.

A, B, C, A, B, C...

OPTION 2

Keyed

Hash a key to pick the server.
The same key always lands on the same server. Not bad!

keyed-balance

client-balance

client-port-balance

$\text{hash}(\text{key}) \% N$

OPTION 3

Dynamic

Pick the server with the lowest load, based on outstanding requests. Auto-tunes for fast and slow home servers.

load-balance

fewest outstanding wins

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load-balance

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The next request goes to the least busy server

Outstanding requests: sent, not answered yet



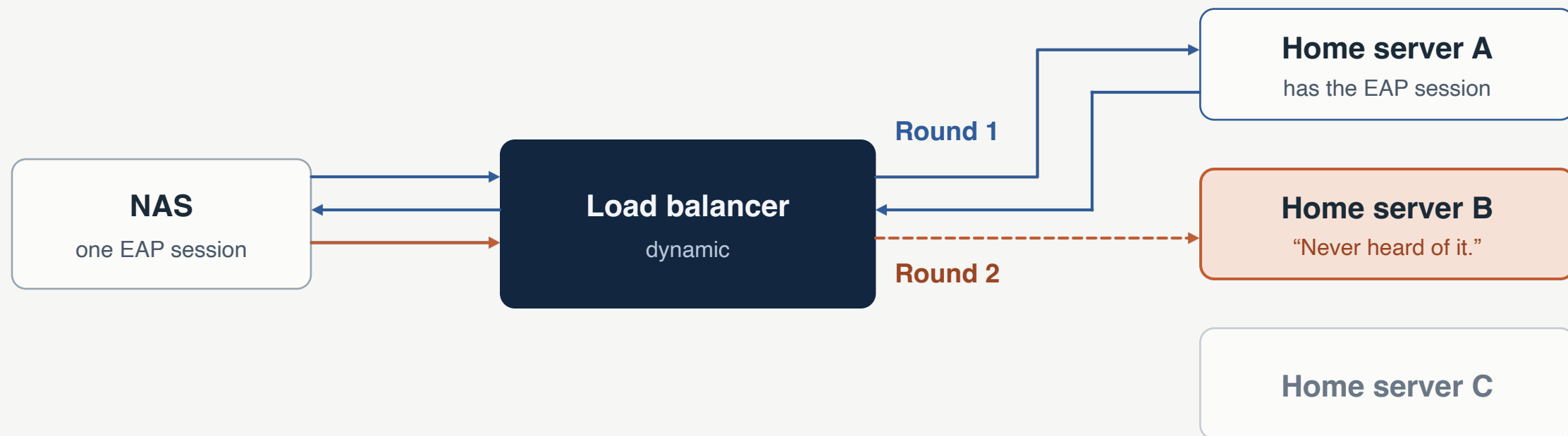
A failed server looks busy, so traffic moves away

Outstanding requests: sent, not answered yet



Per-packet load balancing doesn't work for EAP

EAP uses multiple round packets, and all packets have to go to the same server.



What are you to do?

Go back to keyed?

`hash(key) % N`

Sessions move, even on healthy servers.

Track every session?

session	server
3f9a...	A
c71e...	B
08bd...	A
...	...

