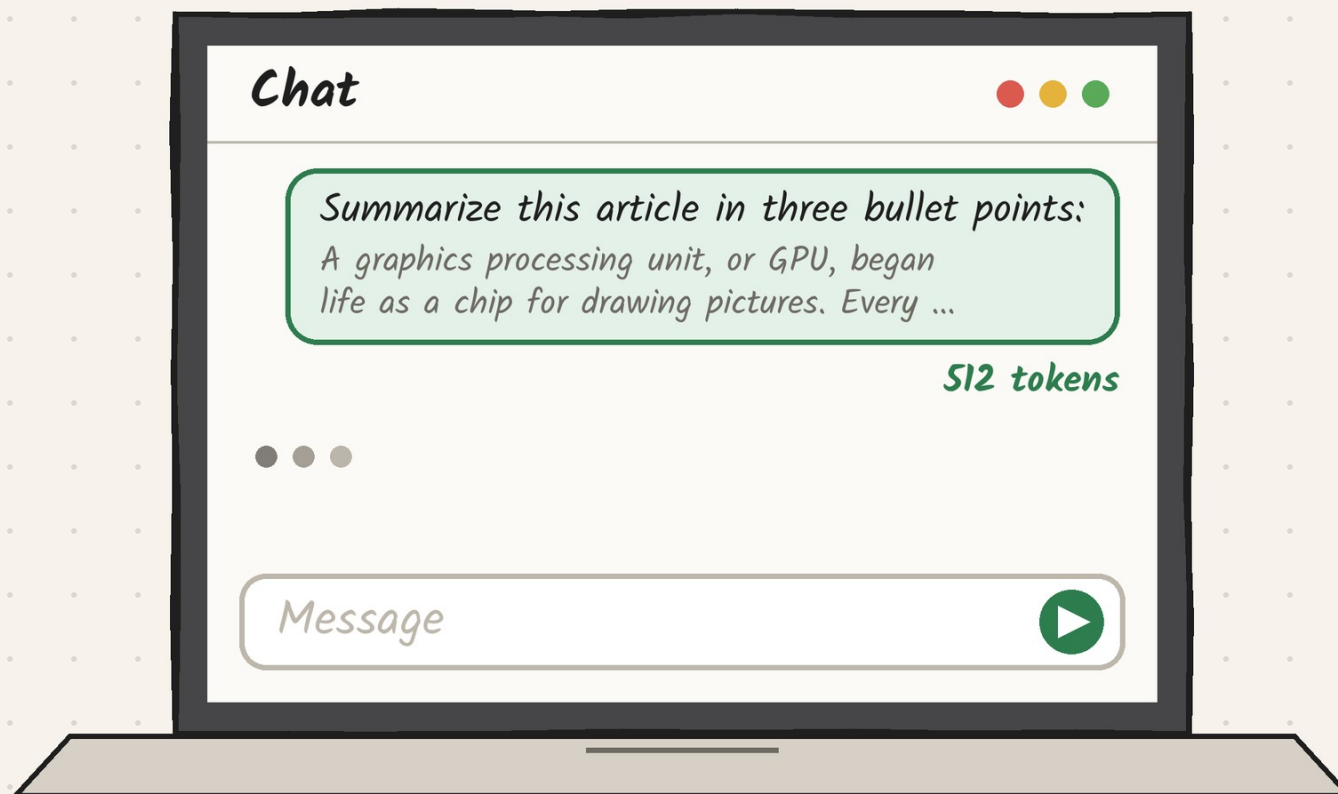


AI through the lens of a GPU

how Qwen3.8-27B makes tokens on 1x NVIDIA H100 GPU



*the prompt travels from your laptop to the 1x NVIDIA H100 GPU server
(network time is not counted: every time in this video is measured on the server)*

1/3

It starts with your prompt
an article to summarize: 512 tokens

AI through the lens of a GPU

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tokenizer (CPU)

