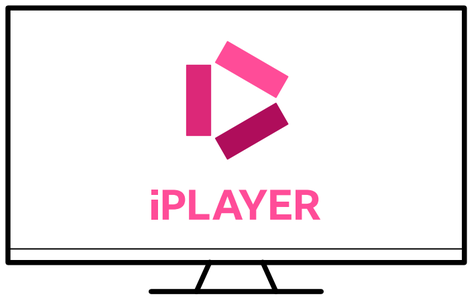
Towards a higher throughput media CDN

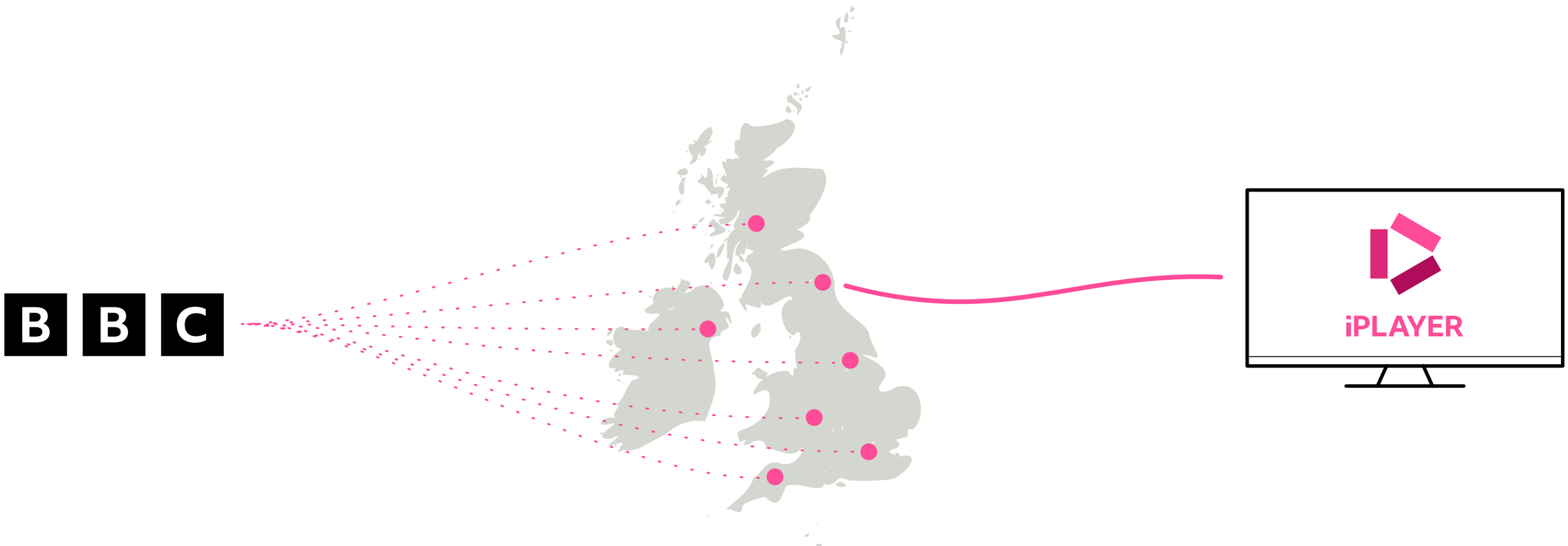
Jonathan Heathcote • BBC Research & Development • NetUK 2024

BBC

The BBC's Media CDN

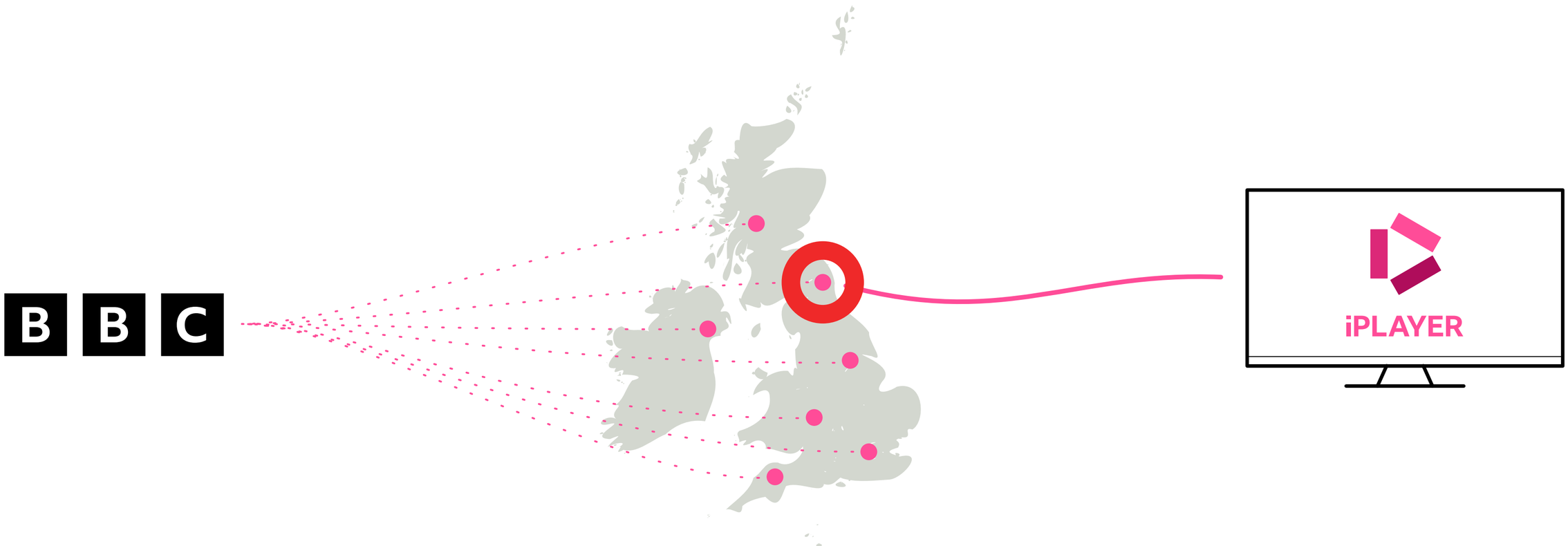


The BBC's Media CDN



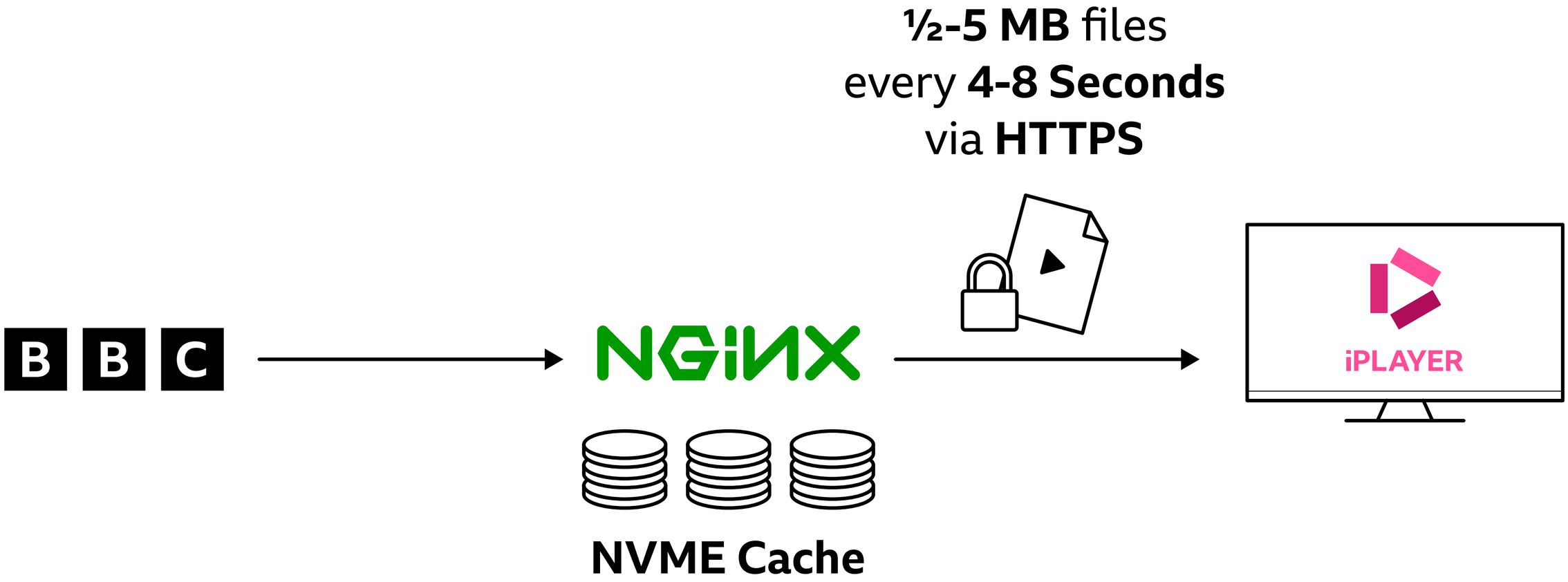
BBC

The BBC's Media CDN

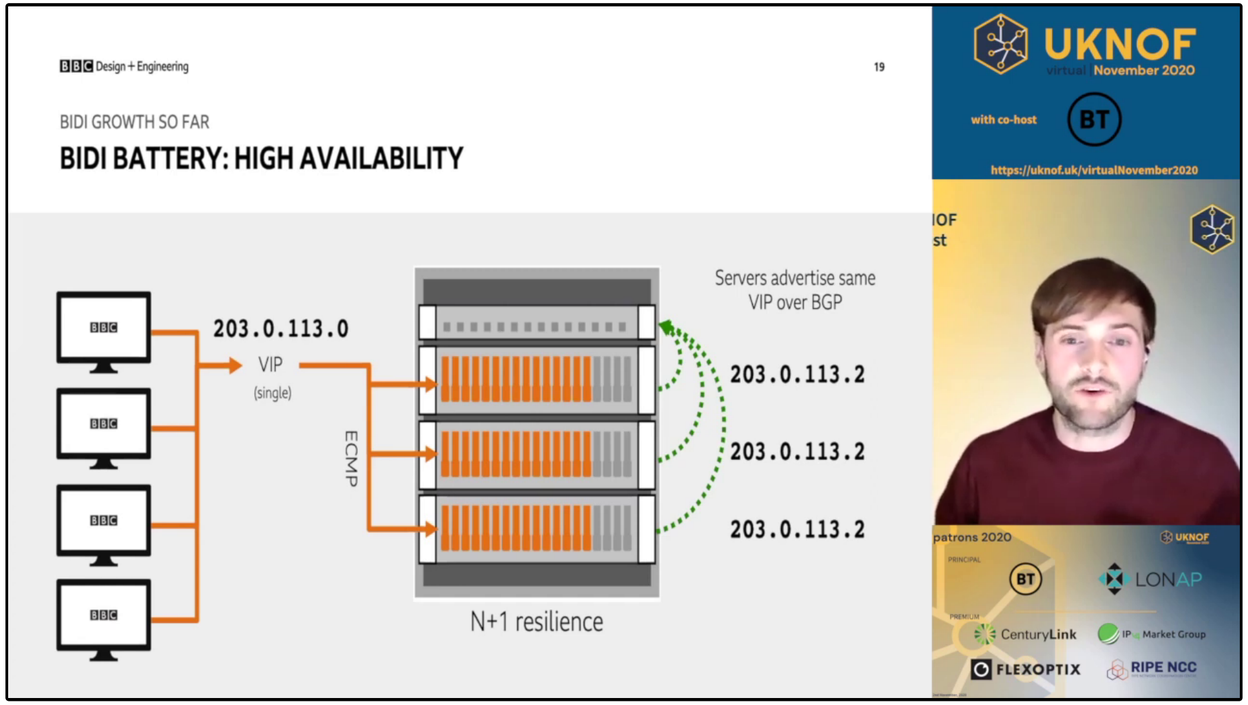


BBC

Edge cache workload

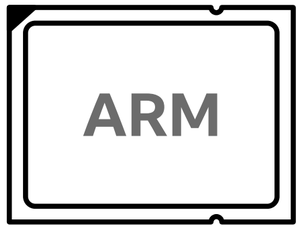


See also...

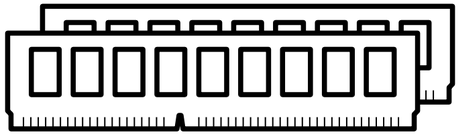


“**Building the BBC's media CDN**” by Alistair Wooldrige from UKNOF 2020

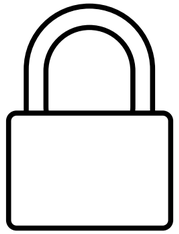
This talk



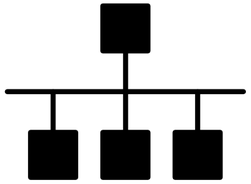
ARM Servers



Memory Bandwidth



kTLS & Offload



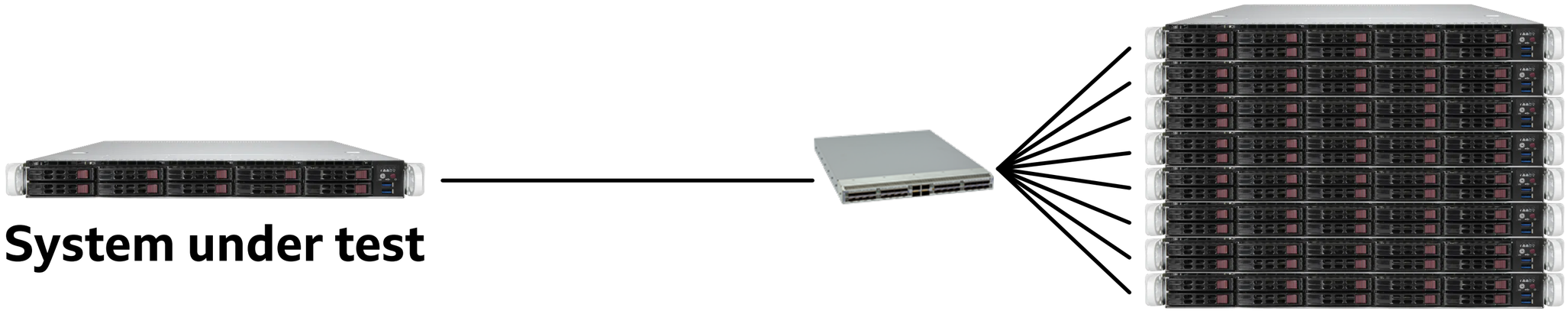
Network Behaviour

BBC

ARM Servers

BBC

Test lab



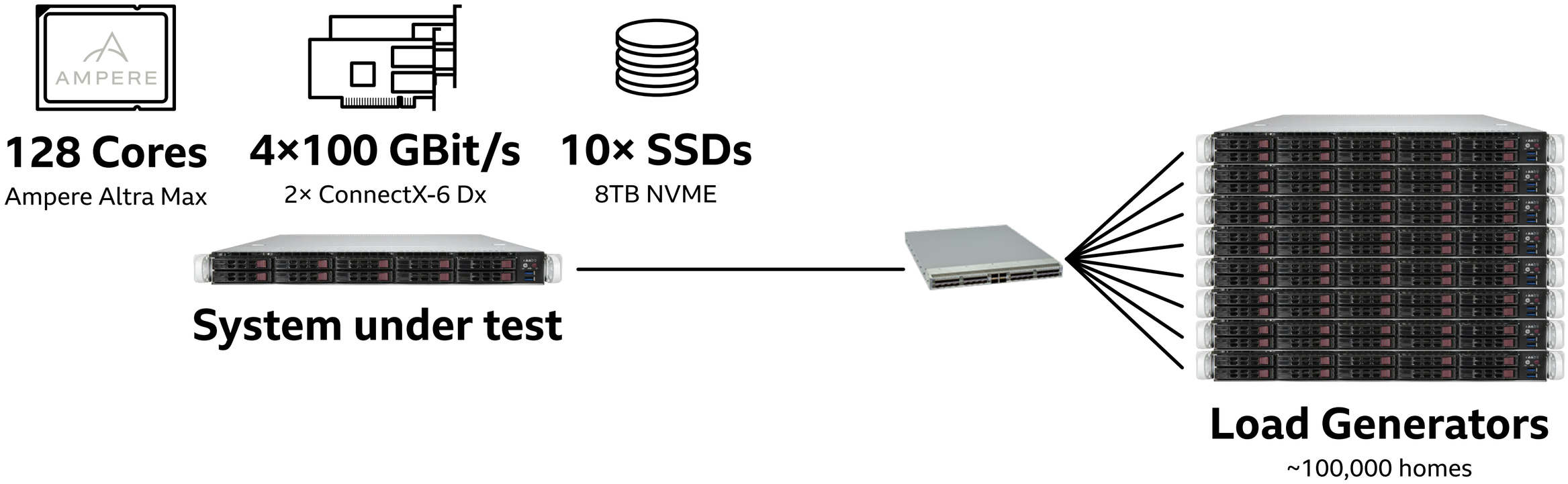
System under test

Load Generators

~100,000 homes

BBC

Test lab


AMPERE
128 Cores
Ampere Altra Max
4×100 GBit/s
2× ConnectX-6 Dx
10× SSDs
8TB NVME
System under test
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BBC