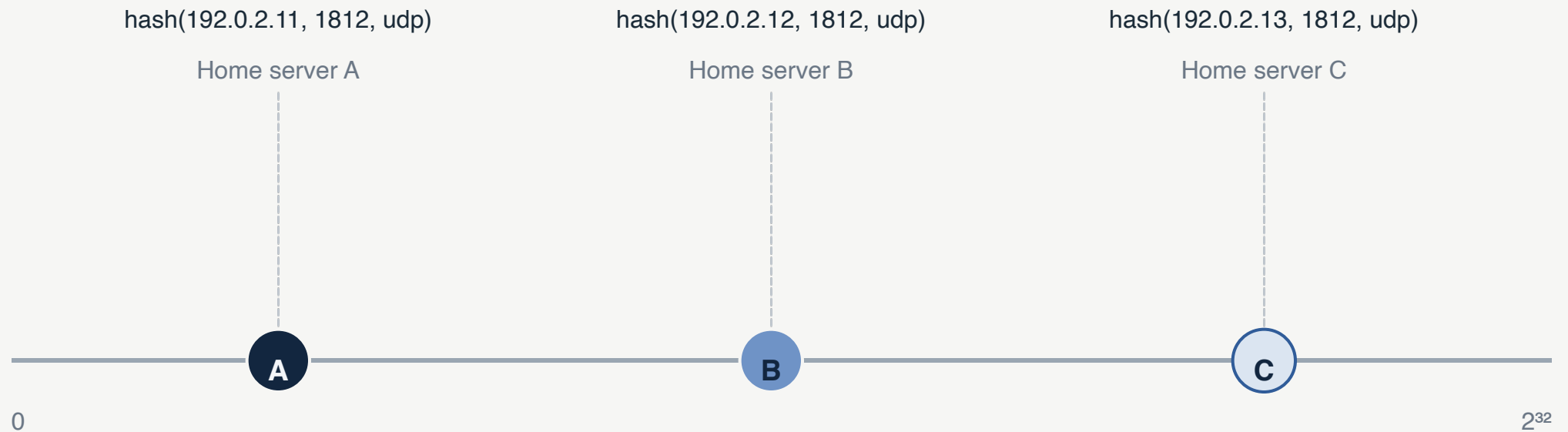
State for every session, in the load balancer.

SO, THE SOLUTION YOU LAND ON IS...

**Power down your servers, pack
up, and go home.**

Better method “consistent hashing”

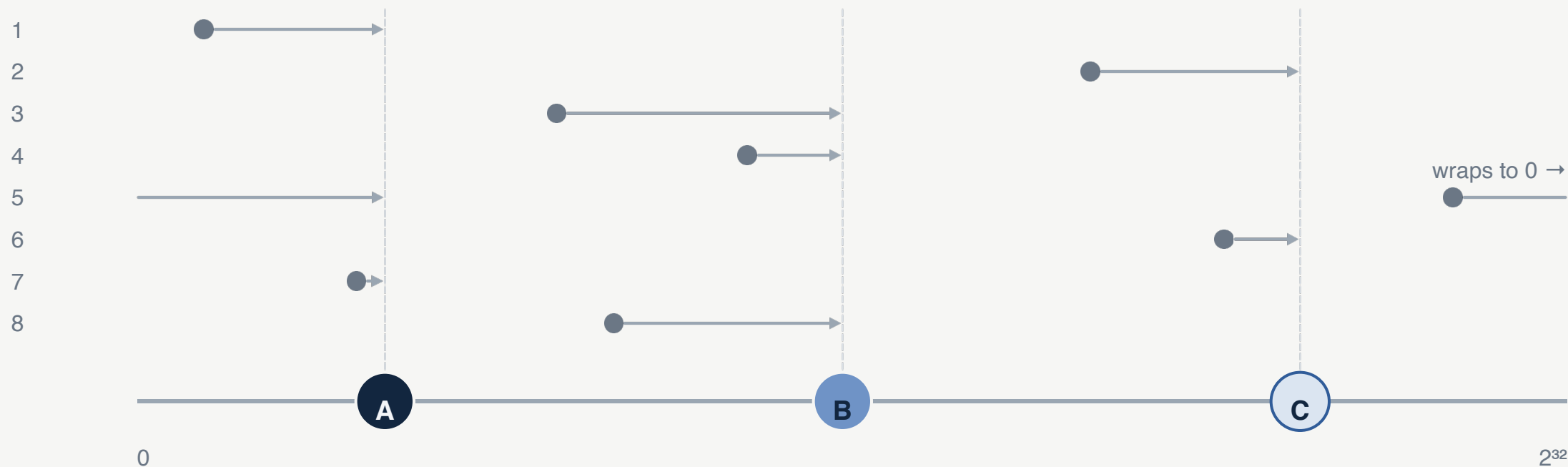
Same key, same server. No session table.