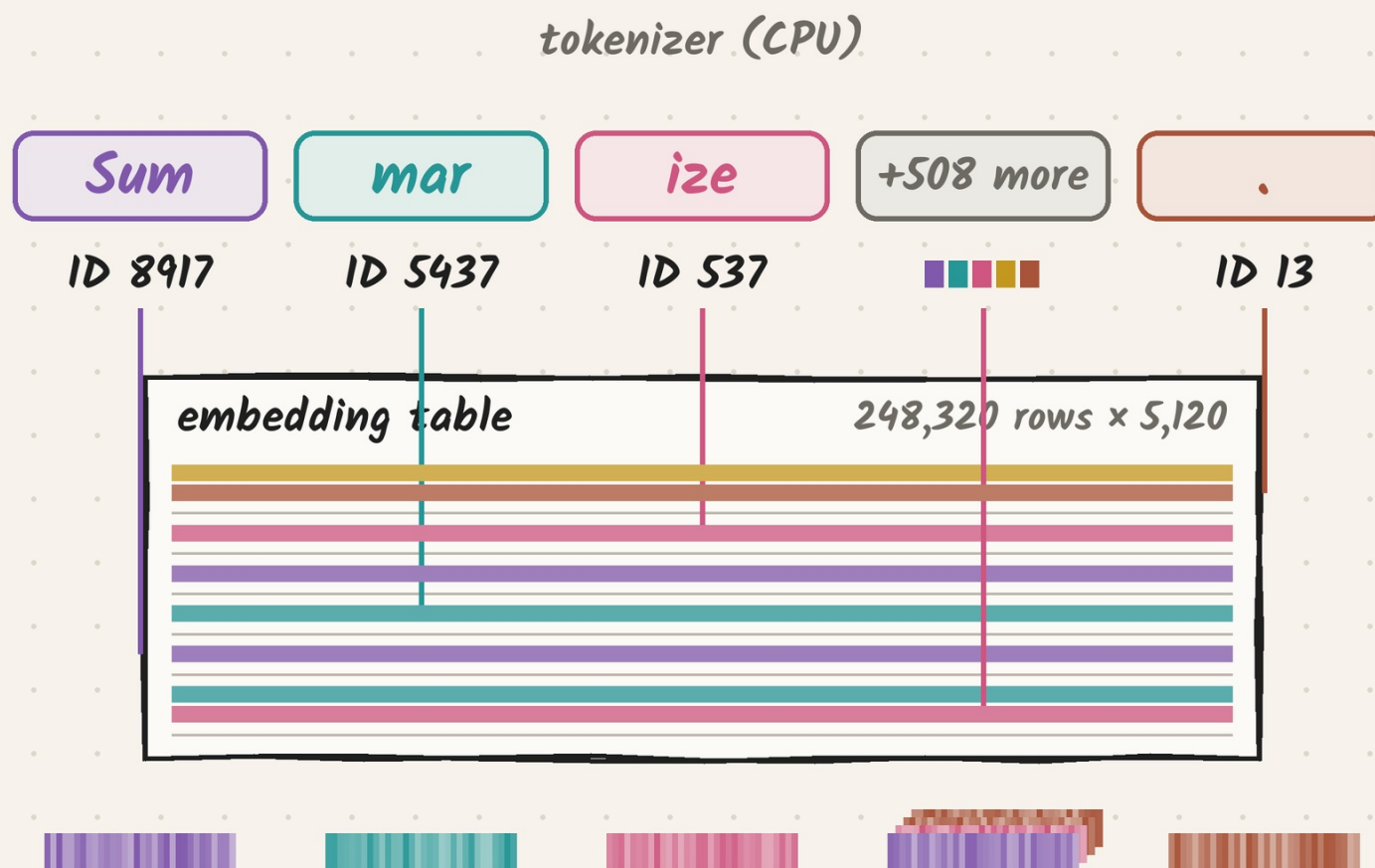


2/3

The tokenizer (CPU) splits it
into 512 token IDs: Sum · mar · ize ...