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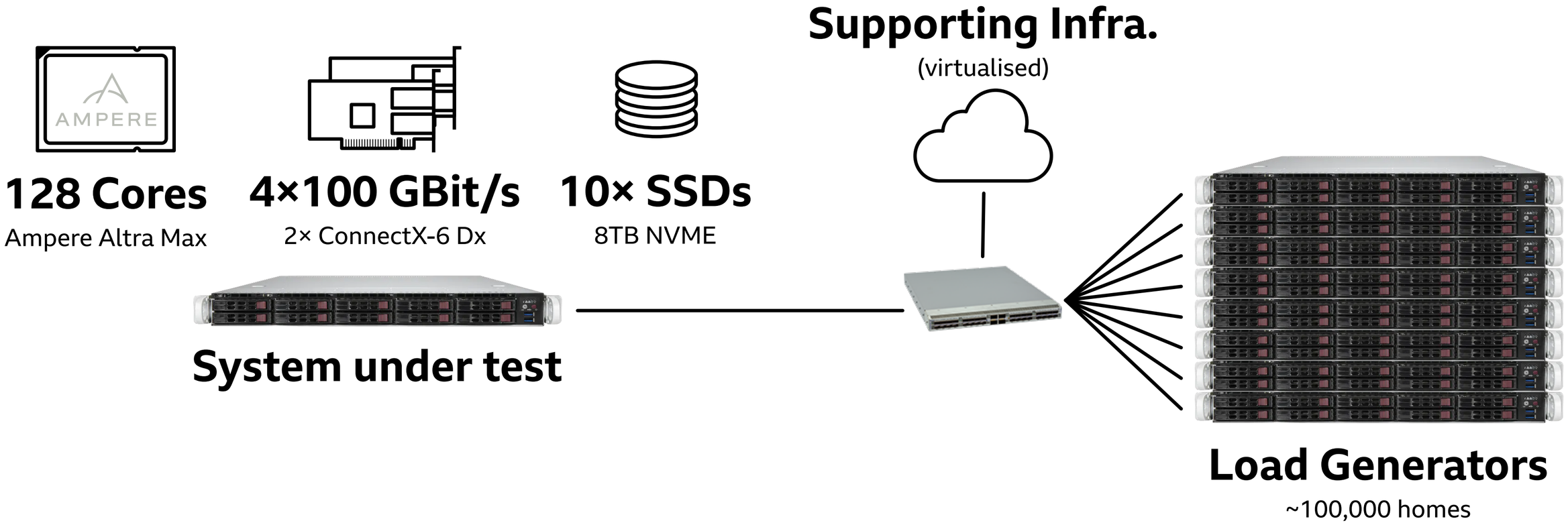
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Supporting Infra.
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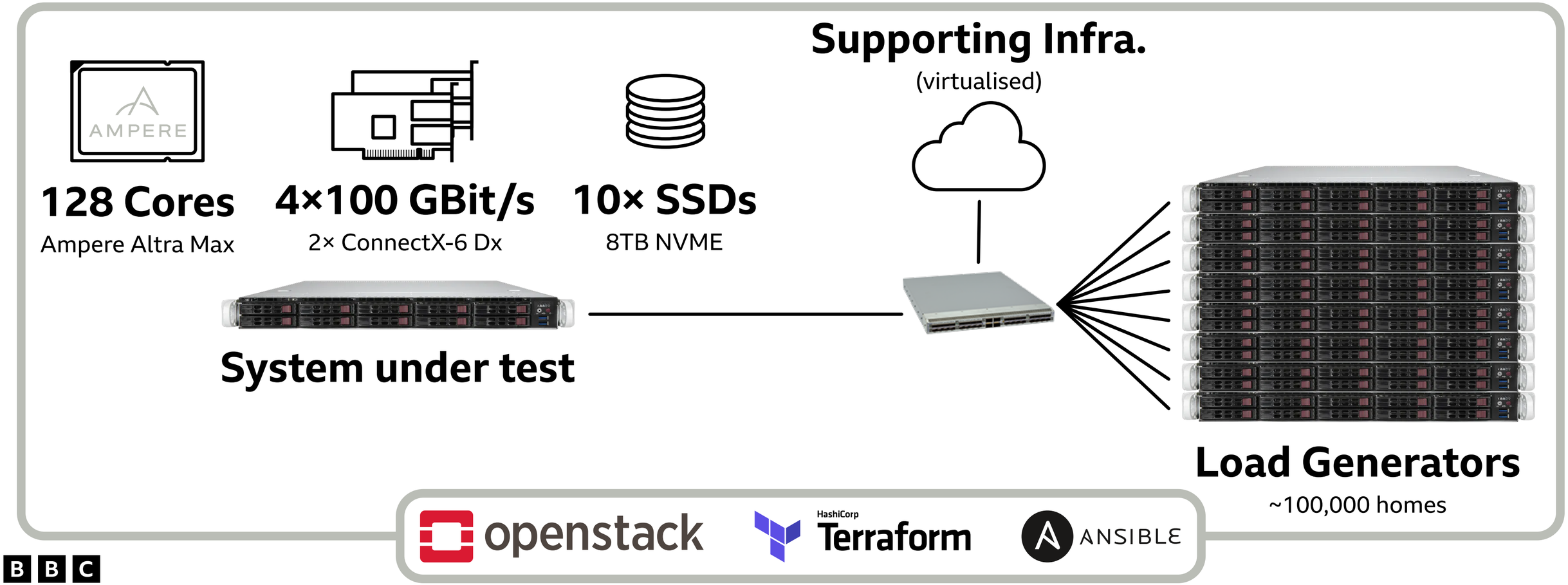
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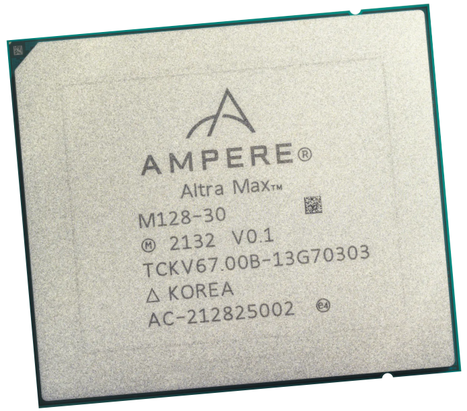
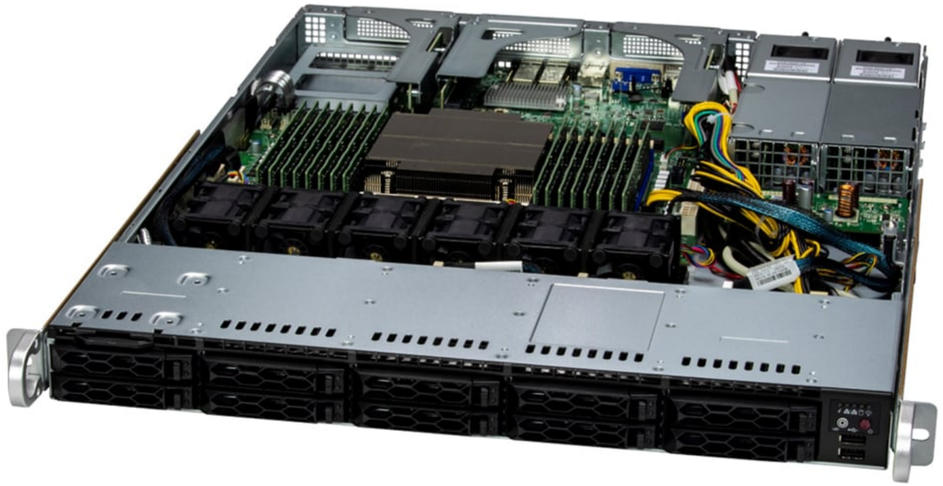
openstack
HashiCorp
Terraform
ANSIBLE

BBC

ARM Servers





BBC

Operating System Page Cache Primer

NGINX

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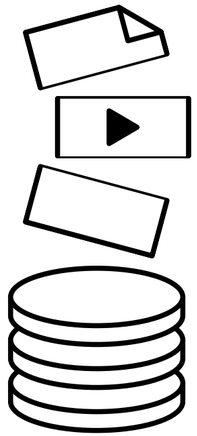
Operating System Page Cache Primer



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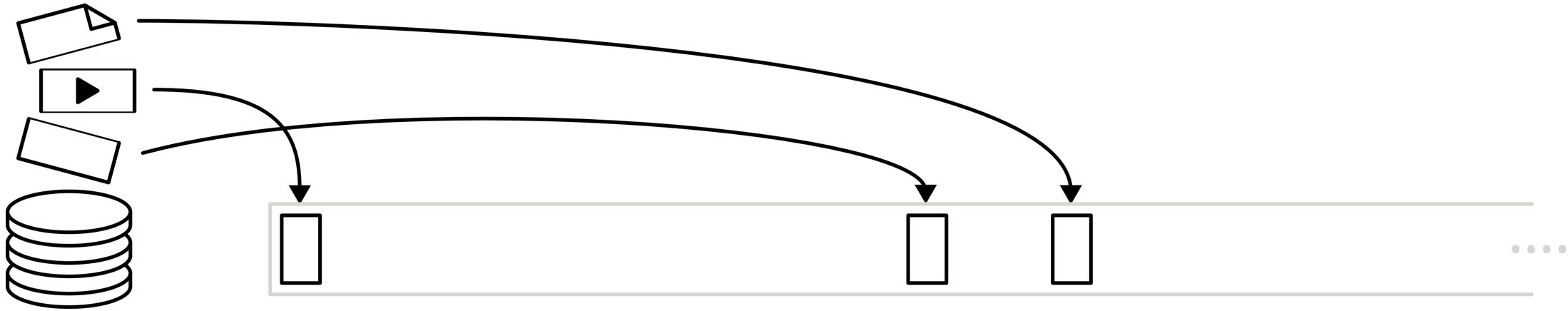

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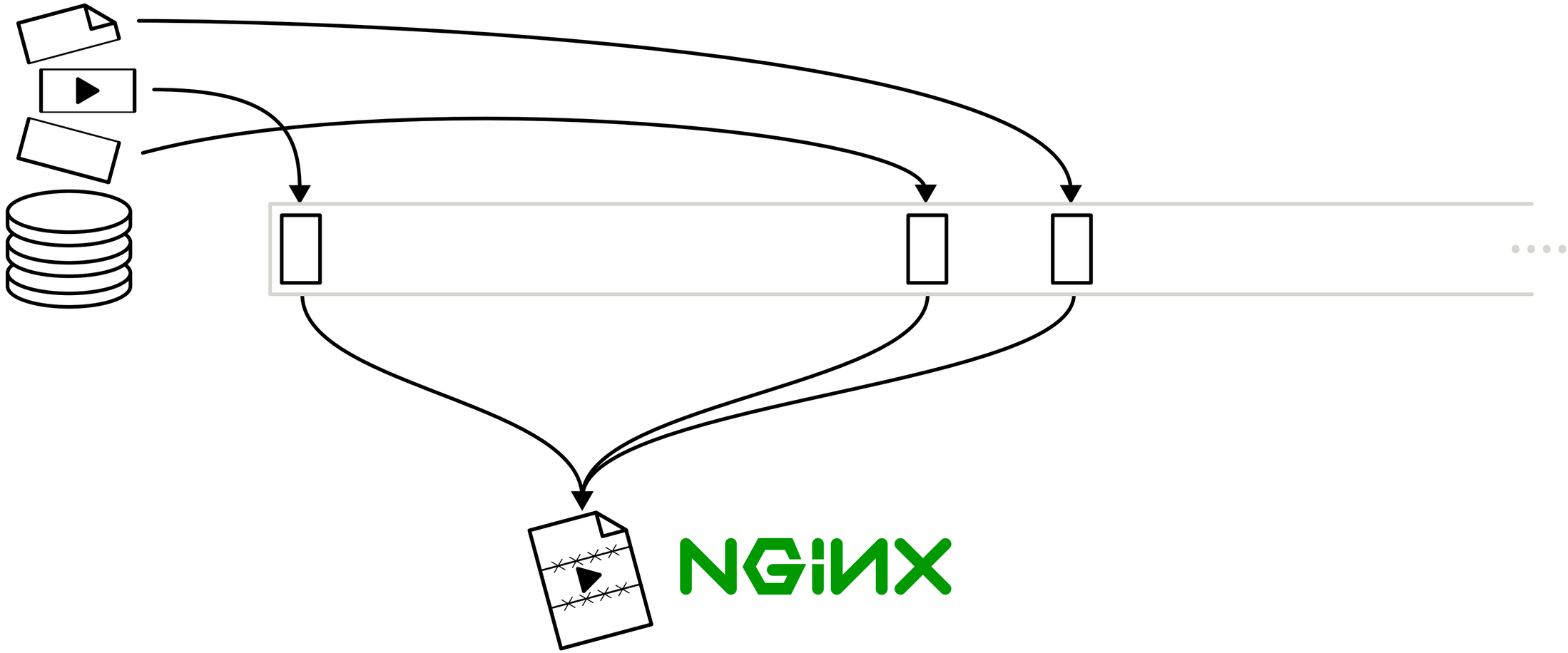

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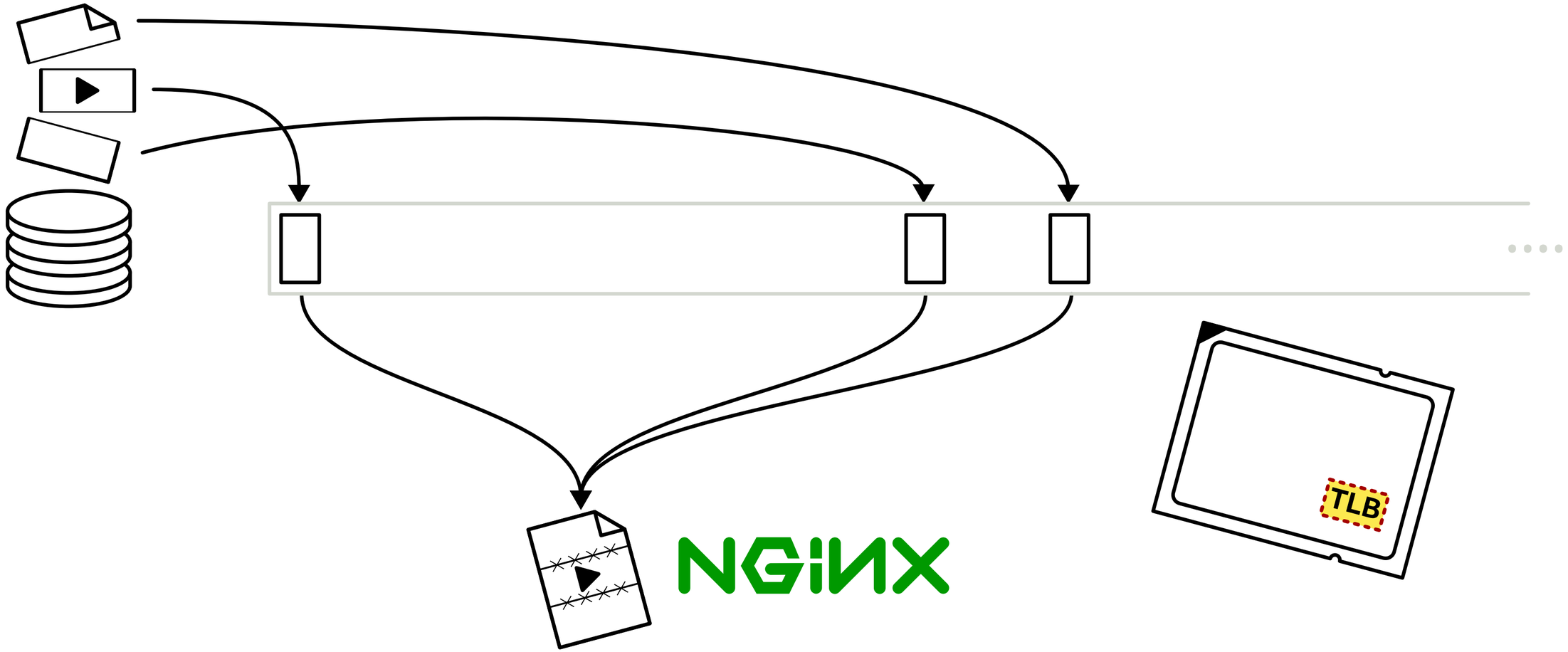