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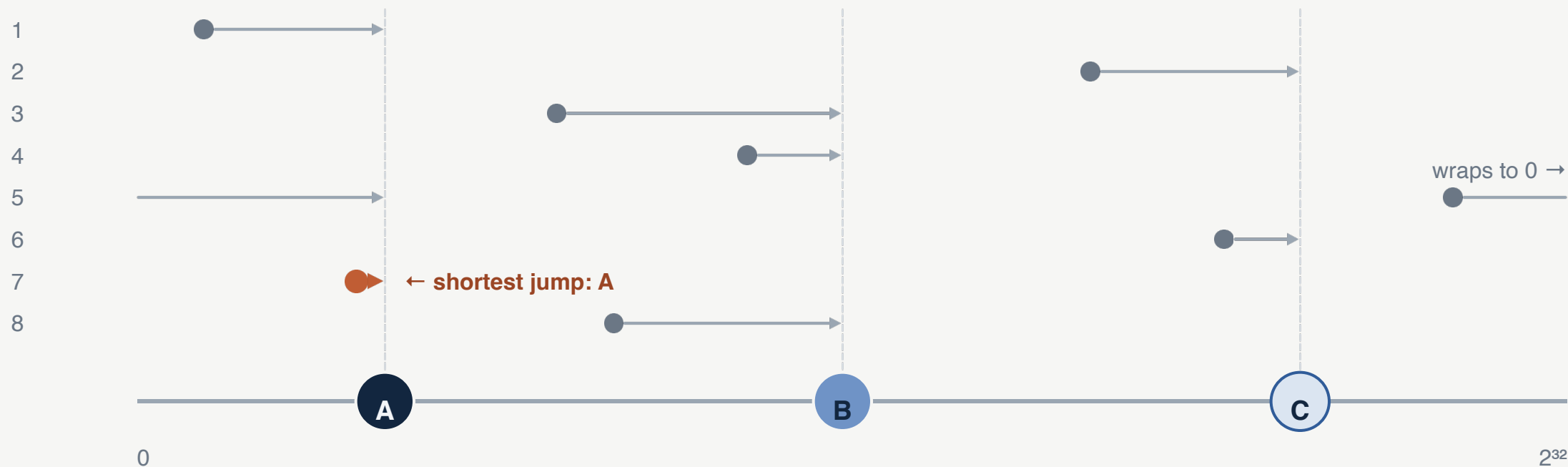
$$\text{key}_i = \text{hash}(\text{Calling-Station-ID}, \text{seed}_i)$$