AI through the lens of a GPU

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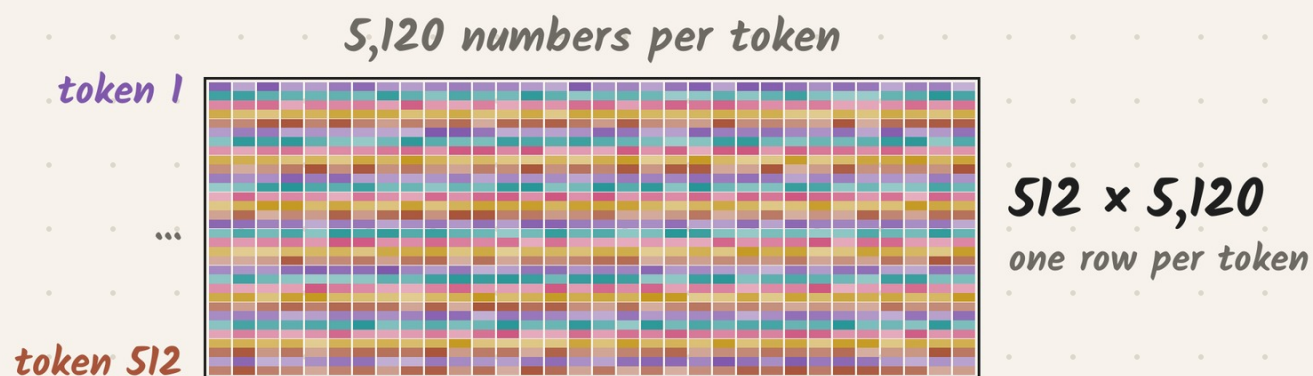


3/13

Each ID picks a row of 5,120 numbers
from the embedding table

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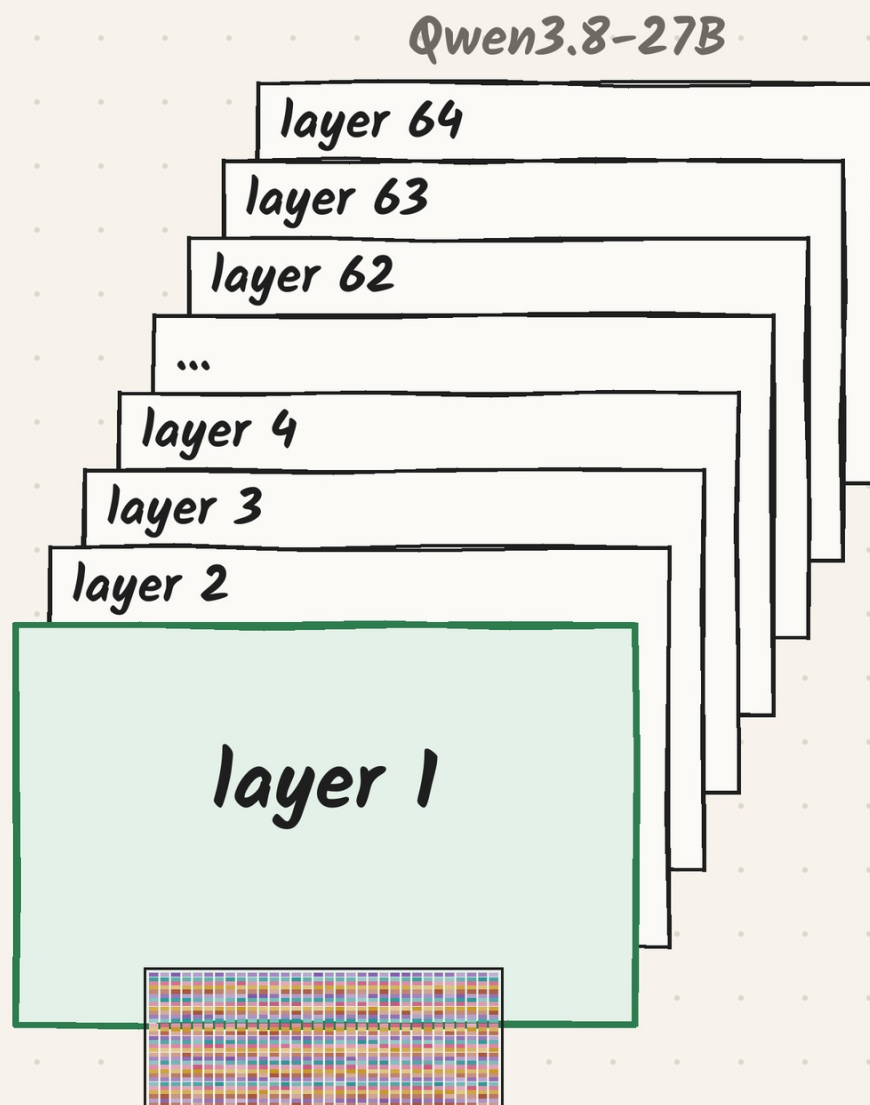