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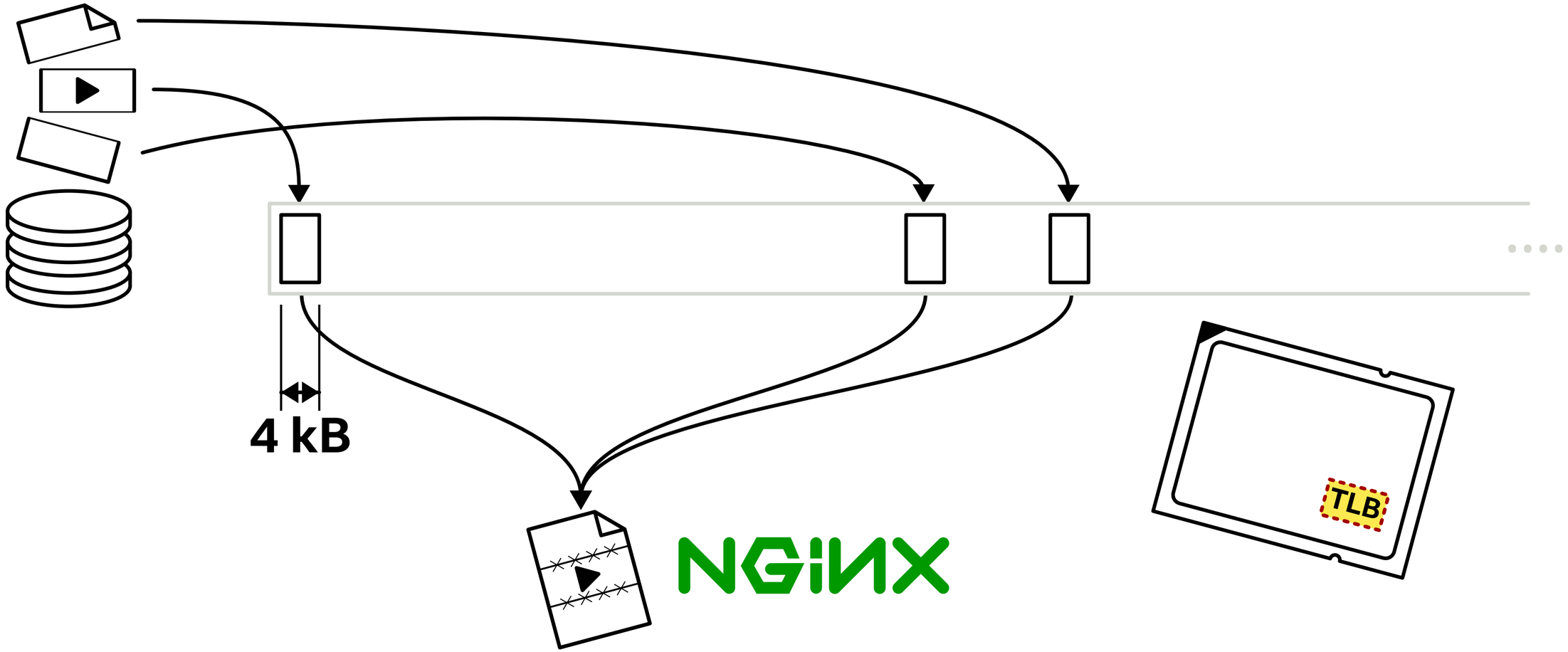

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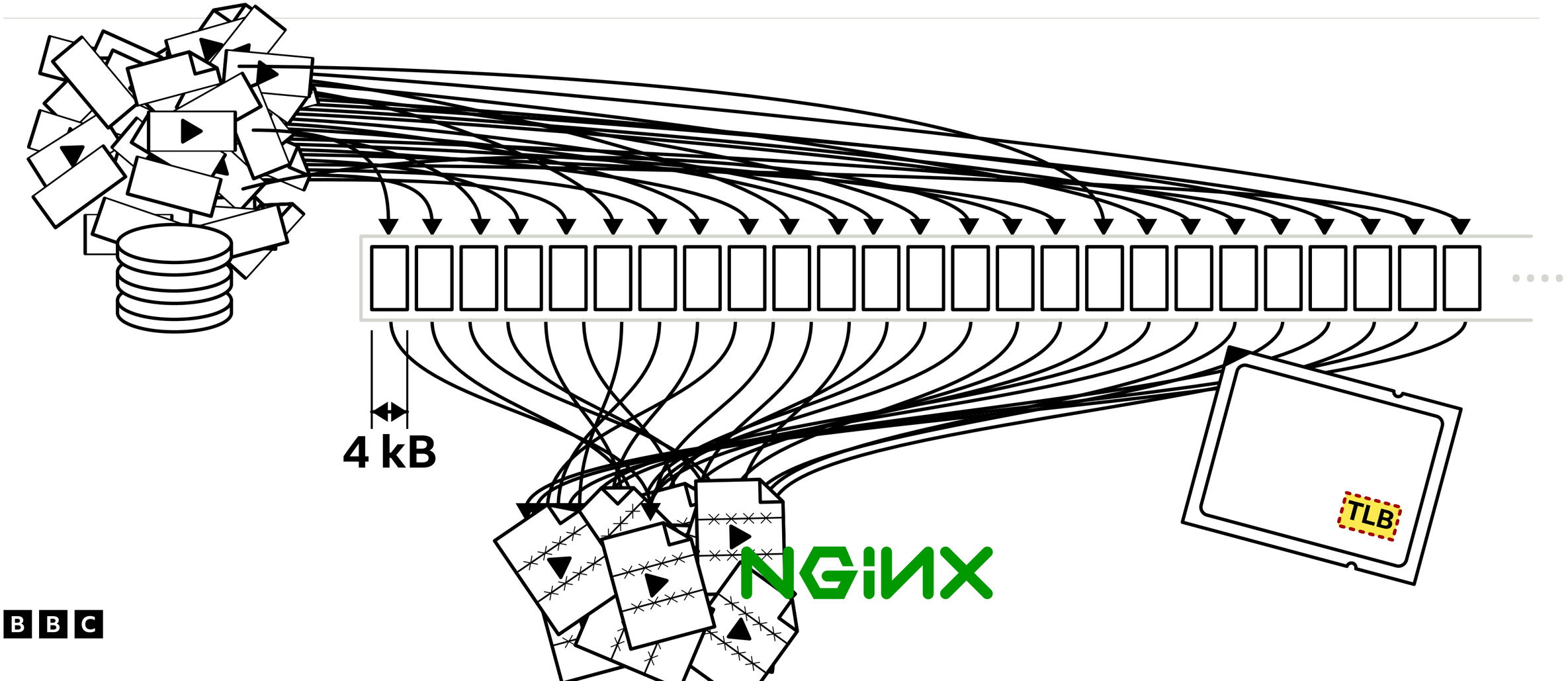

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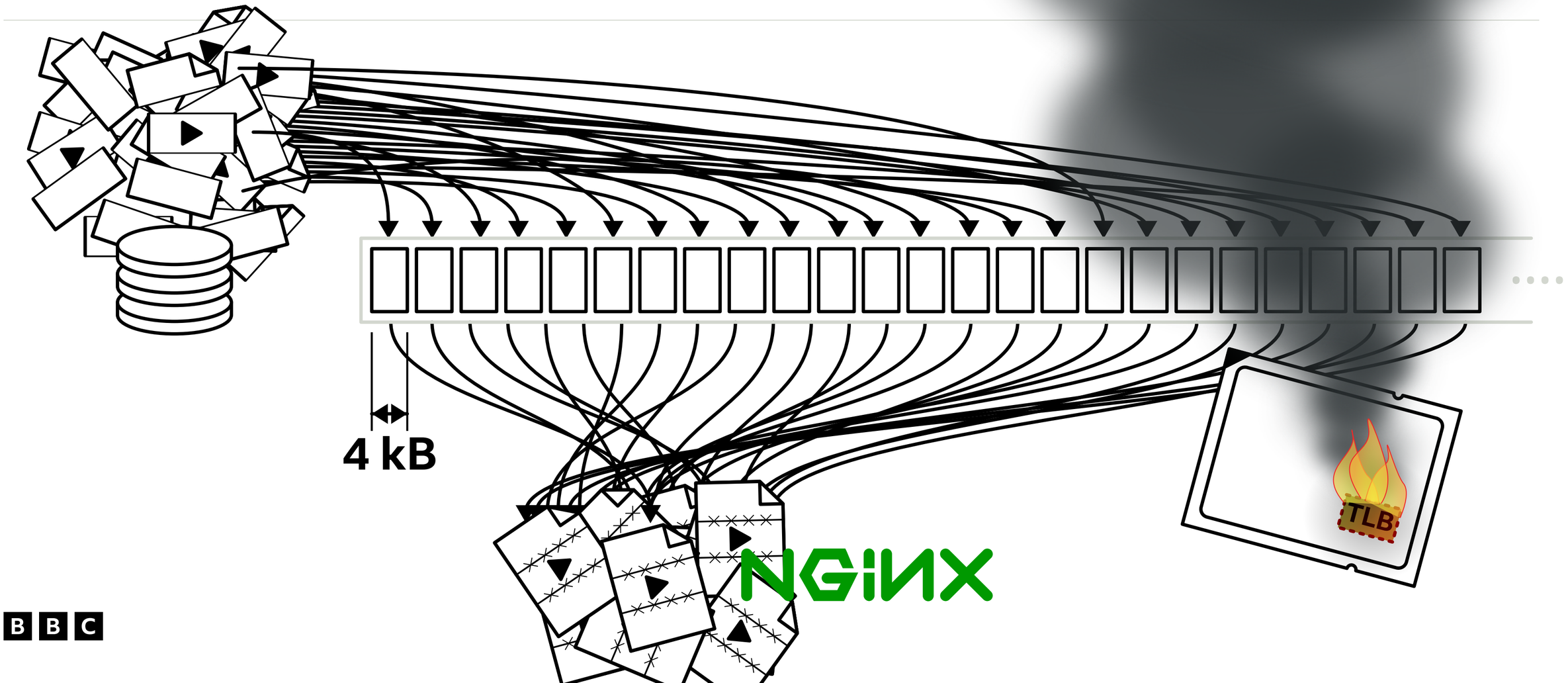
Operating System Page Cache Primer



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~~1 GB~~

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4kB Pages

64kB Pages

80 GBit/s

150 GBit/s

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Memory Bandwidth

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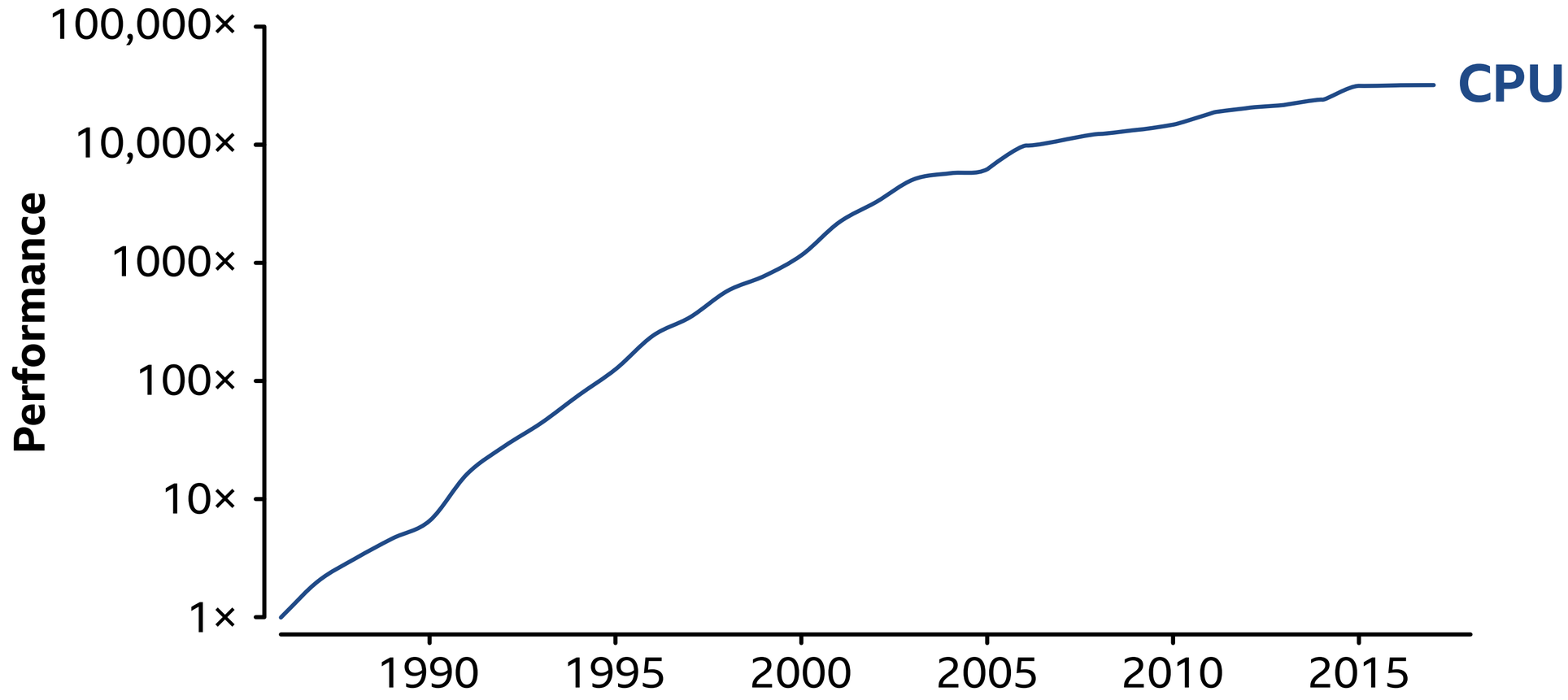
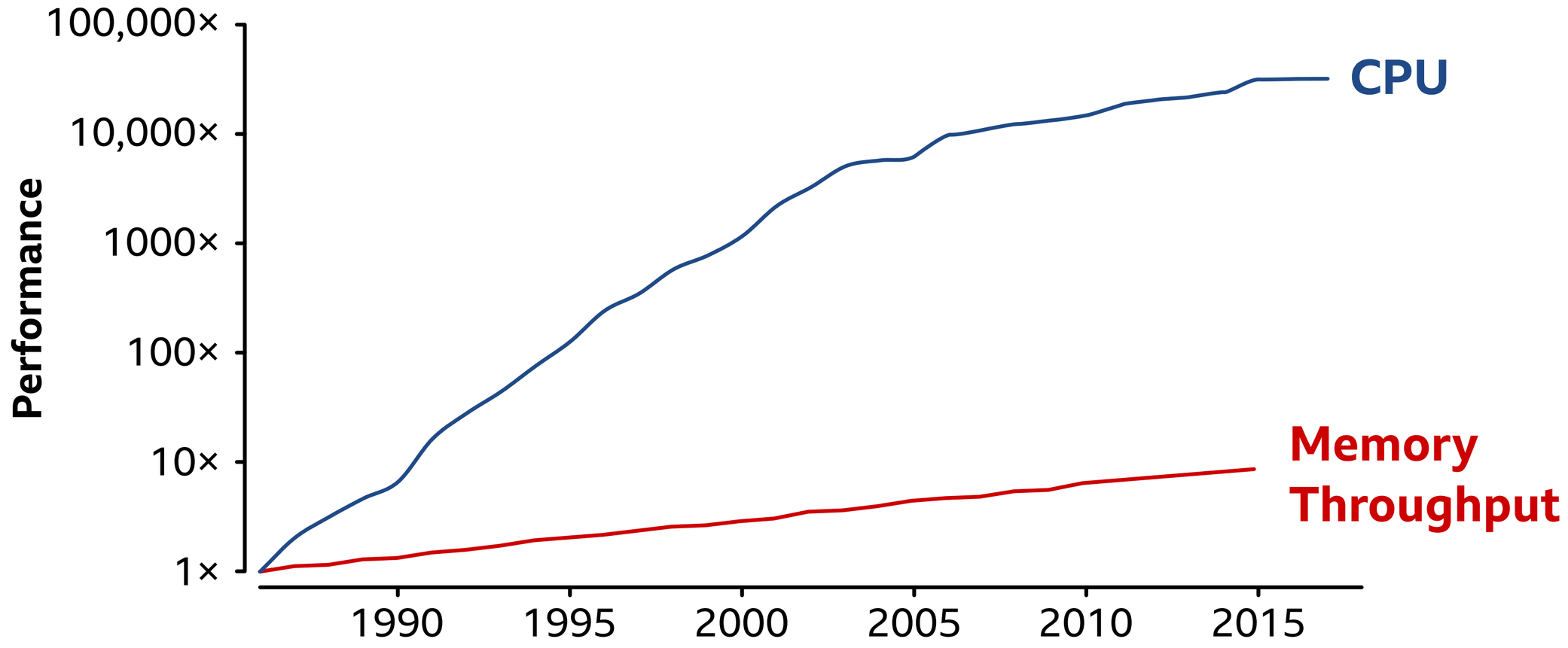
Bottleneck: Not the CPU anymore



BBC

Data from “Computer Architecture, A Quantitative Approach (Sixth Edition)”
Hennesy and Patterson 2019, figures 1.1 (CPU) and 2.2 (Memory Throughput).