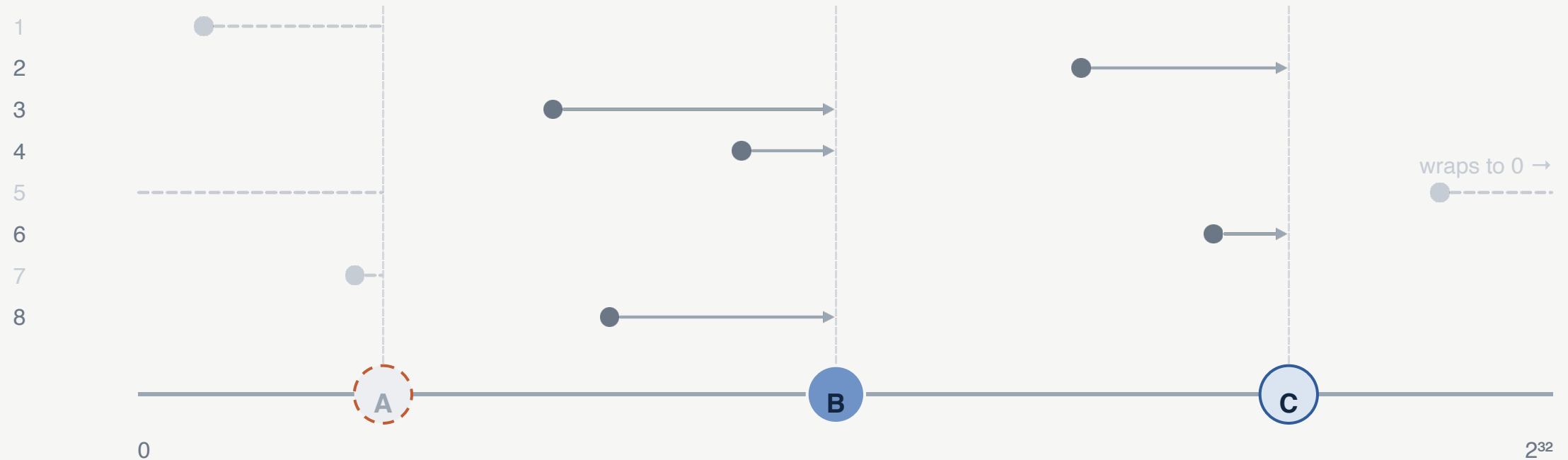
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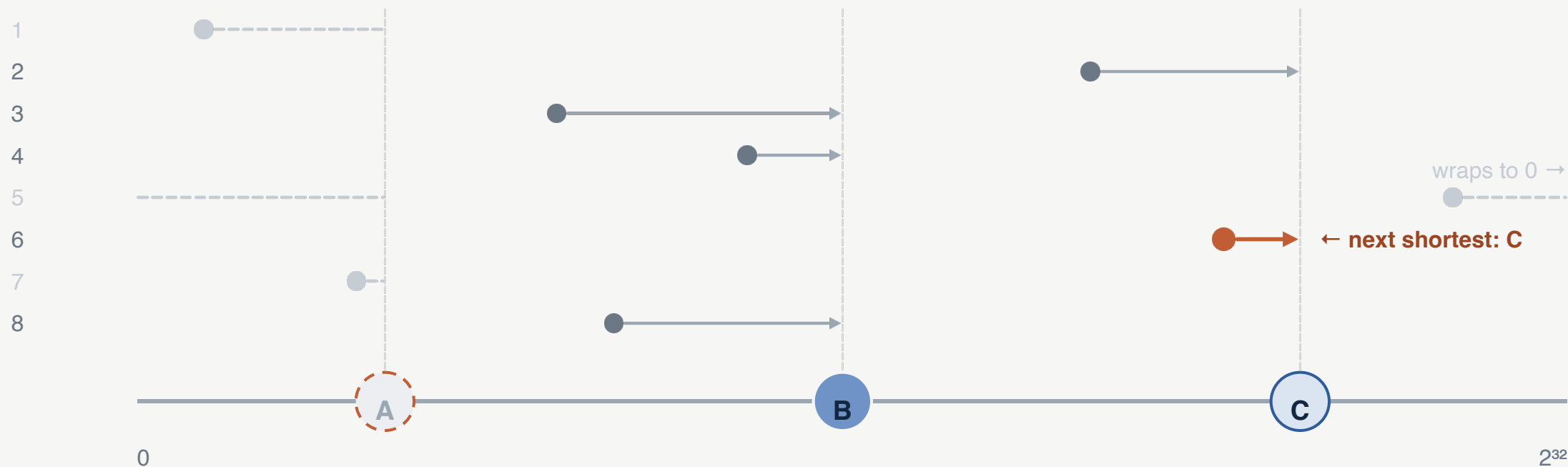