4/13

Stack them: $512 \times 5,120$
one row per token

AI through the lens of a GPU

how Qwen3.8-27B makes tokens on 1x NVIDIA H100 GPU



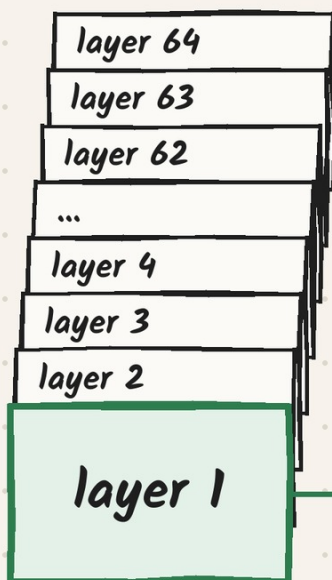
5/13

Prompt phase: all 512 go in together
the whole matrix enters layer 1

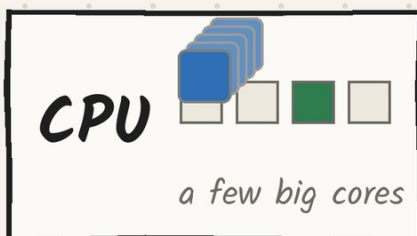
AI through the lens of a GPU

how Qwen3.8-27B makes tokens on 1x NVIDIA H100 GPU

kernels in a layer:



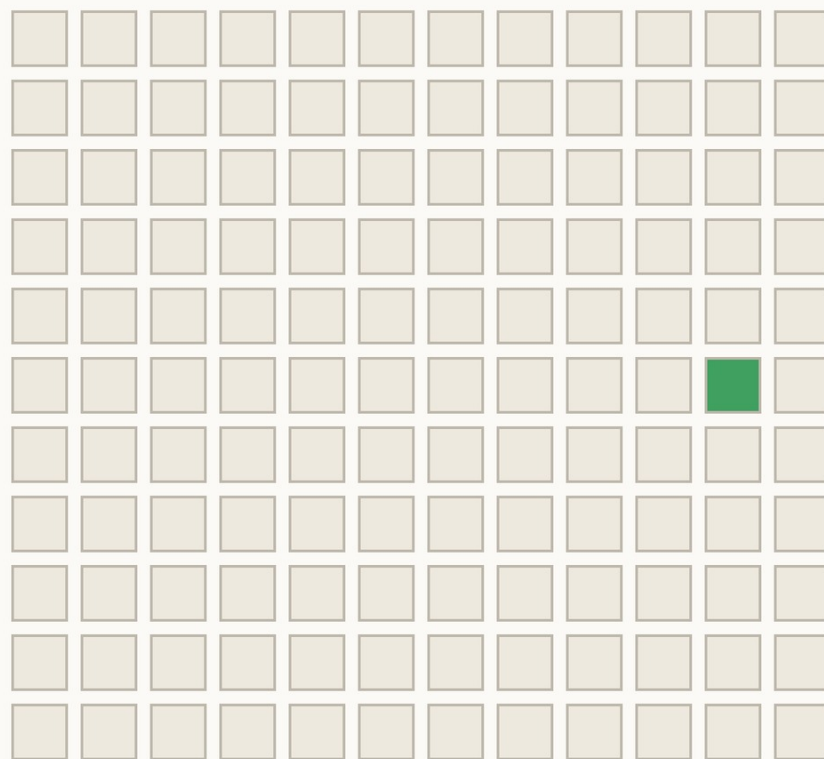
-  RMSNorm
-  GEMM Q, K, V
-  Attention
-  GEMM output
-  RMSNorm
-  GEMM MLP up
-  SiLU
-  GEMM MLP down