Bottleneck: Not the CPU anymore



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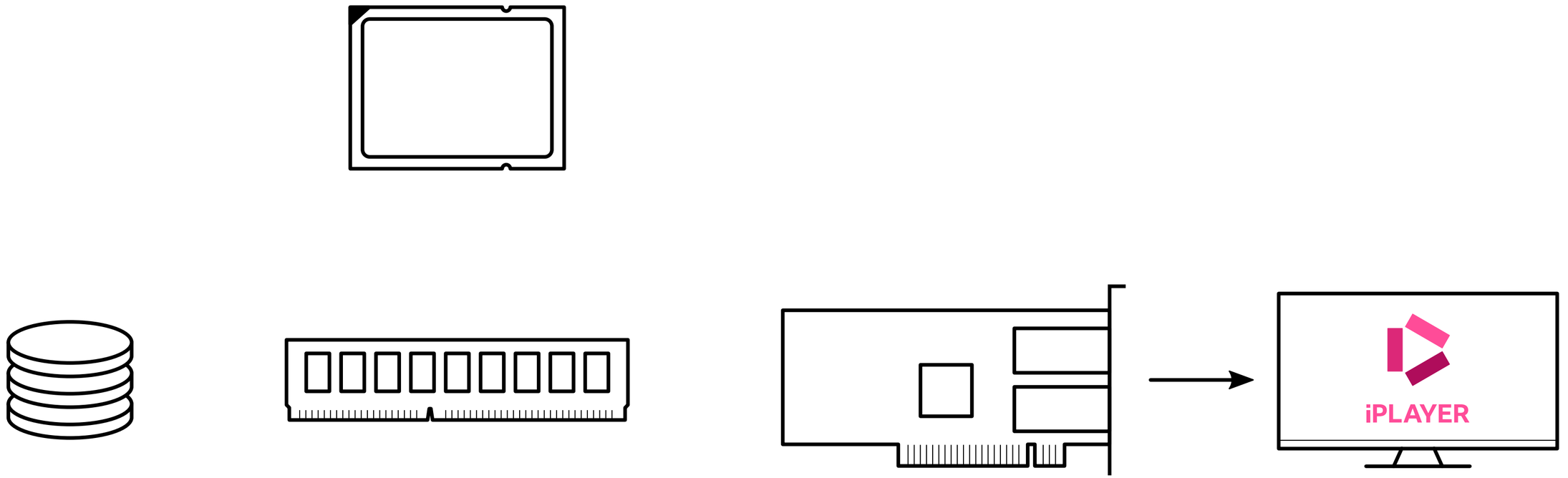
Where is the memory bandwidth going?



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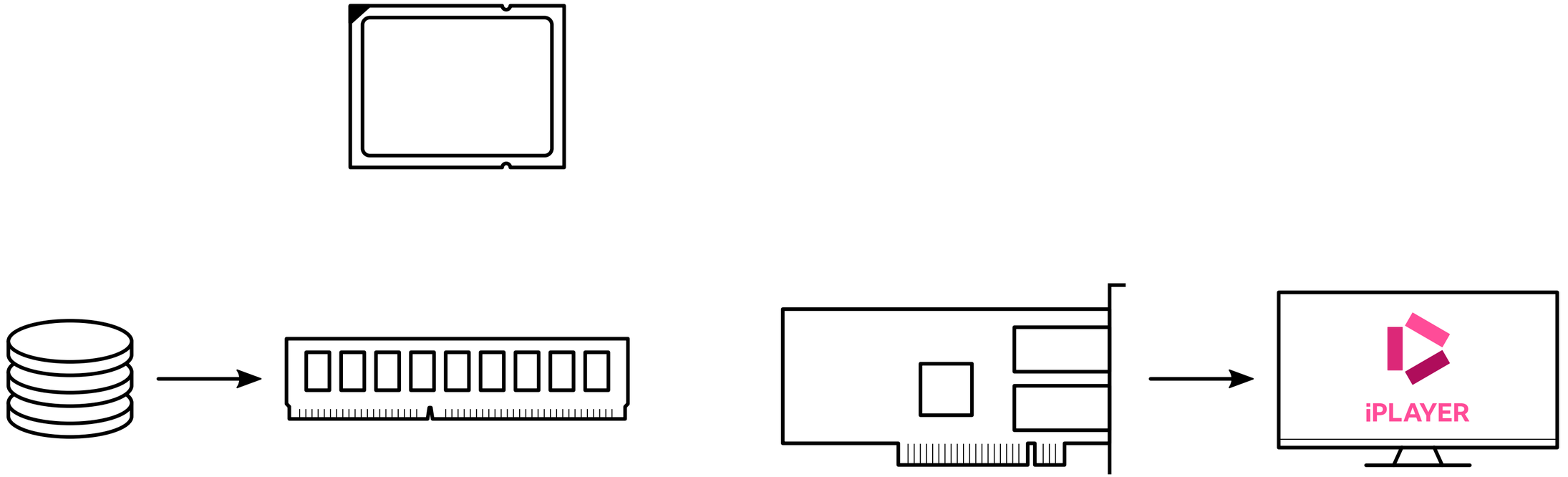

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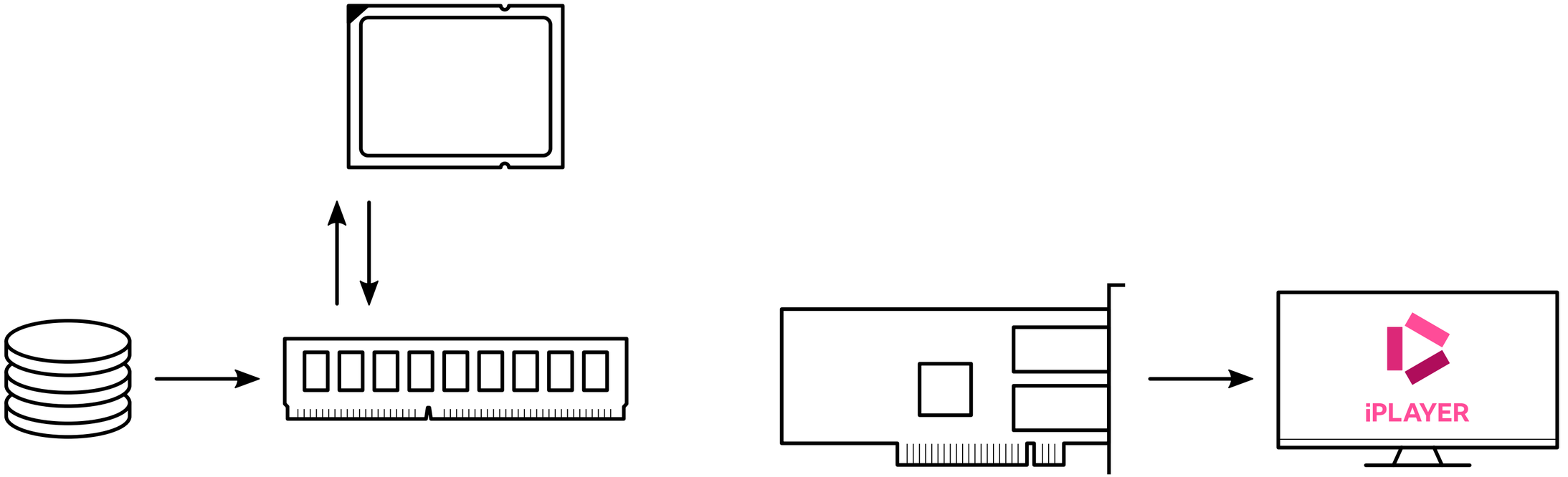

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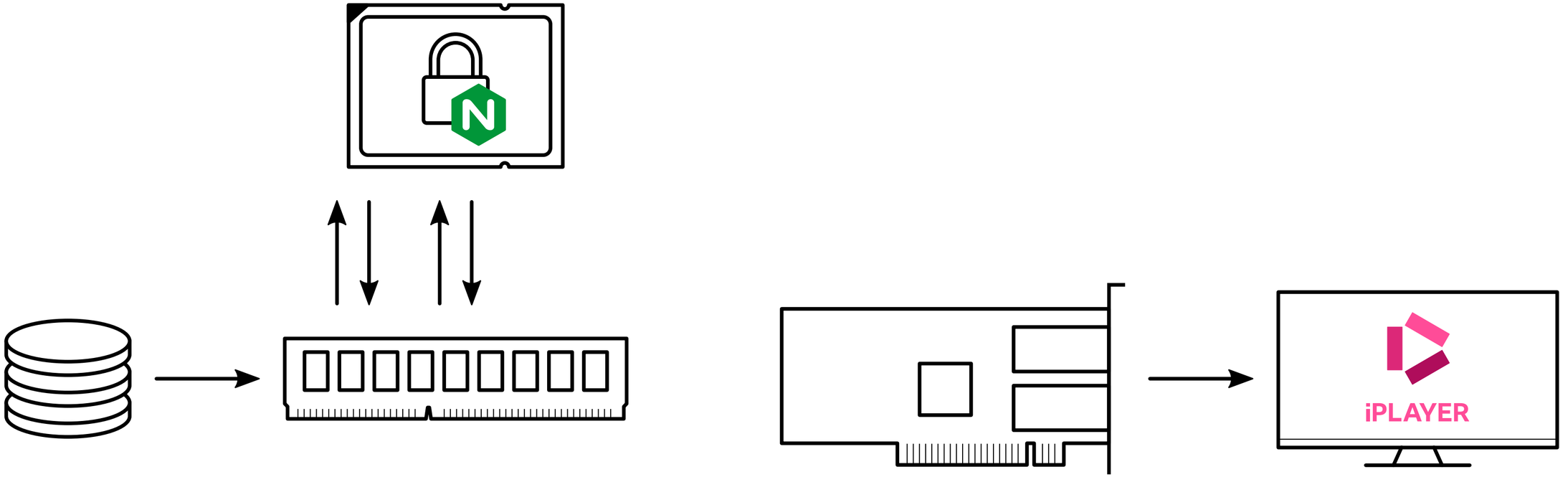

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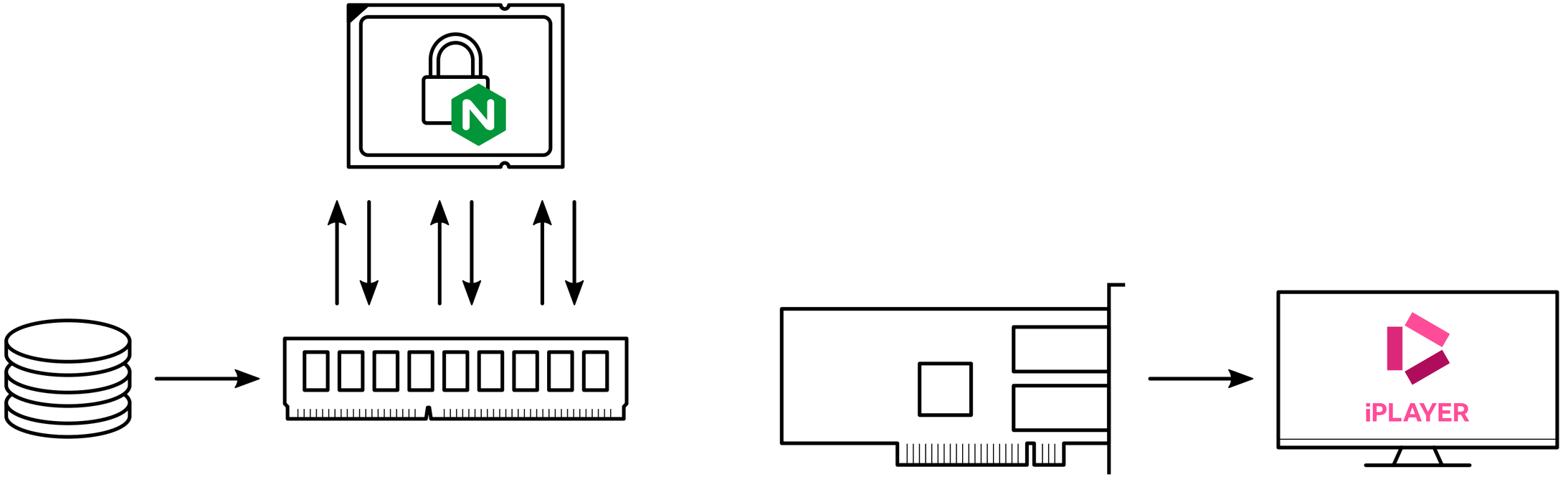

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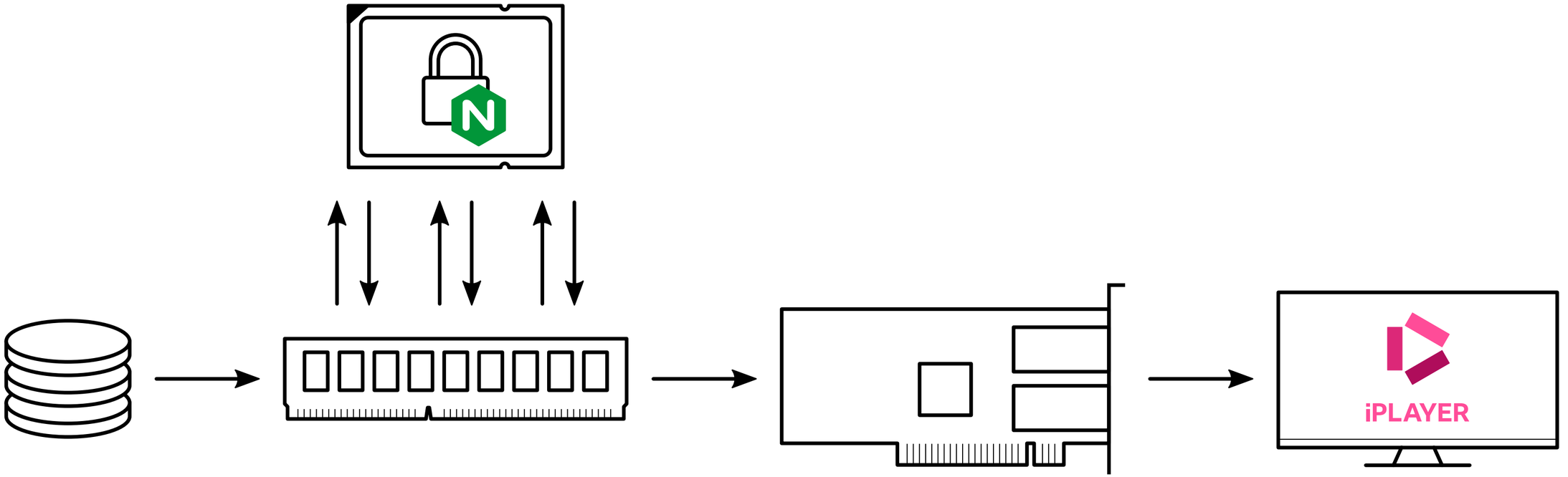
Where is the memory bandwidth going?



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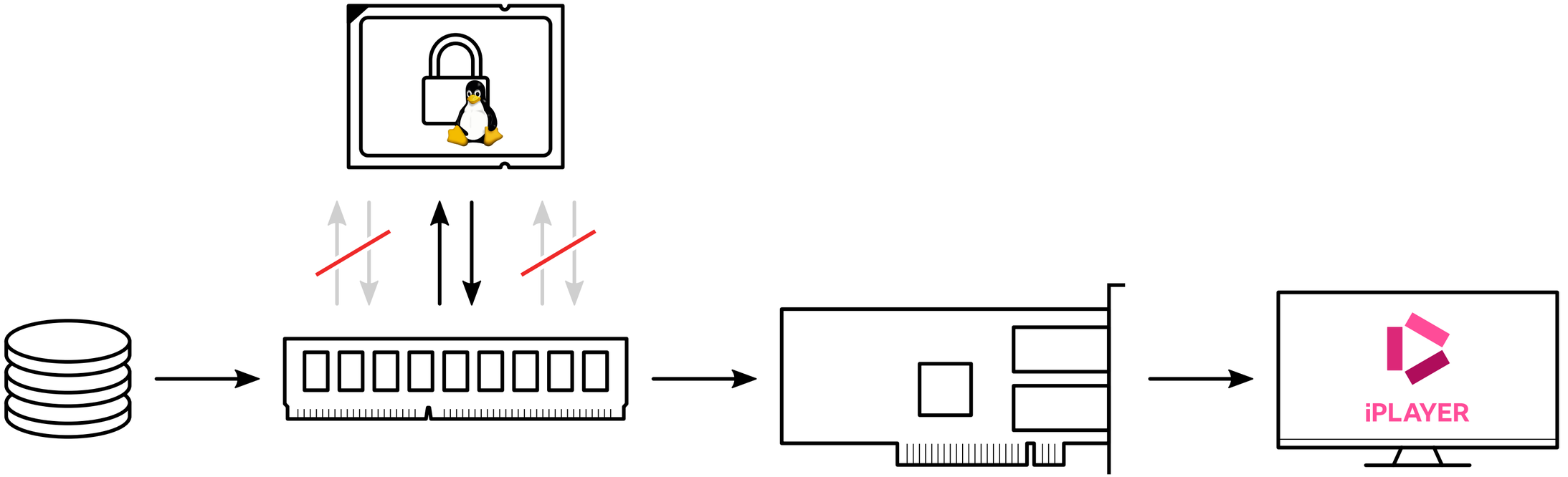
Kernel TLS (kTLS)