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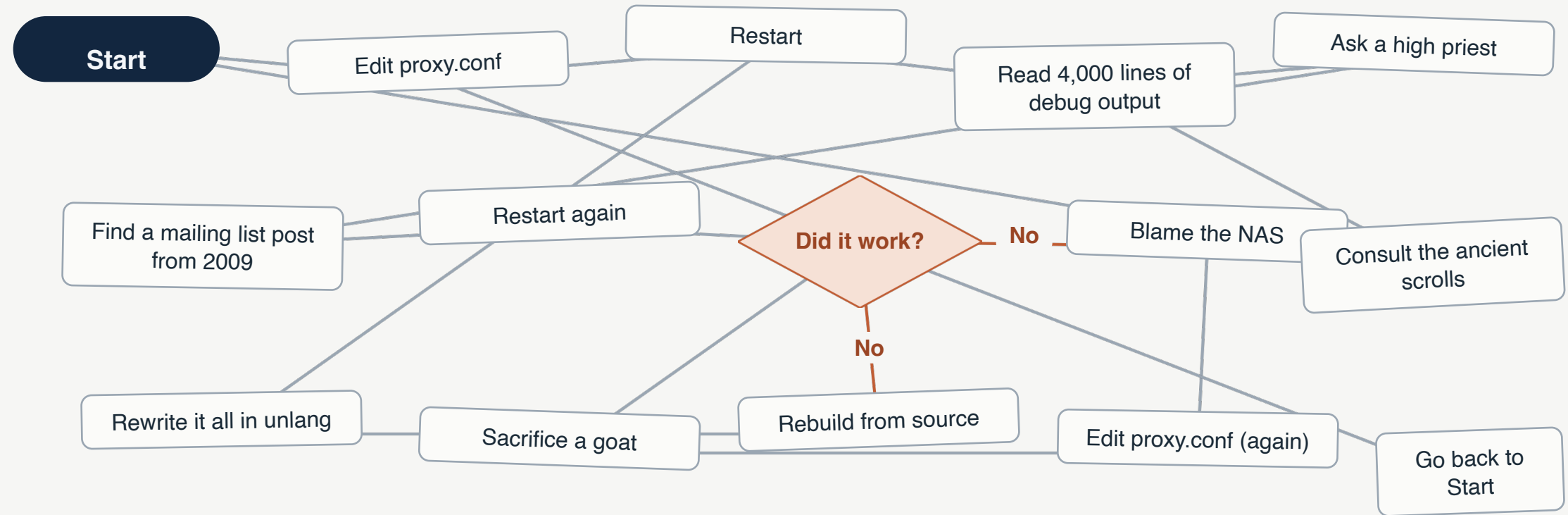
When a home server fails, nothing moves