1x NVIDIA H100 GPU

132 SMs

989 TFLOP/s BF16 · 3.35 TB/s memory · 528 Tensor Cores



KV cache

in GPU memory



512 prompt tokens

new tokens

6/13

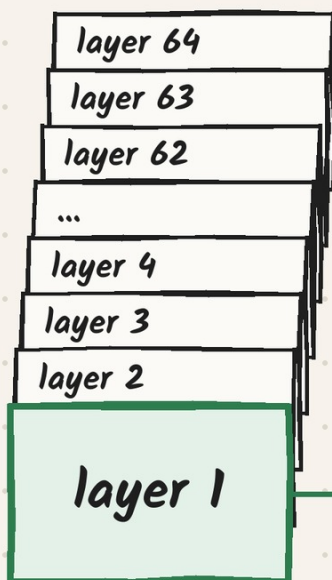
Layer 1 = a chain of kernels

the CPU sends them, the GPU runs them in order

AI through the lens of a GPU

how Qwen3.8-27B makes tokens on 1x NVIDIA H100 GPU

kernels in a layer:



- RMSNorm
- GEMM Q, K, V
- Attention
- GEMM output
- RMSNorm**
- GEMM MLP up
- SiLU
- GEMM MLP down

CPU 
a few big cores

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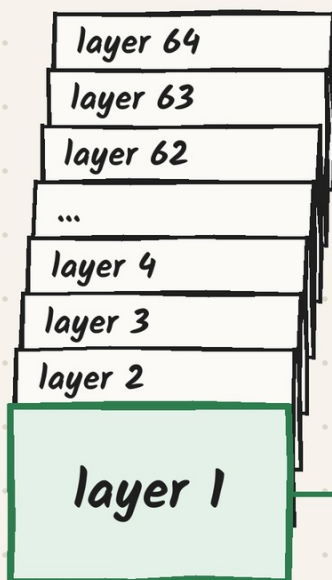
7/13

Q, K, V GEMM saves K and V
of all 512 tokens, in the KV cache

AI through the lens of a GPU

how Qwen3.8-27B makes tokens on 1x NVIDIA H100 GPU

kernels in a layer:



- RMSNorm
- GEMM Q, K, V
- Attention
- GEMM output
- RMSNorm
- GEMM MLP up
- SiLU
- GEMM MLP down