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Userspace TLS

Kernel TLS

150 GBit/s

260 GBit/s

BBC

TLS Offload

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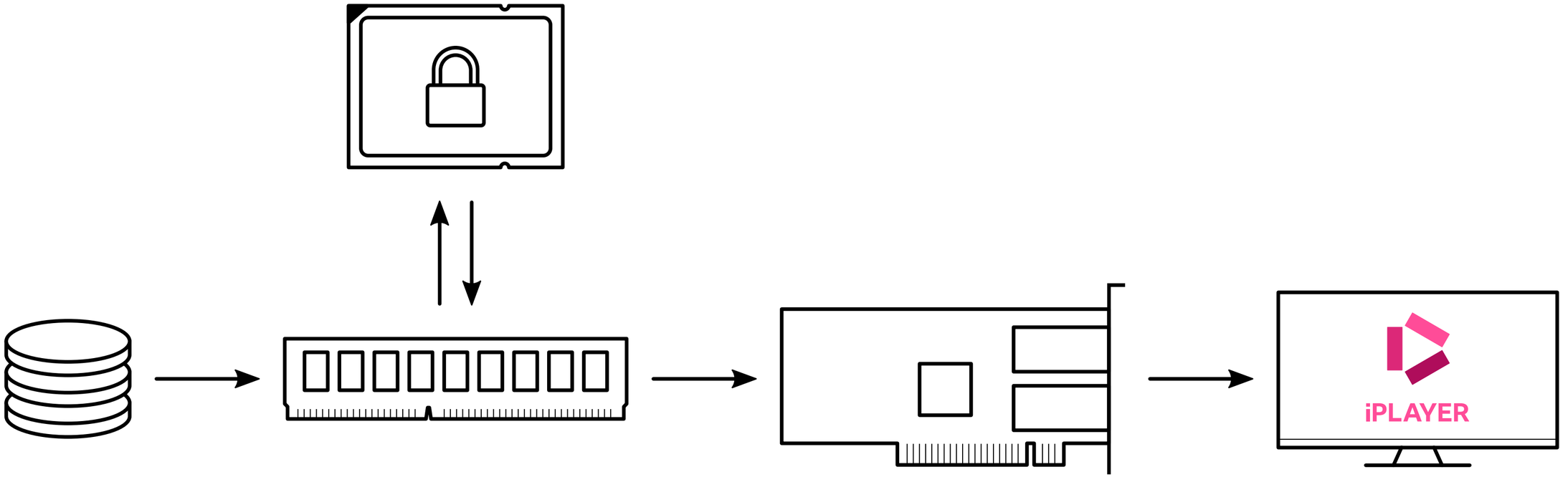
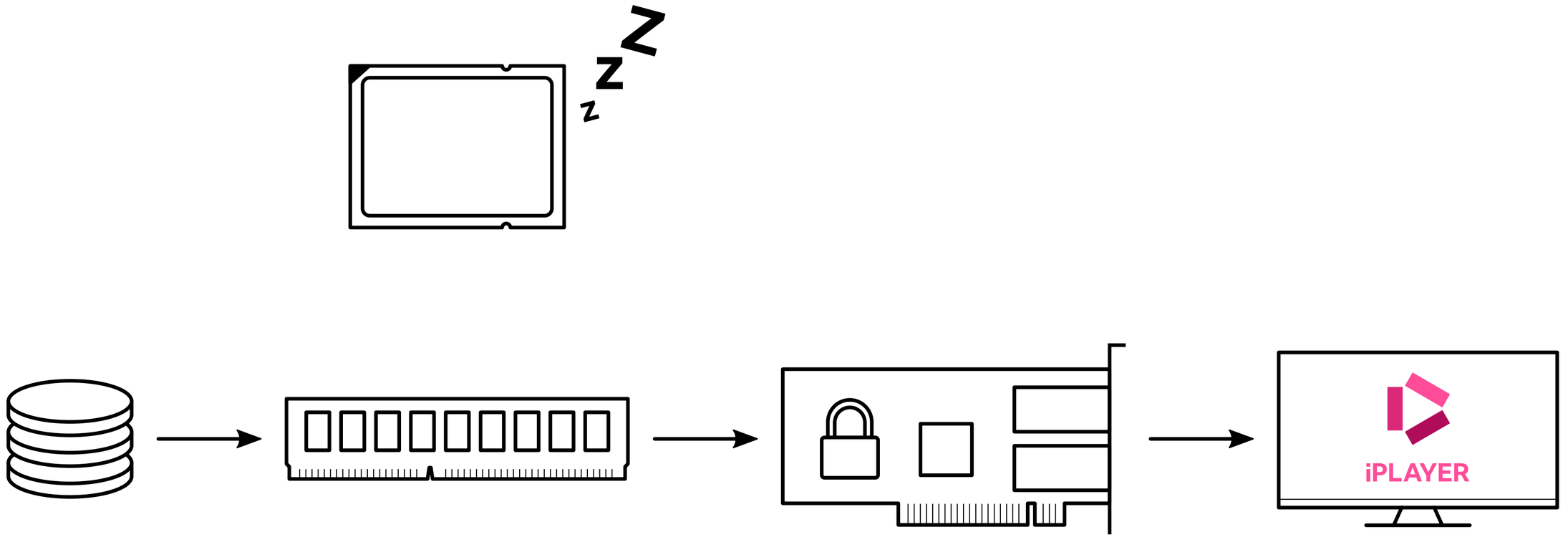
TLS Offload: The theory



BBC

TLS Offload: The theory



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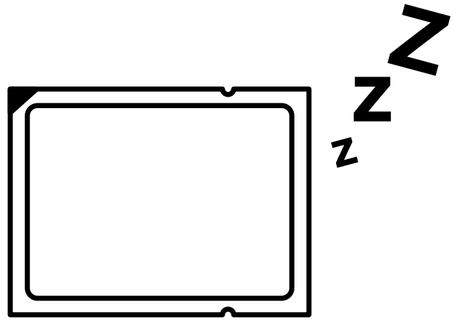

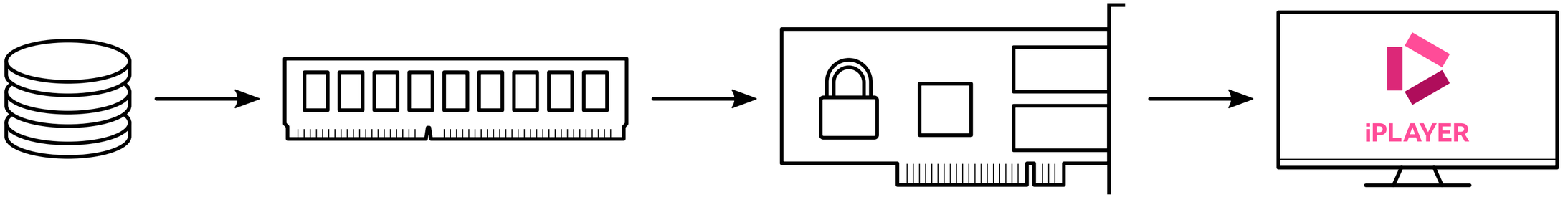

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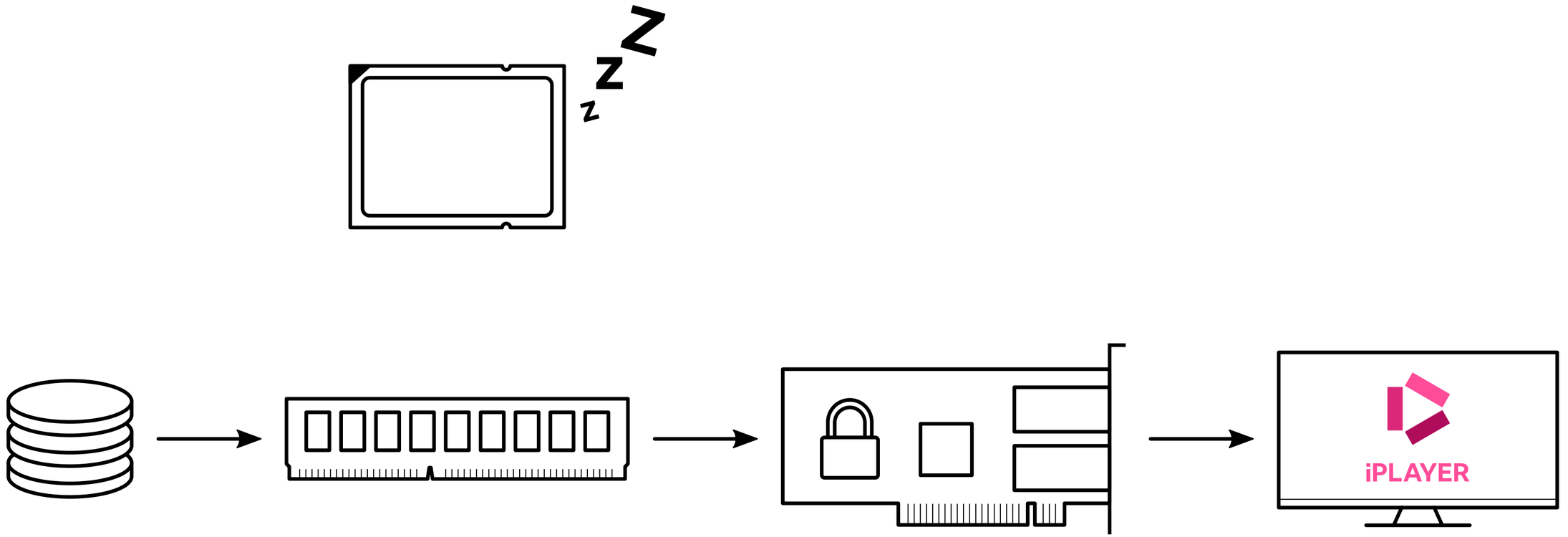
TLS Offload: The reality



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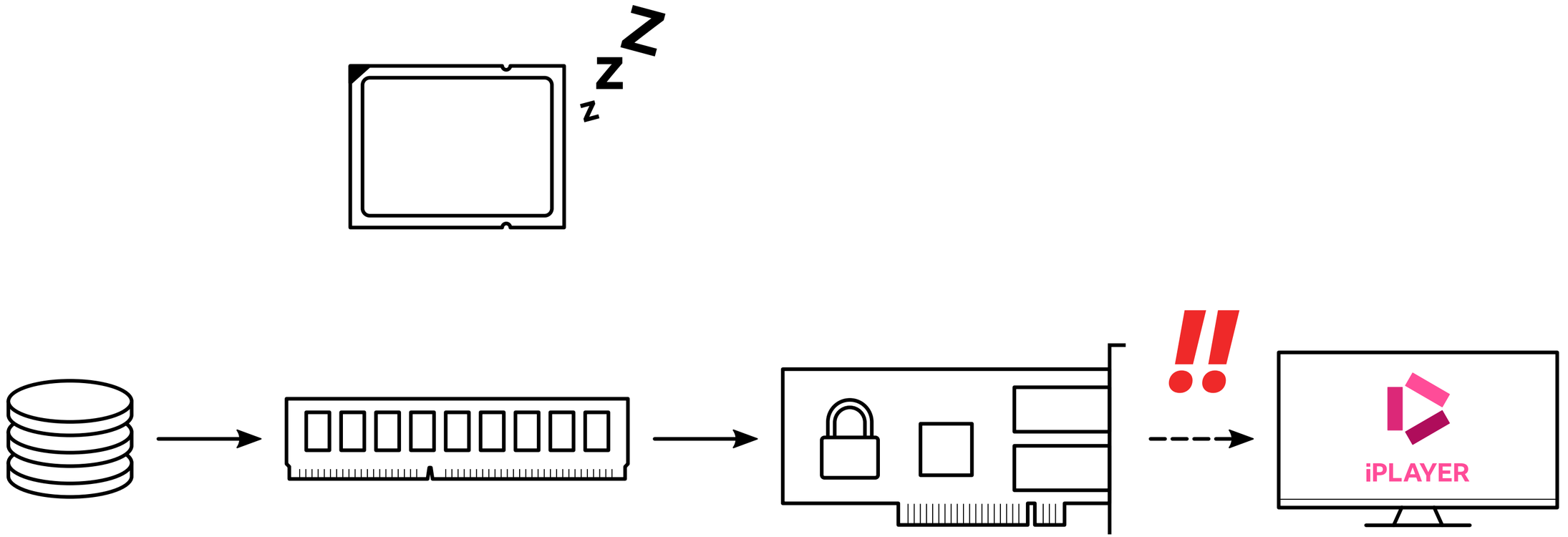
TLS Offload: The reality

Problem 1: Retransmissions



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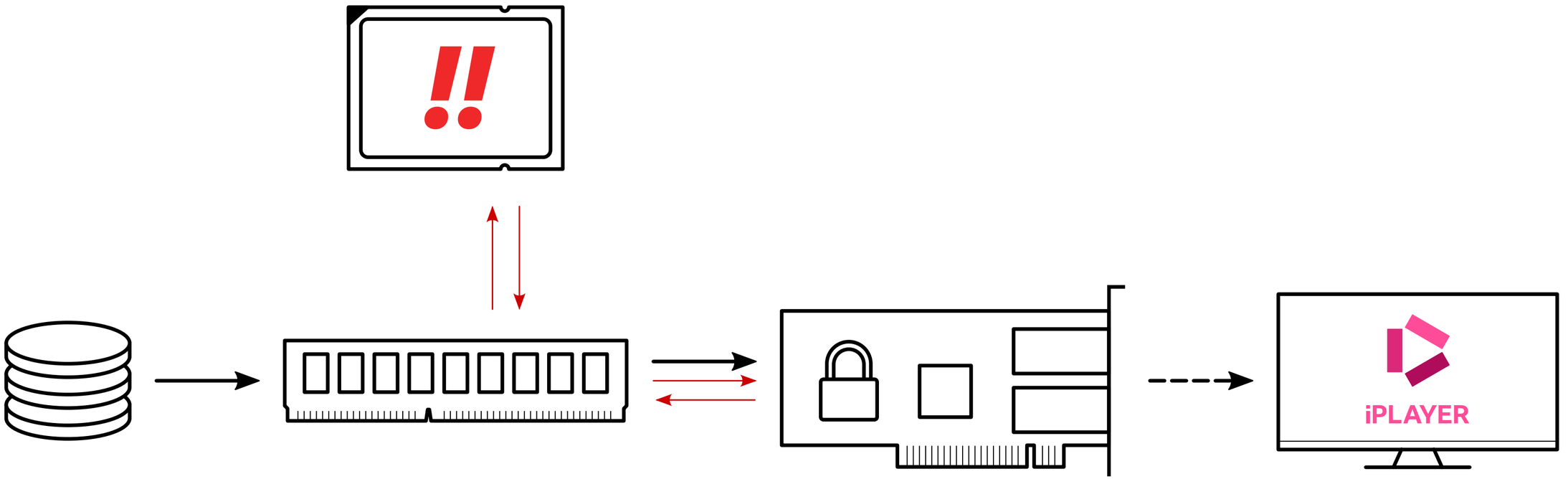

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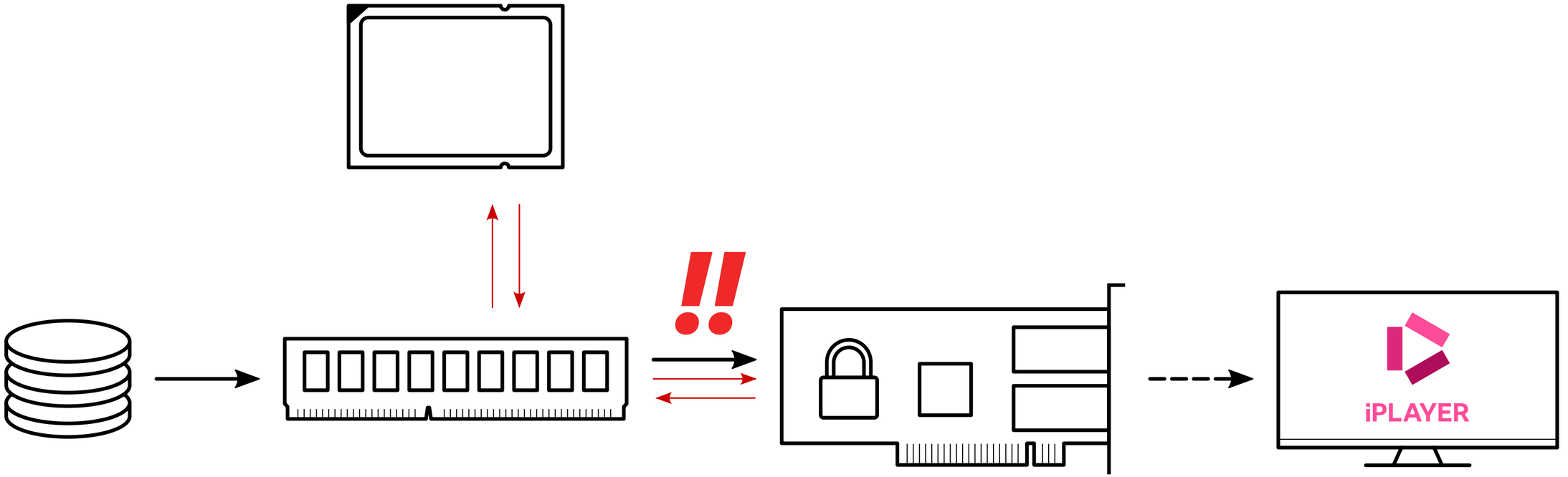