When a home server fails, nothing moves



And here's how you configure it...



No. It's two lines.

proxy.conf

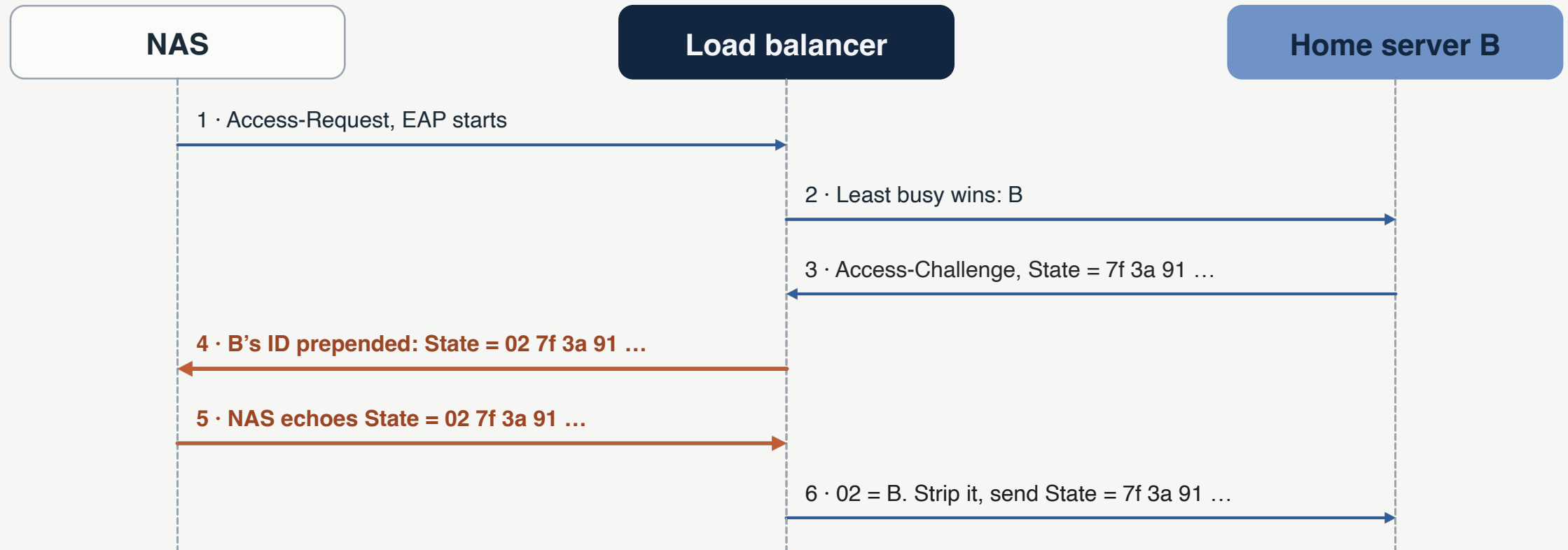
```
home_server_pool eap_pool {  
    type = consistent-keyed-balance  
    home_server = a  
    home_server = b  
}
```