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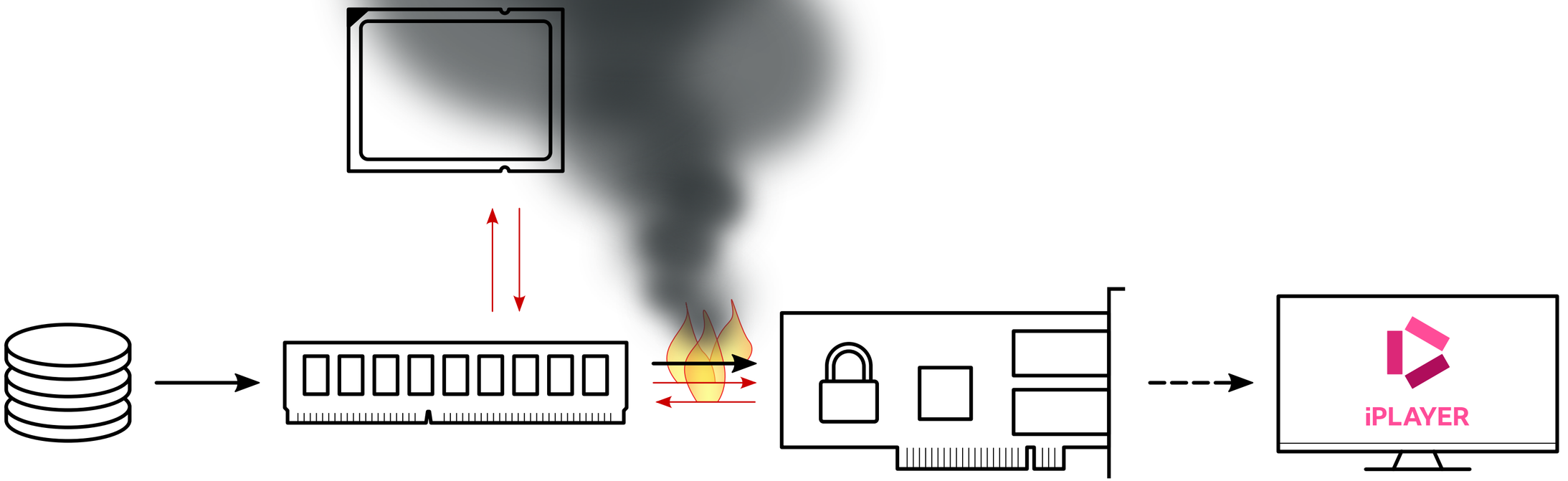

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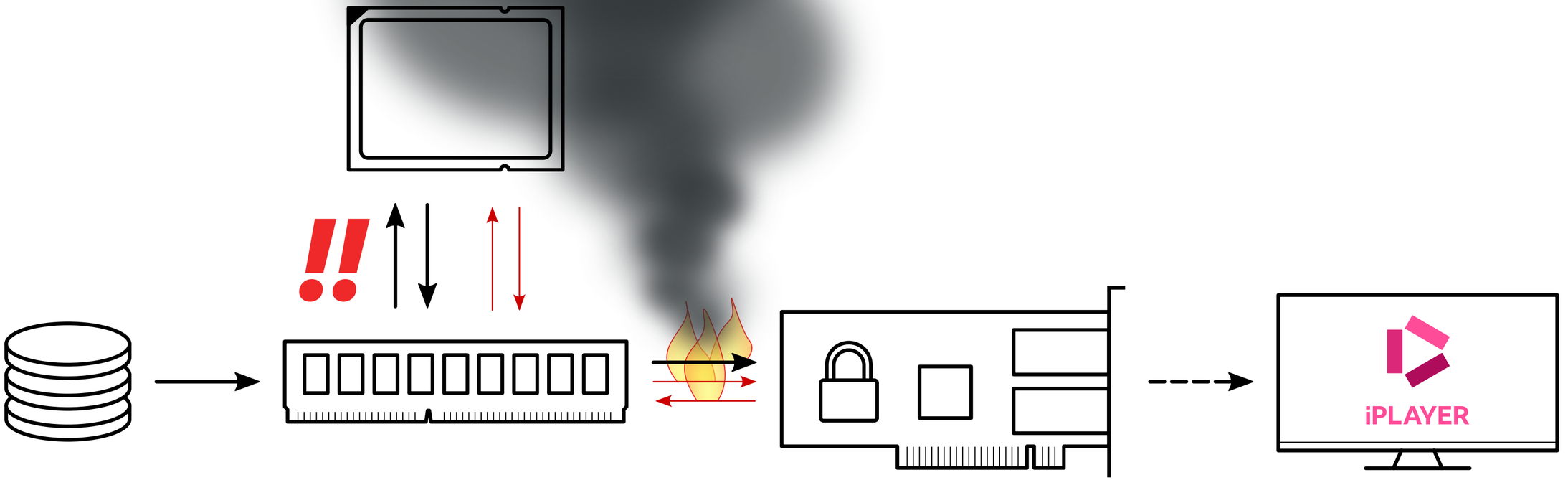
TLS Offload: The reality

Problem 1: Retransmissions
Problem 2: Linux implementation



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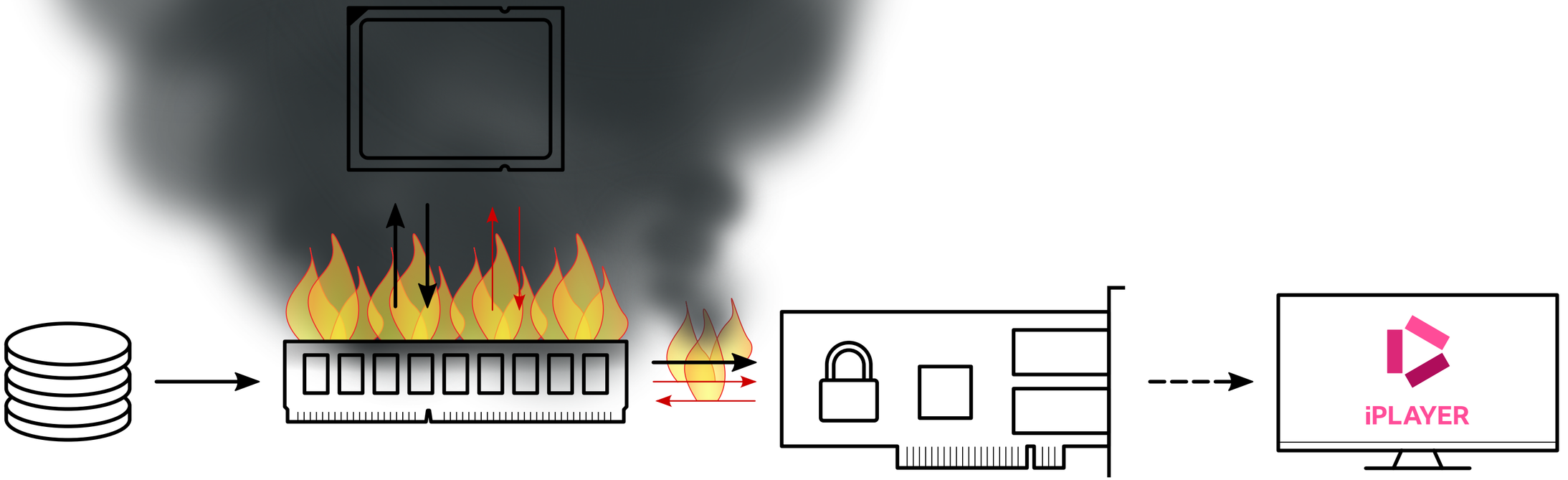

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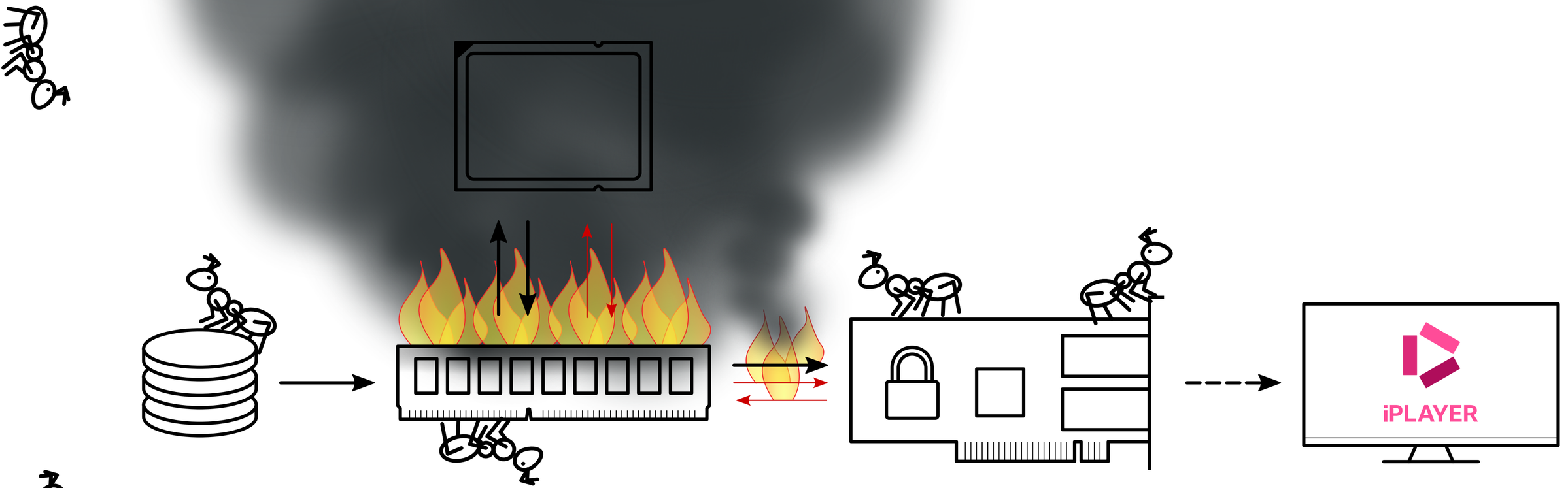
TLS Offload: The reality

Problem 1: Retransmissions
Problem 2: Linux implementation
Problem 3: Stability



TLS Offload: The reality

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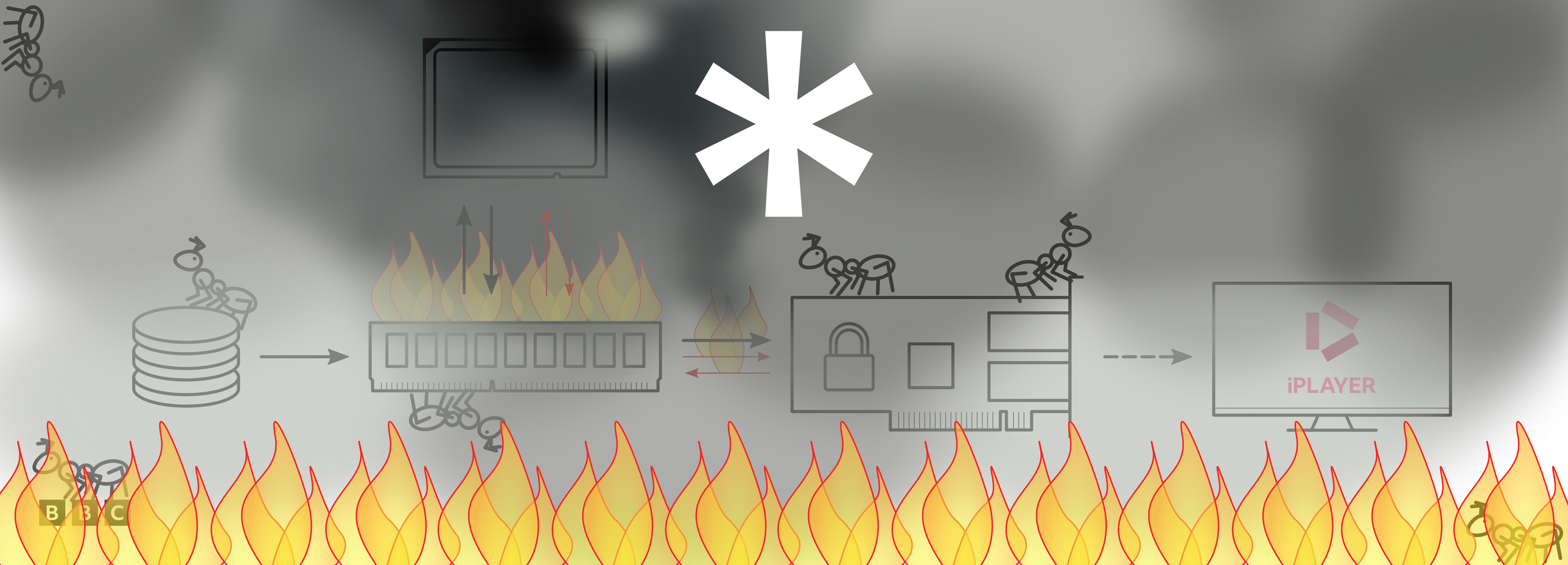
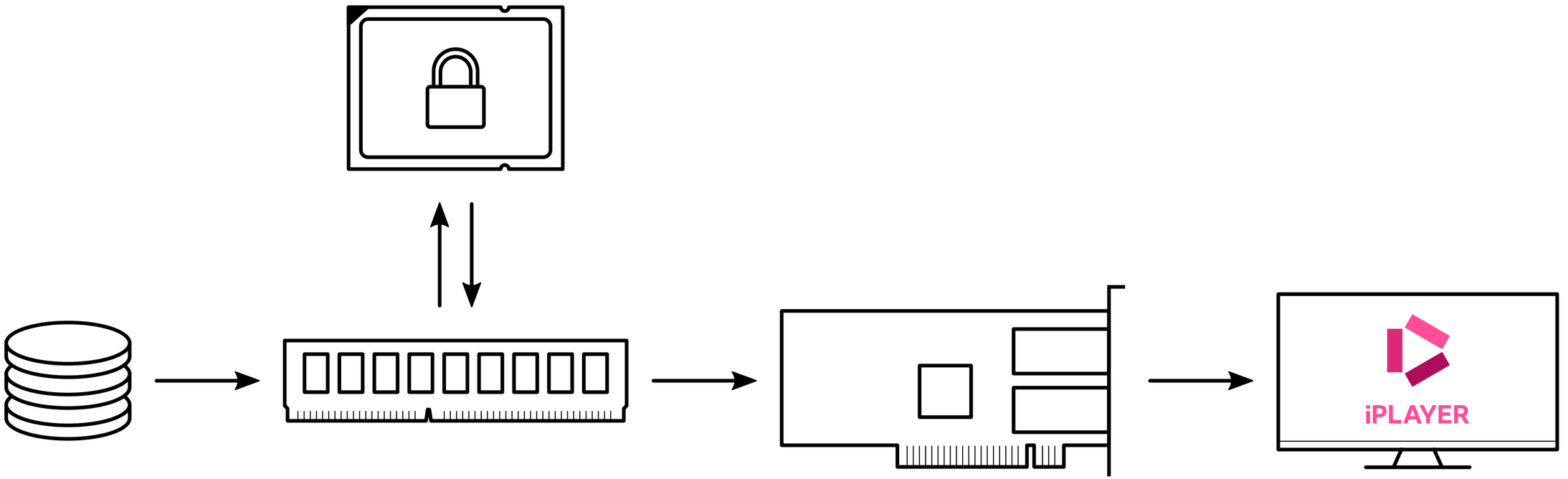


Network Behaviour

BBC

Request pattern effects



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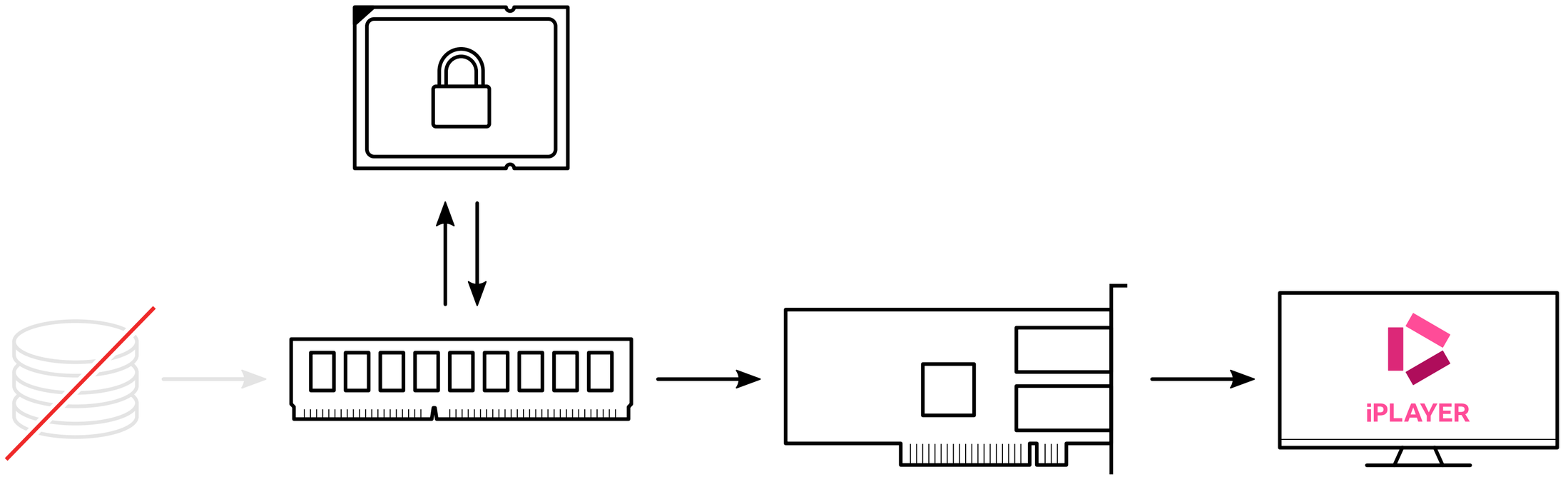