your virtual server, before proxying

```
update control {  
    &Load-Balance-Key := "%{Calling-Station-ID}%{Called-Station-ID}%{User-Name}"  
}
```

But it could be even better...

Put the state in the packet



Also two lines.

proxy.conf, on the load balancer

```
home_server_pool eap_pool {  
    type = load-balance  
    track_home_server = yes  
    home_server = a  
    home_server = b  
}
```

Pick one: **consistent hashing**, or **dynamic plus affinity**.

Every EAP session is tied to a home server



**Dynamic and
consistent**



**Failures stay
contained**



Instant failover

SO, I PROMISED YOU...

A sneak peek

01 Load balancing RADIUS, and keeping EAP sessions together

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02 · TOOLS

So, you have the honour of operating a RADIUS server.

You shouldn't need to be a **high priest** to do it well.

AI won't save you

• • • AI assistant

Users get Access-Reject after the upgrade. How do I fix it?

Easy fix! Add this to your policy:

```
update control { Auth-Type := Accept }
```

OK, I made that change and restarted the server. Now it looks like we're letting EVERYONE online, regardless of password.

Good catch! You're right to call me out on that. That was a mistake on my part.

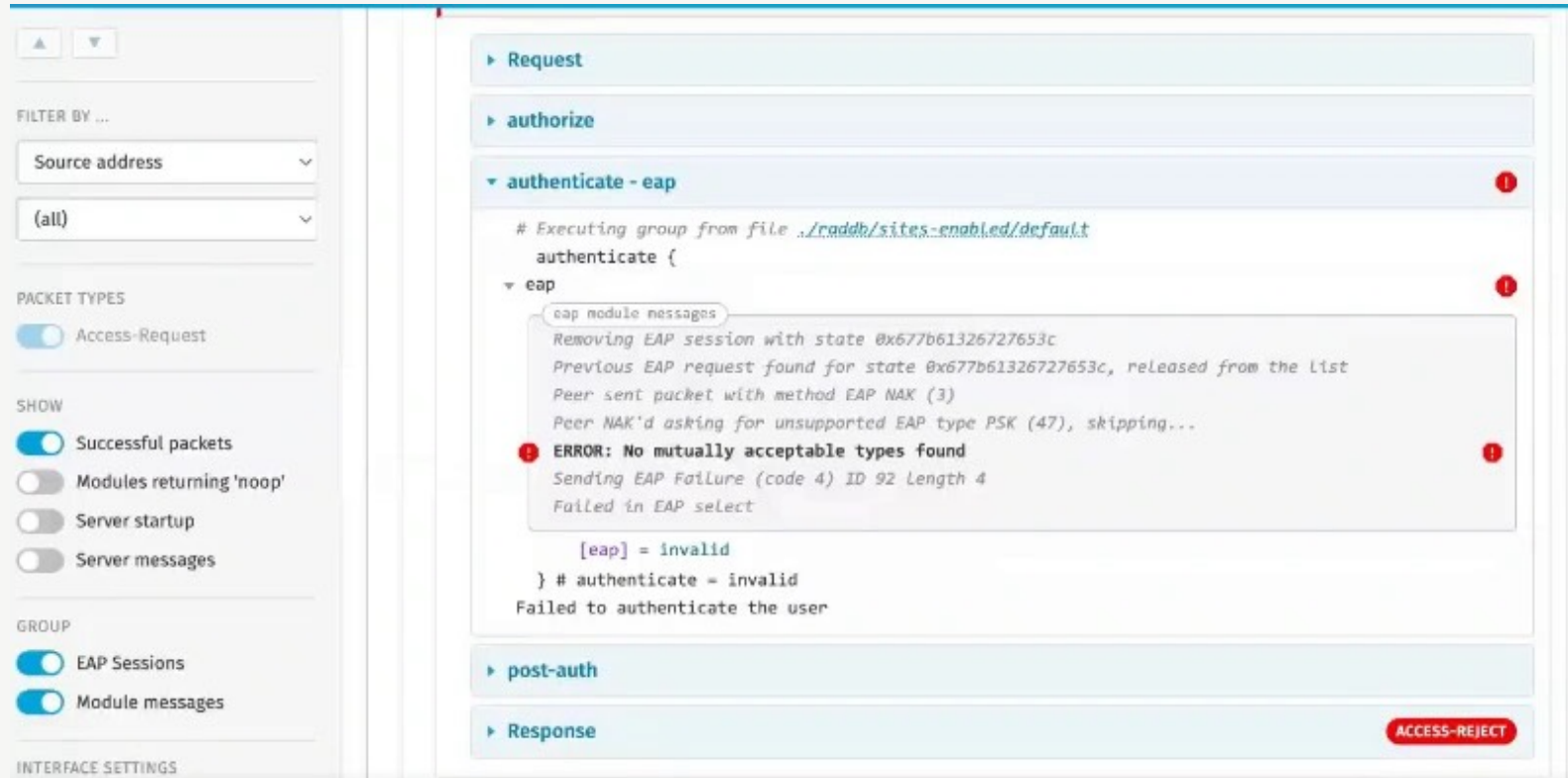
WHAT ARE YOU TO DO?!

InkBridge and the Inkquire tools to the rescue

Starting with...

02 · TOOLS · SPOTLIGHT

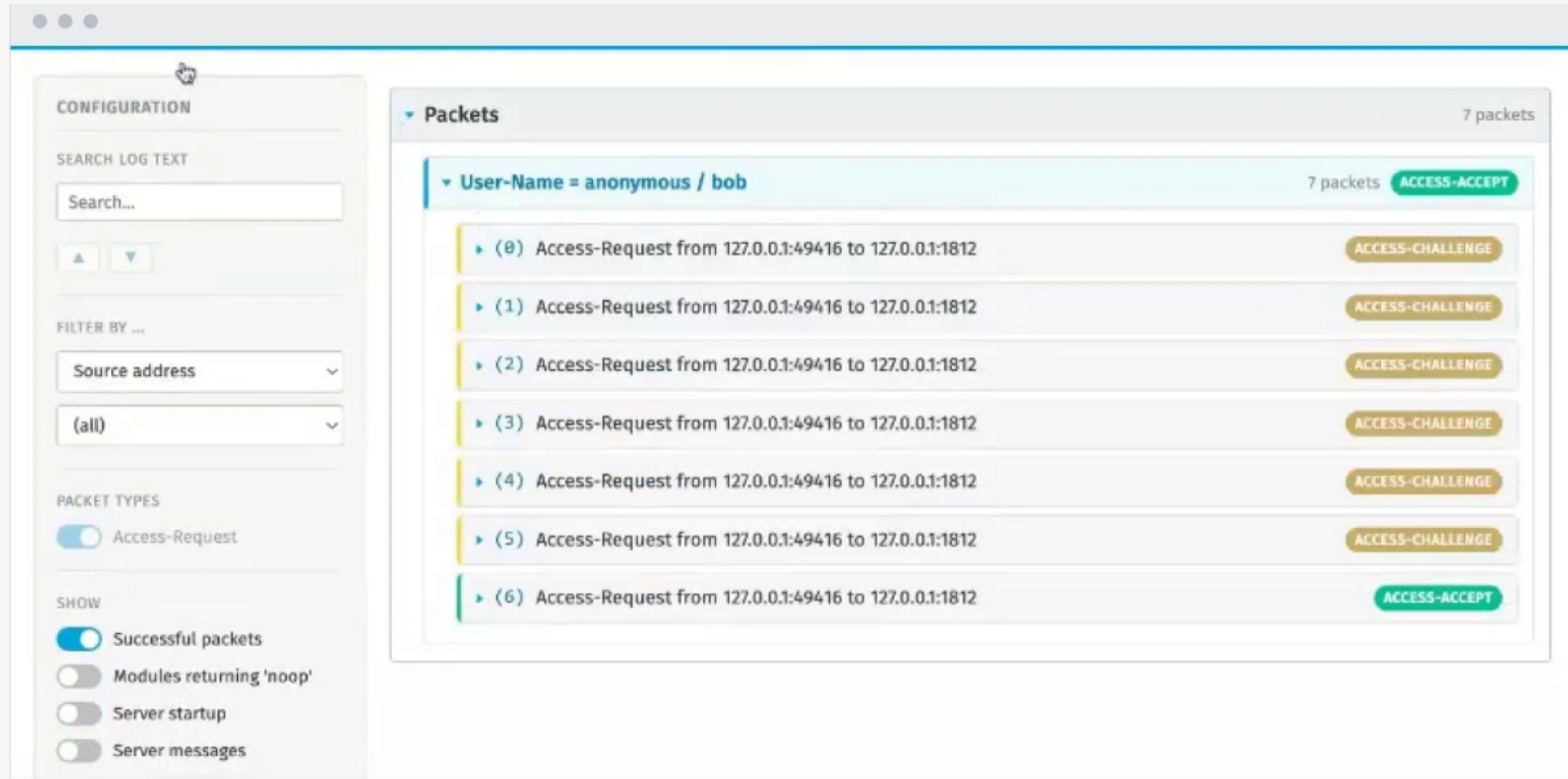
A GUI Debug viewer



The screenshot displays the InkBridge GUI Debug viewer interface. On the left sidebar, there are sections for 'FILTER BY ...' (Source address, (all)), 'PACKET TYPES' (Access-Request), 'SHOW' (Successful packets, Modules returning 'noop', Server startup, Server messages), 'GROUP' (EAP Sessions, Module messages), and 'INTERFACE SETTINGS'. The main panel shows a packet capture with a tree view on the left containing 'Request', 'authorize', 'authenticate - eap', 'post-auth', and 'Response'. The 'authenticate - eap' packet is expanded, showing a detailed log of the authentication process. The log includes messages such as 'Removing EAP session with state 0x677b61326727653c', 'Previous EAP request found for state 0x677b61326727653c, released from the list', 'Peer sent packet with method EAP NAK (3)', and 'Peer NAK'd asking for unsupported EAP type PSK (47), skipping...'. A red error icon is present next to the text 'ERROR: No mutually acceptable types found', followed by 'Sending EAP Failure (code 4) ID 92 Length 4' and 'Failed in EAP select'. The log concludes with '[eap] = invalid', '} # authenticate = invalid', and 'Failed to authenticate the user'. A red 'ACCESS-REJECT' button is visible at the bottom right of the main panel.

- 1 Organize the output
- 2 Find errors and solutions
- 3 Filter out noise

A GUI Debug viewer



4 Follow EAP sessions

5 Search the full output

Tools for troubleshooting, and for managing

Troubleshooting

iq capture	manage packet captures
iq client	act as a RADIUS client
iq debug	analyze debug output
iq discover	find information about your server
iq log	read and analyze logs

Configuring/Managing

iq config	read and write FreeRADIUS configs
iq convert	convert configs between FreeRADIUS versions
iq status	server and dependency health
iq anonymize	anonymize and de-anonymize data

100% local. No AI required.

THANK YOU

Questions?



Test the tools

starting with eduroam troubleshooting



Talk to us



Thank you

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