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Served From Disk

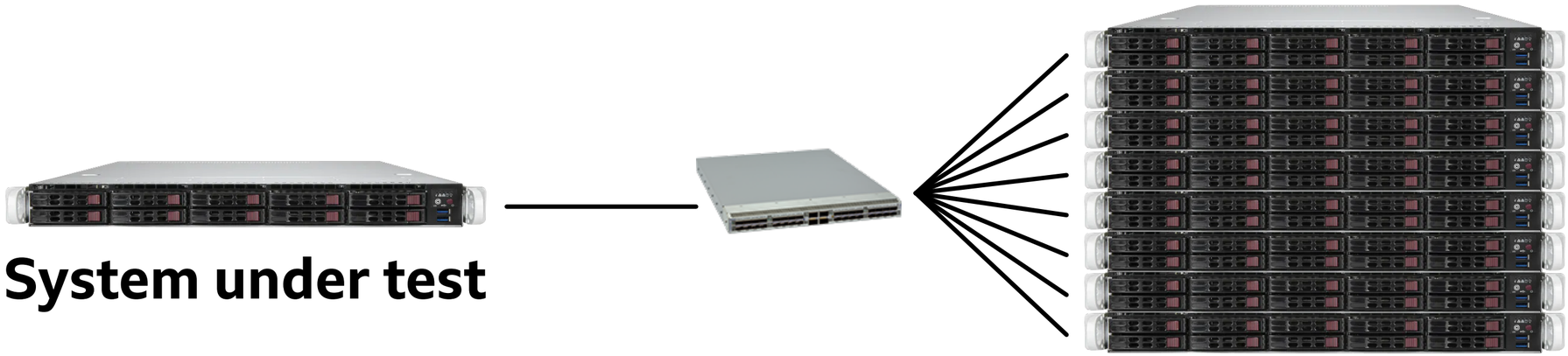
Served from RAM

260 GBit/s

340 GBit/s

BBC

Test lab realism



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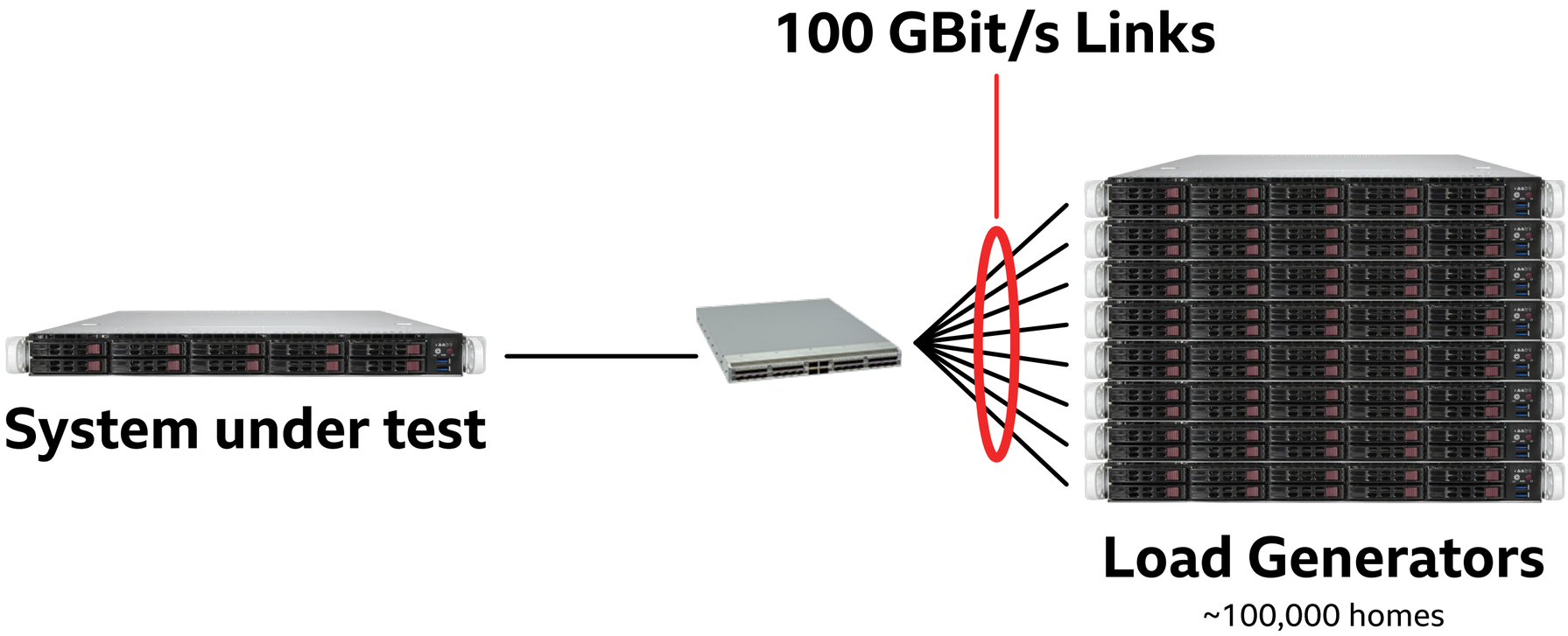

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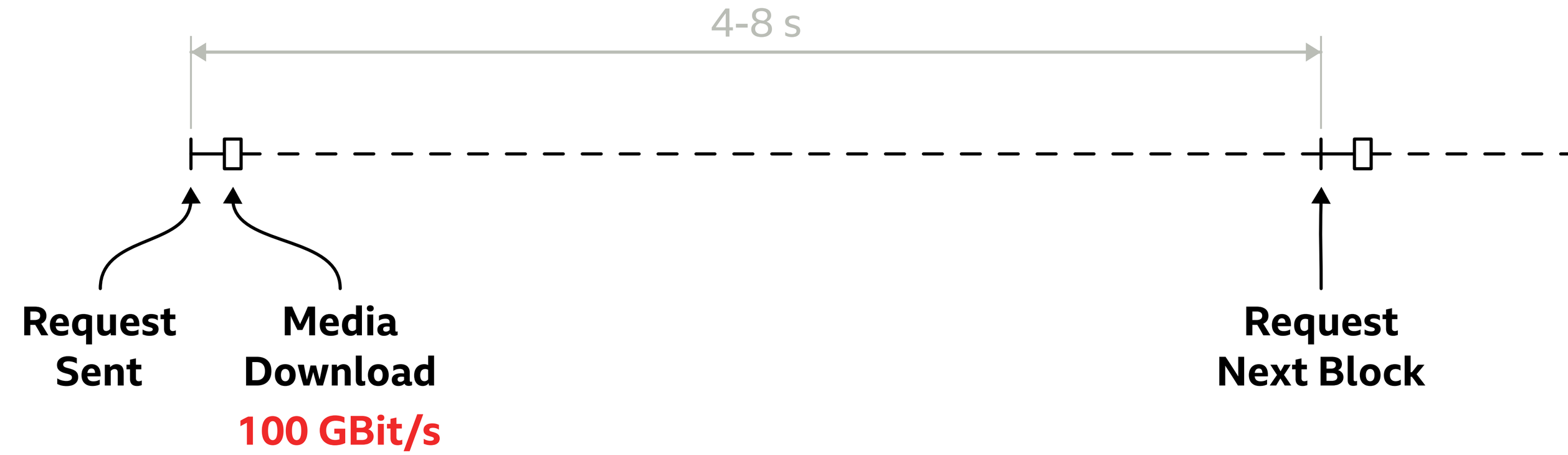
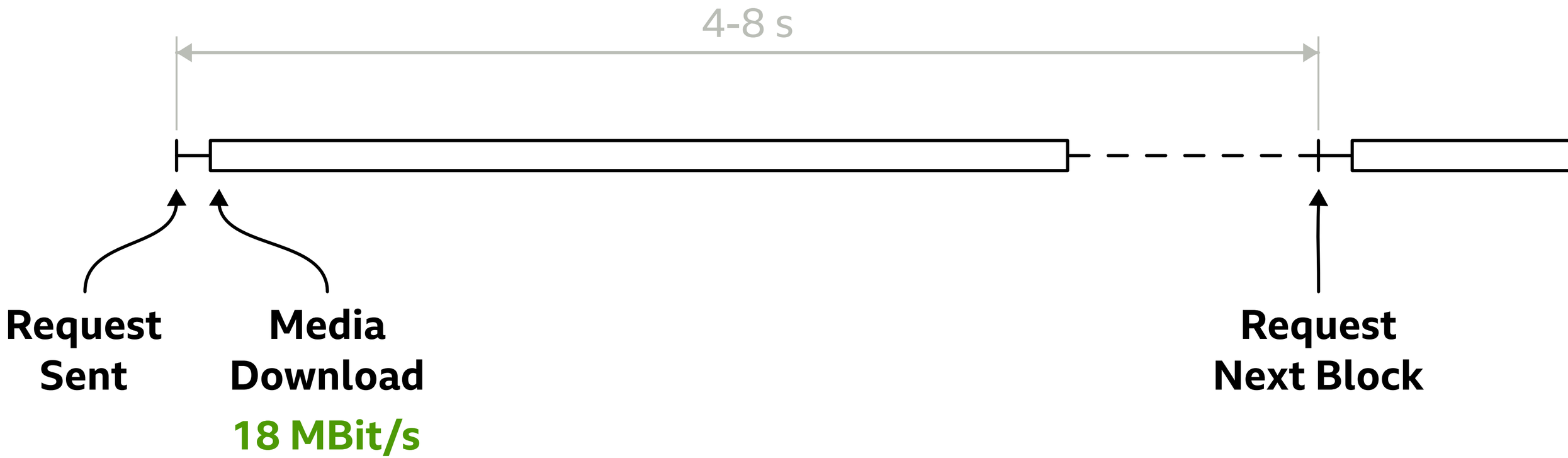
Client behaviour



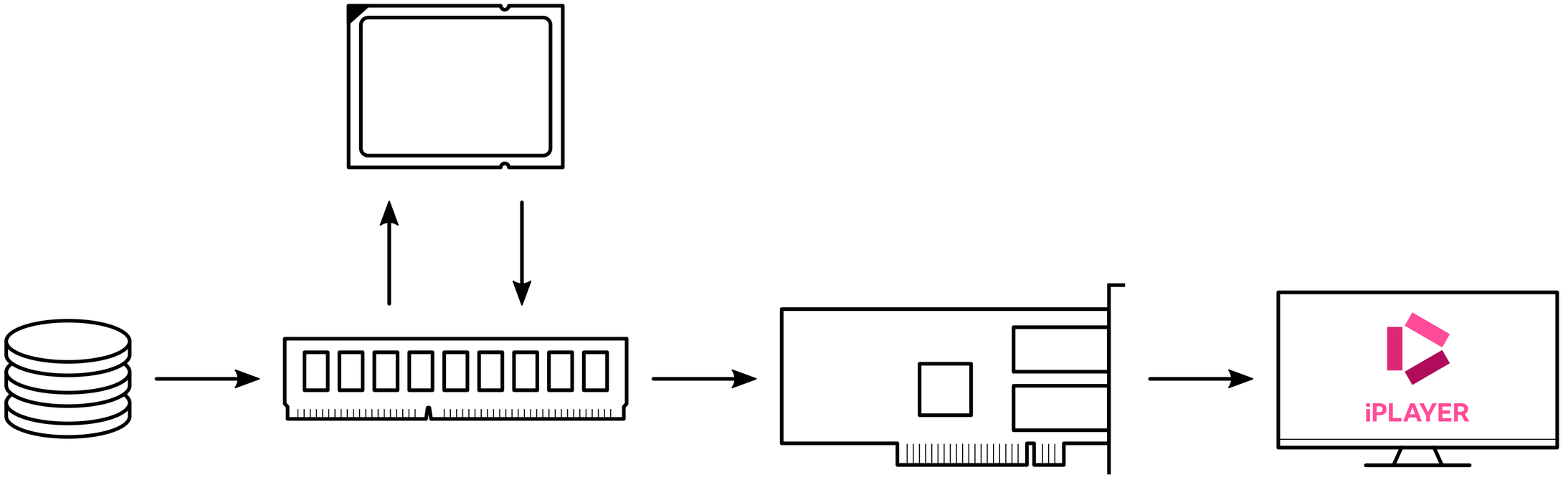
BBC

Client behaviour



BBC

Slow client effects



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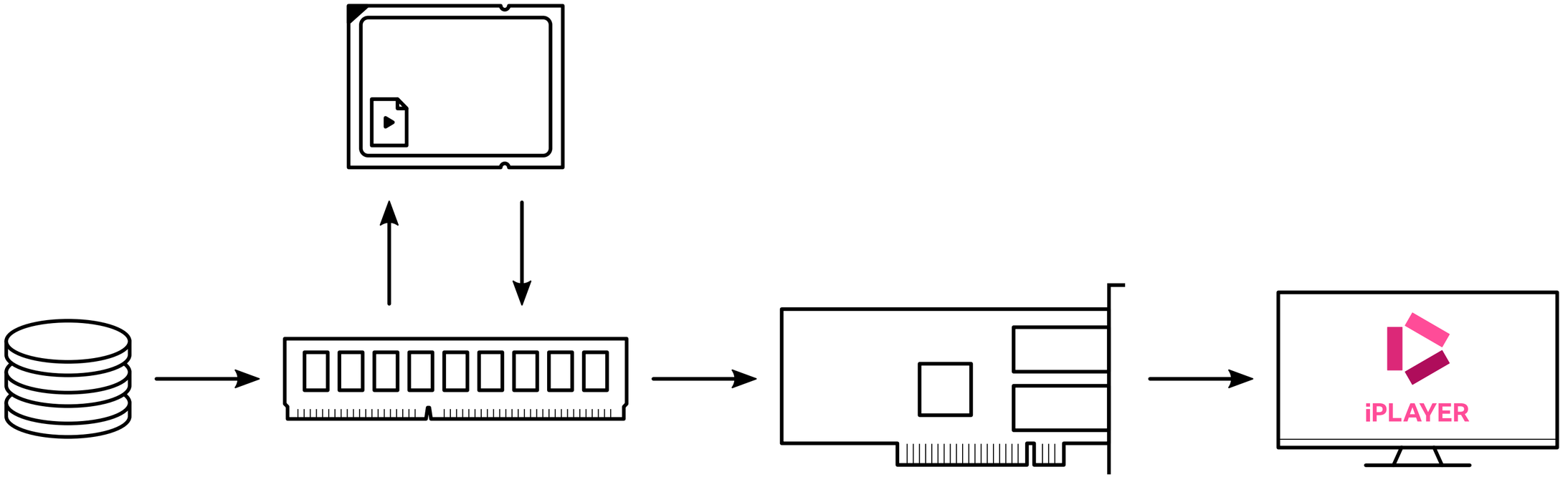
Slow client effects



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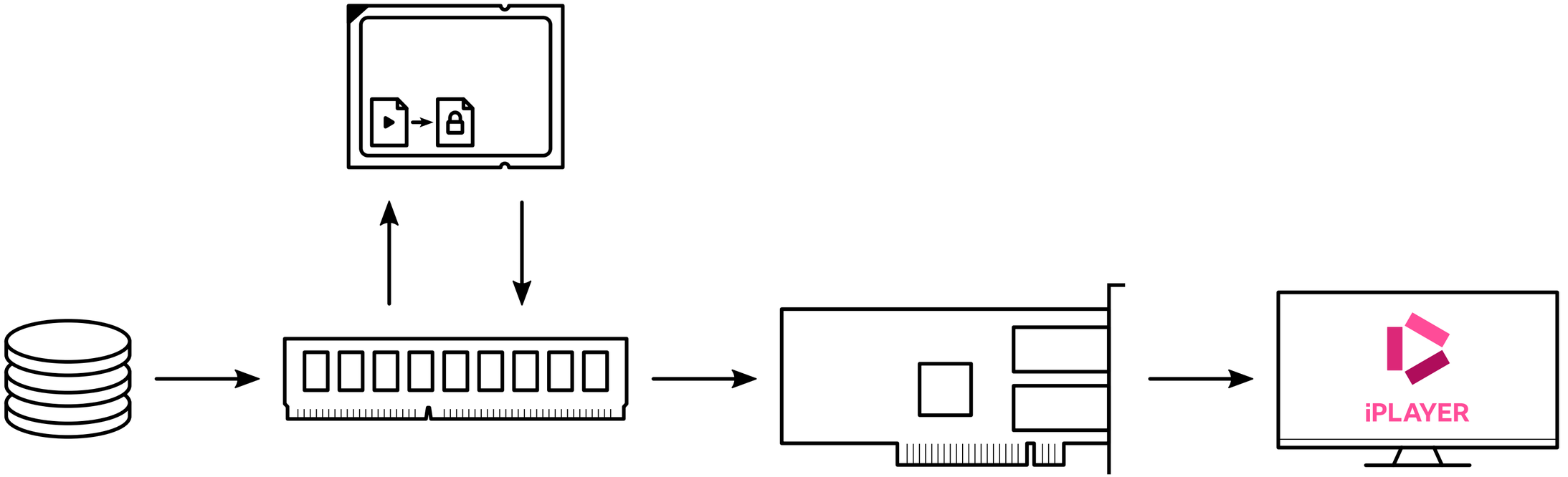
Slow client effects



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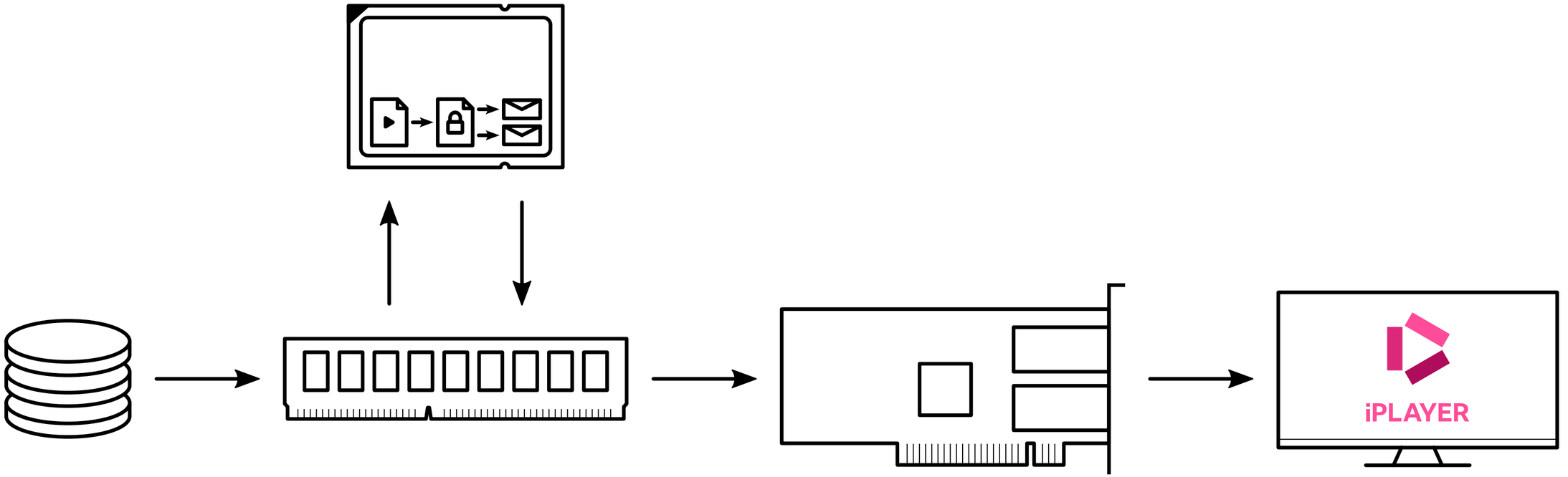
Slow client effects



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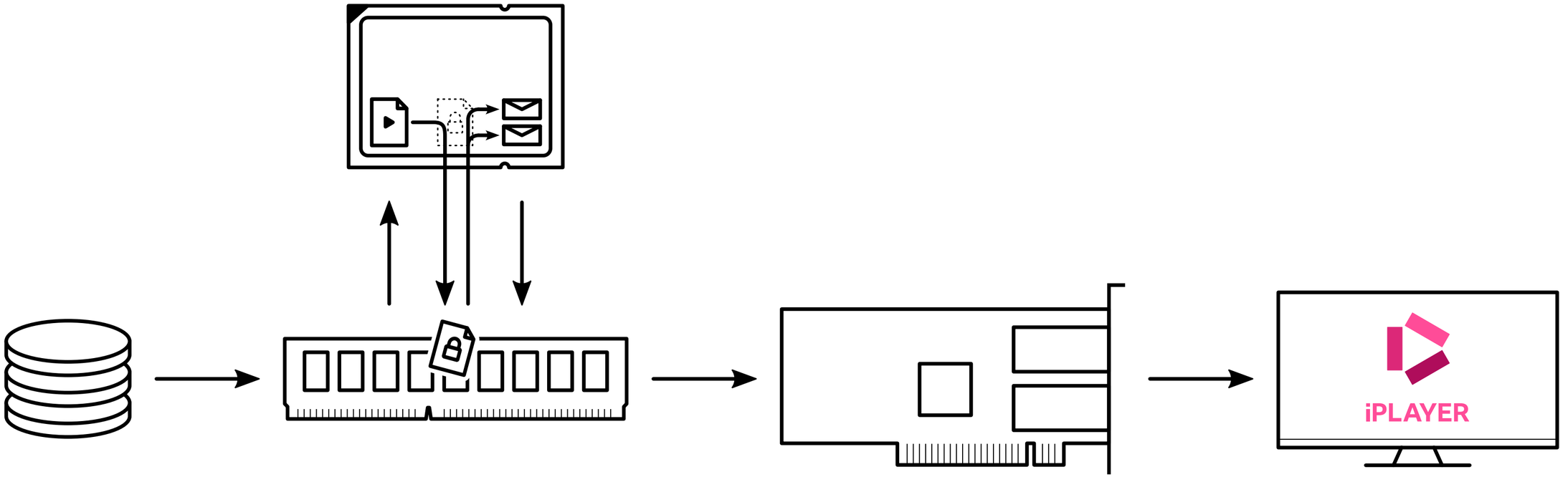
Slow client effects



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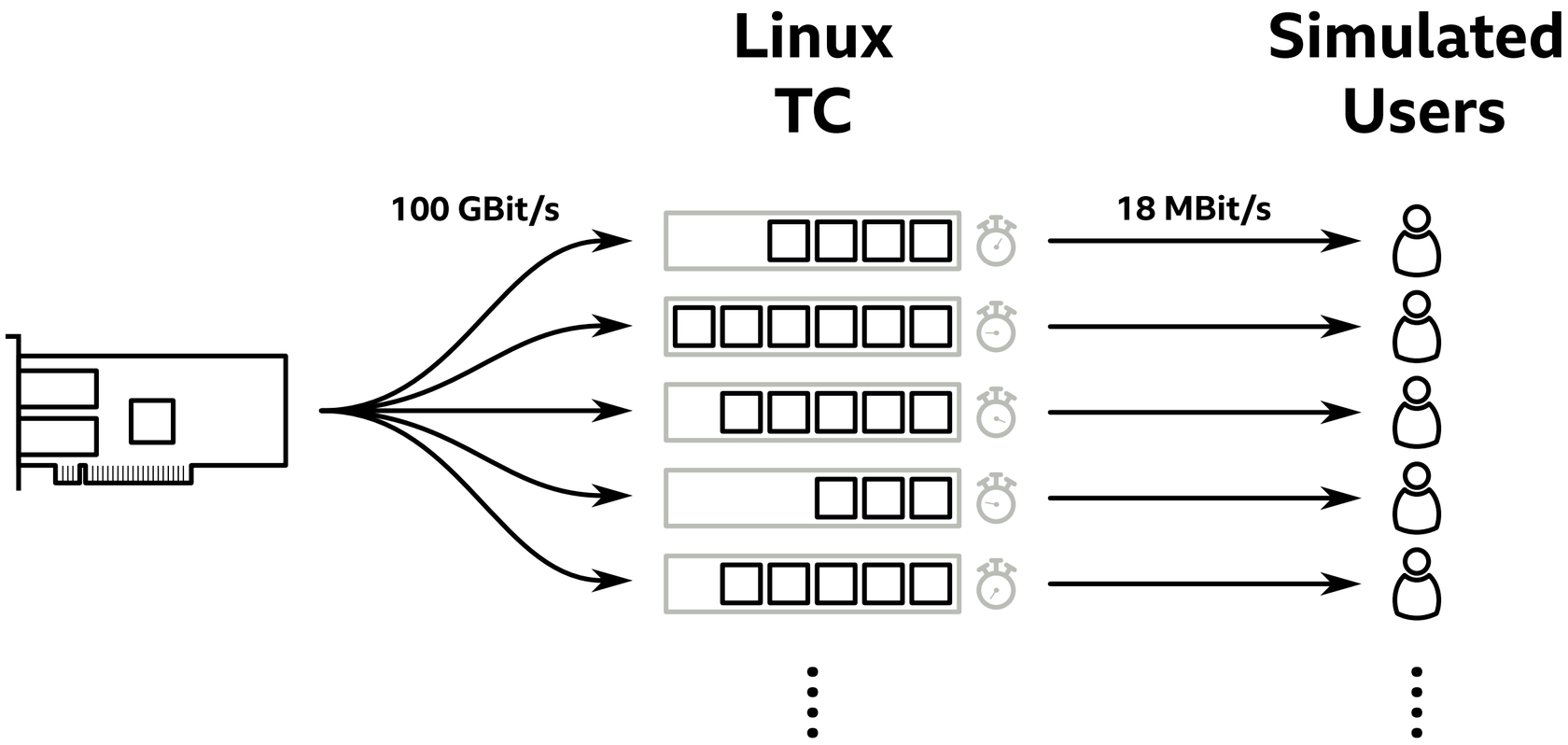
Modelling real internet connections: Linux TC



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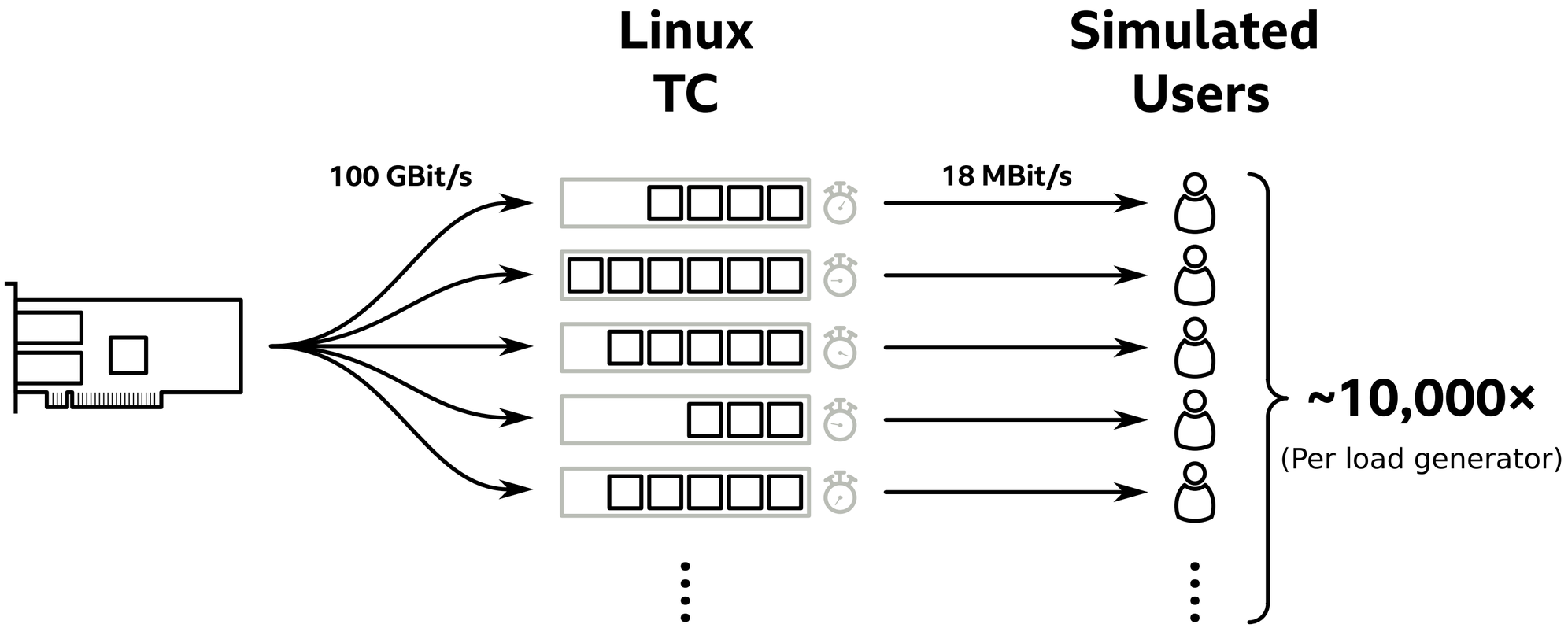
For a superb introduction TC see: https://medium.com/criteo-engineering/demystification-of-tc-de3dfe4067c2

Modelling real internet connections: Linux TC



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Demystification of TC

Frederic Boismenu · Follow
Published in Criteo R&D Blog
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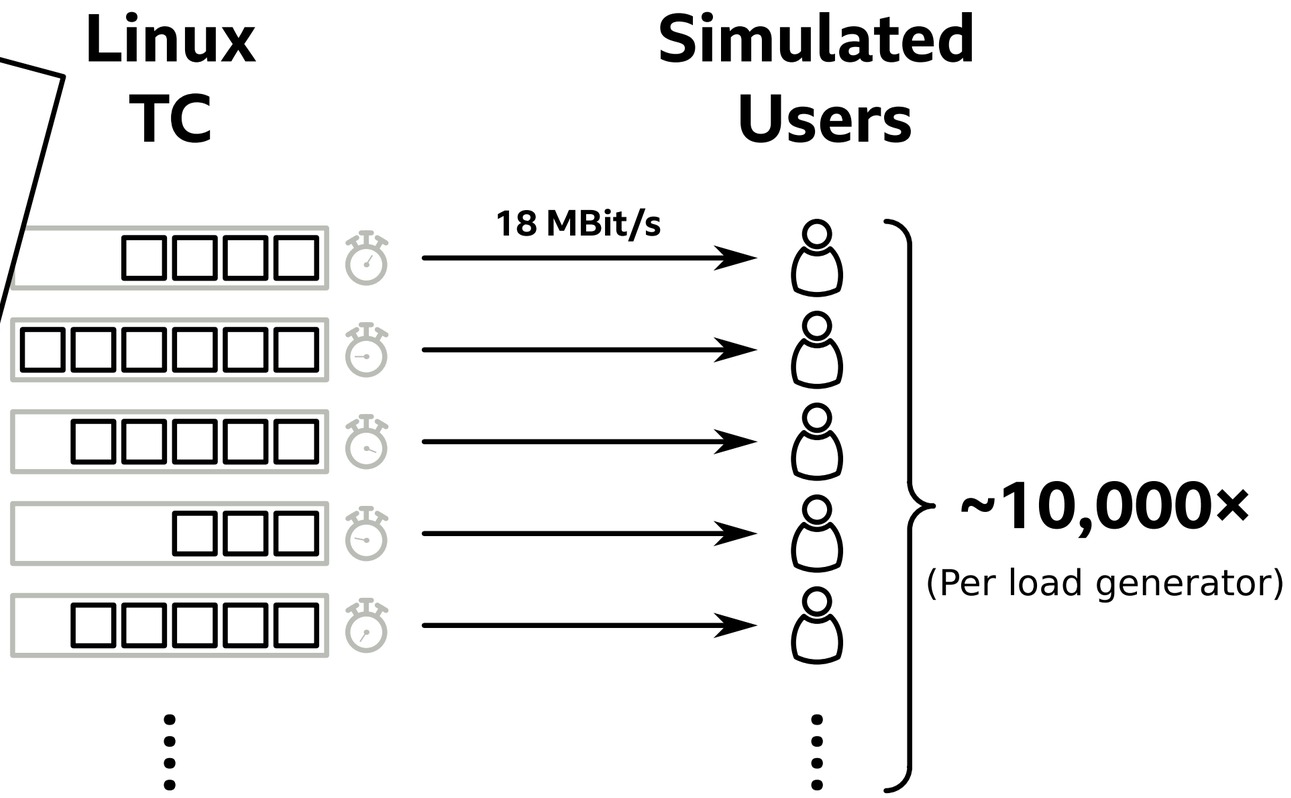
At Criteo we operate containers with Mesos. Containers are sharing the resources of their host. Applications are competing to access these resources. One of the great benefits of containers is to allow tackling the resource contention issue.

The network resources are somewhat special compared to other ones such as CPU and memory for several reasons. First of all, it is the most sensitive to contention just because of the (relative) lack of speed of the network compared to CPU and RAM. A network bound application will notice any added latency to its flow, which may be visible at human scale. It is easy for an application to impact the network performance of a co-hosted one. This is the noisy neighbor issue.

Then, network optimization issues are much more complex than, for example, CPU sharing because the overall performance of the system depends on external, unpredictable, and rapidly changing factors.

Finally, the way you share your network resources is political, and as such there is no one-size-fit-all policy addressing all use cases.

Since we did not find any off-the-shelf solution ma
network usage of Mesos container
on Linux standard tool
informatio



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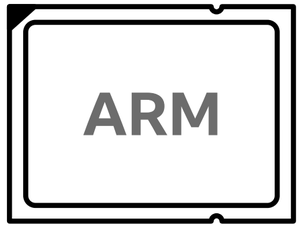
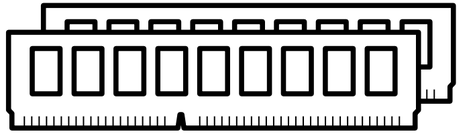
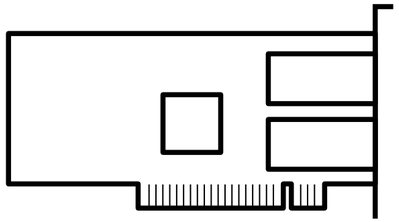
Conclusions



ARM Servers Work Well



Memory Bandwidth now the Bottleneck



Realising NIC Performance is Challenging

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Thank you!

Jonathan Heathcote

BBC Research & Development

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