CPU

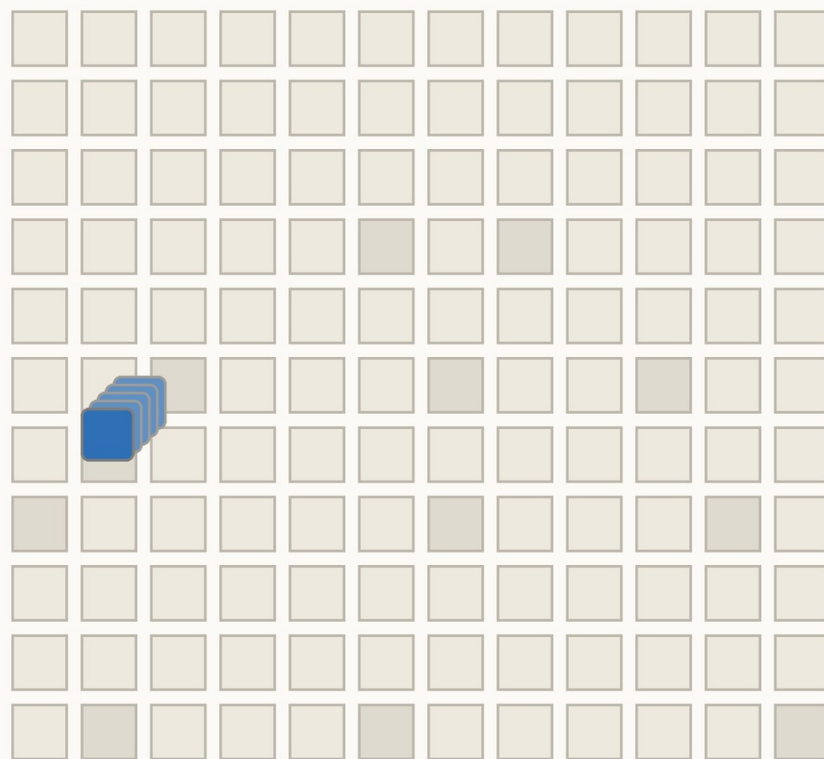


a few big cores

1x NVIDIA H100 GPU

132 SMs

989 TFLOP/s BF16 · 3.35 TB/s memory · 528 Tensor Cores



KV cache

in GPU memory



512 prompt tokens

new tokens

8/13

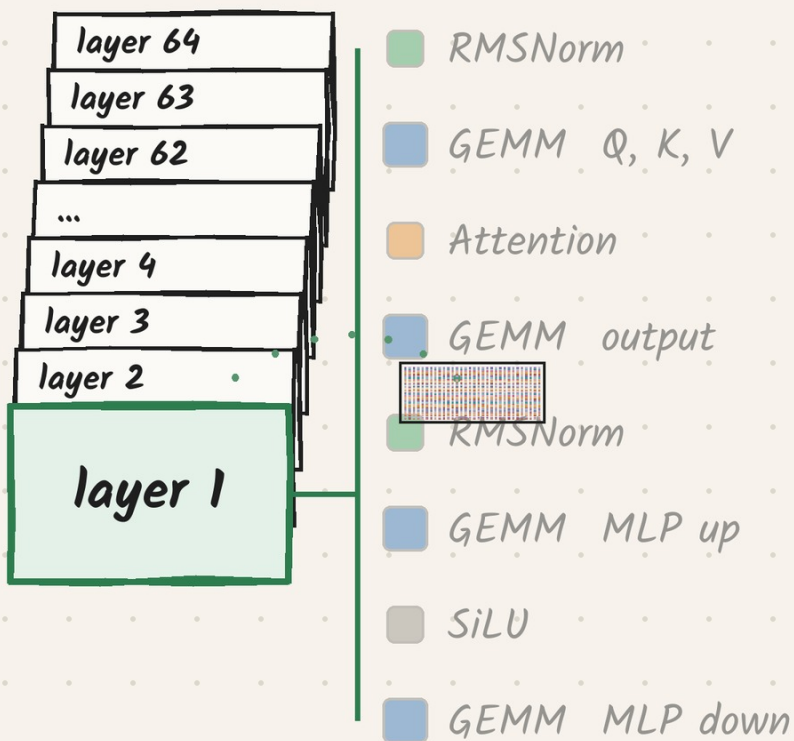
Each kernel spreads over 132 SMs

GEMMs (blue): 92.6% of the GPU time

AI through the lens of a GPU

how Qwen3.8-27B makes tokens on 1x NVIDIA H100 GPU

kernels in a layer:



CPU



a few big cores

1x NVIDIA H100 GPU

132 SMs

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KV cache

in GPU memory



512 prompt tokens

new tokens

Layer 1's output = layer 2's input

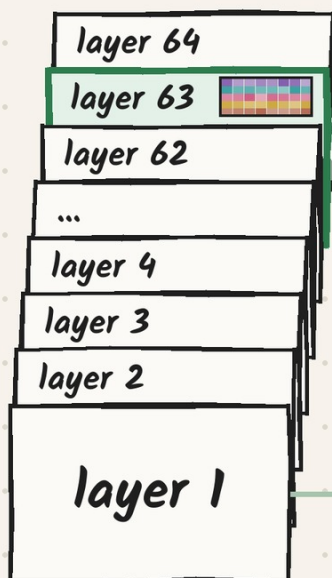
still 512 × 5,120

9/13

AI through the lens of a GPU

how Qwen3.8-27B makes tokens on 1x NVIDIA H100 GPU

kernels in a layer:



- RMSNorm
- GEMM Q, K, V
- Attention
- GEMM output
- RMSNorm
- GEMM MLP up
- SiLU
- GEMM MLP down

CPU

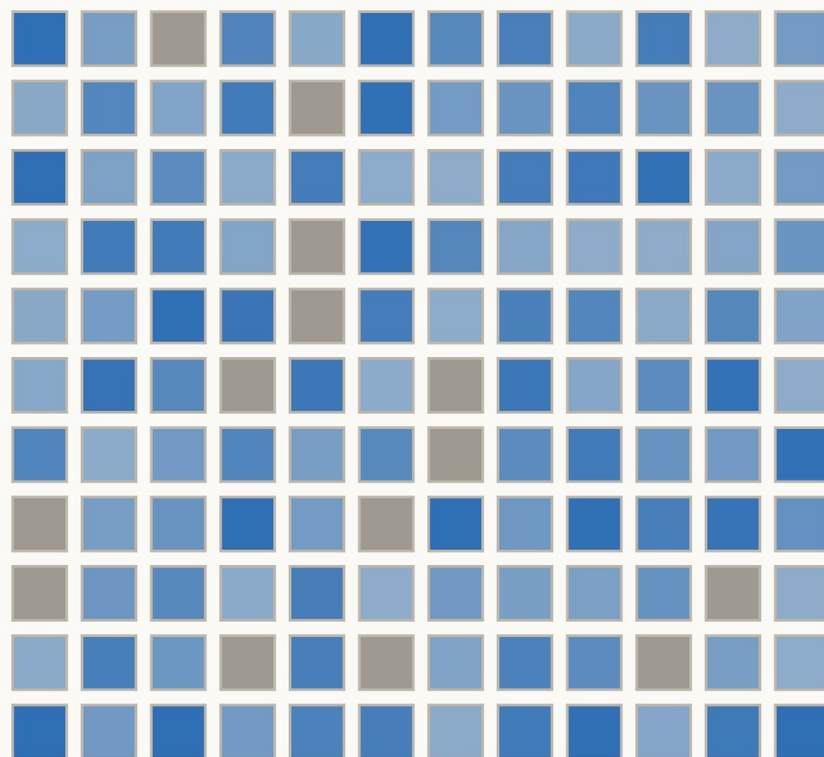


a few big cores

1x NVIDIA H100 GPU

132 SMs

989 TFLOP/s BF16 · 3.35 TB/s memory · 528 Tensor Cores



KV cache

in GPU memory



512 prompt tokens

new tokens

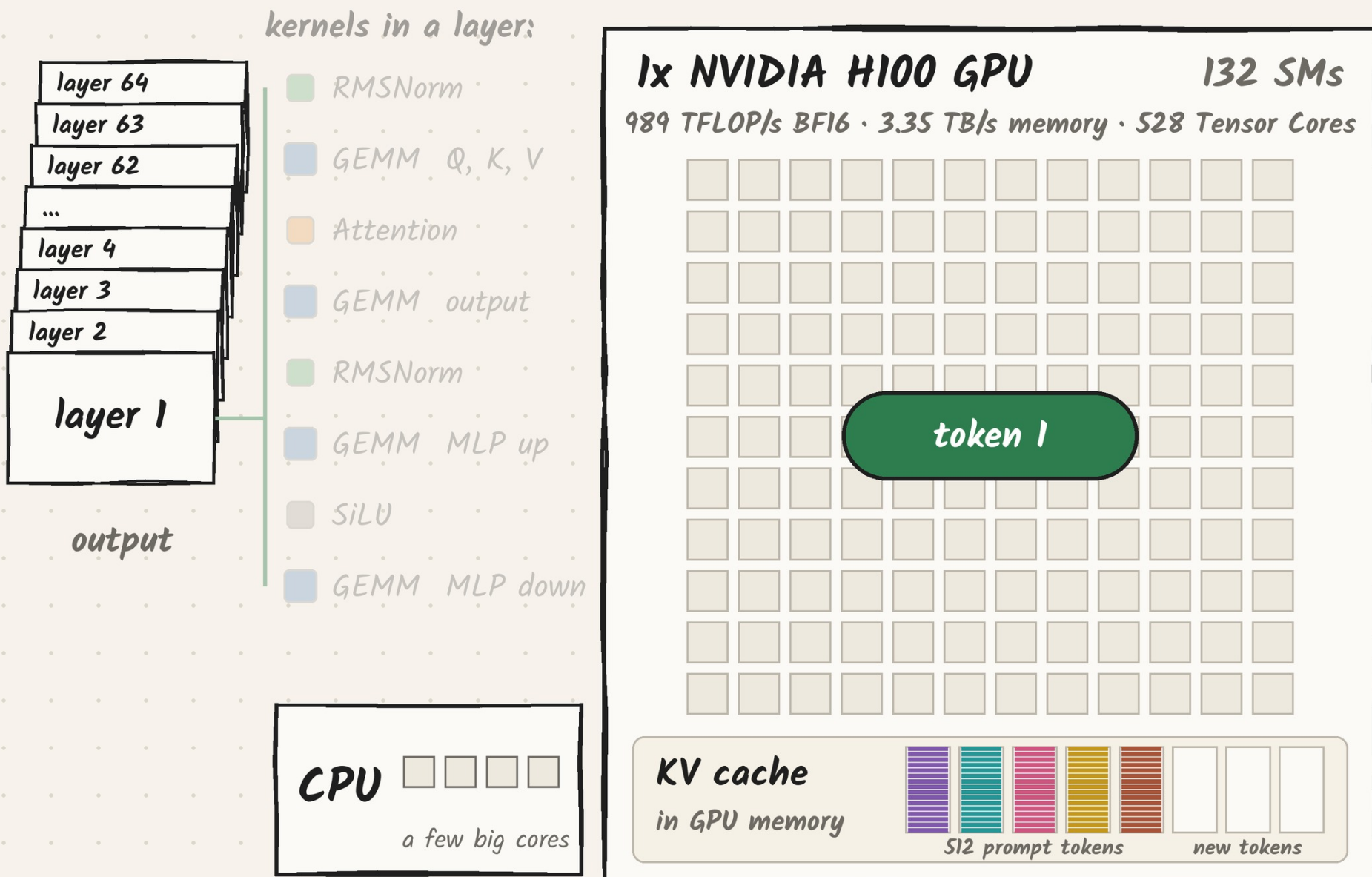
10/13

Then layers 2, 3 ... 64

now: layer 63

AI through the lens of a GPU

how Qwen3.8-27B makes tokens on 1x NVIDIA H100 GPU



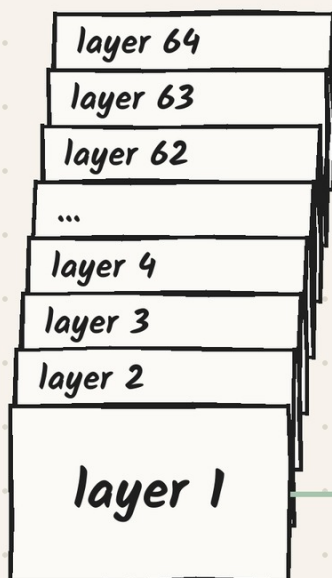
11/13

Output head picks token 1
prompt phase: 512 tokens in 54.3 ms

AI through the lens of a GPU

how Qwen3.8-27B makes tokens on 1x NVIDIA H100 GPU

kernels in a layer:



output

token 2

token 2

- RMSNorm
- GEMM Q, K, V
- Attention
- GEMM output
- RMSNorm
- GEMM MLP up
- SiLU
- GEMM MLP down

CPU



a few big cores

1x NVIDIA H100 GPU

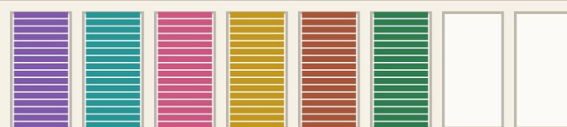
132 SMs

989 TFLOP/s BF16 · 3.35 TB/s memory · 528 Tensor Cores



KV cache

in GPU memory



512 prompt tokens

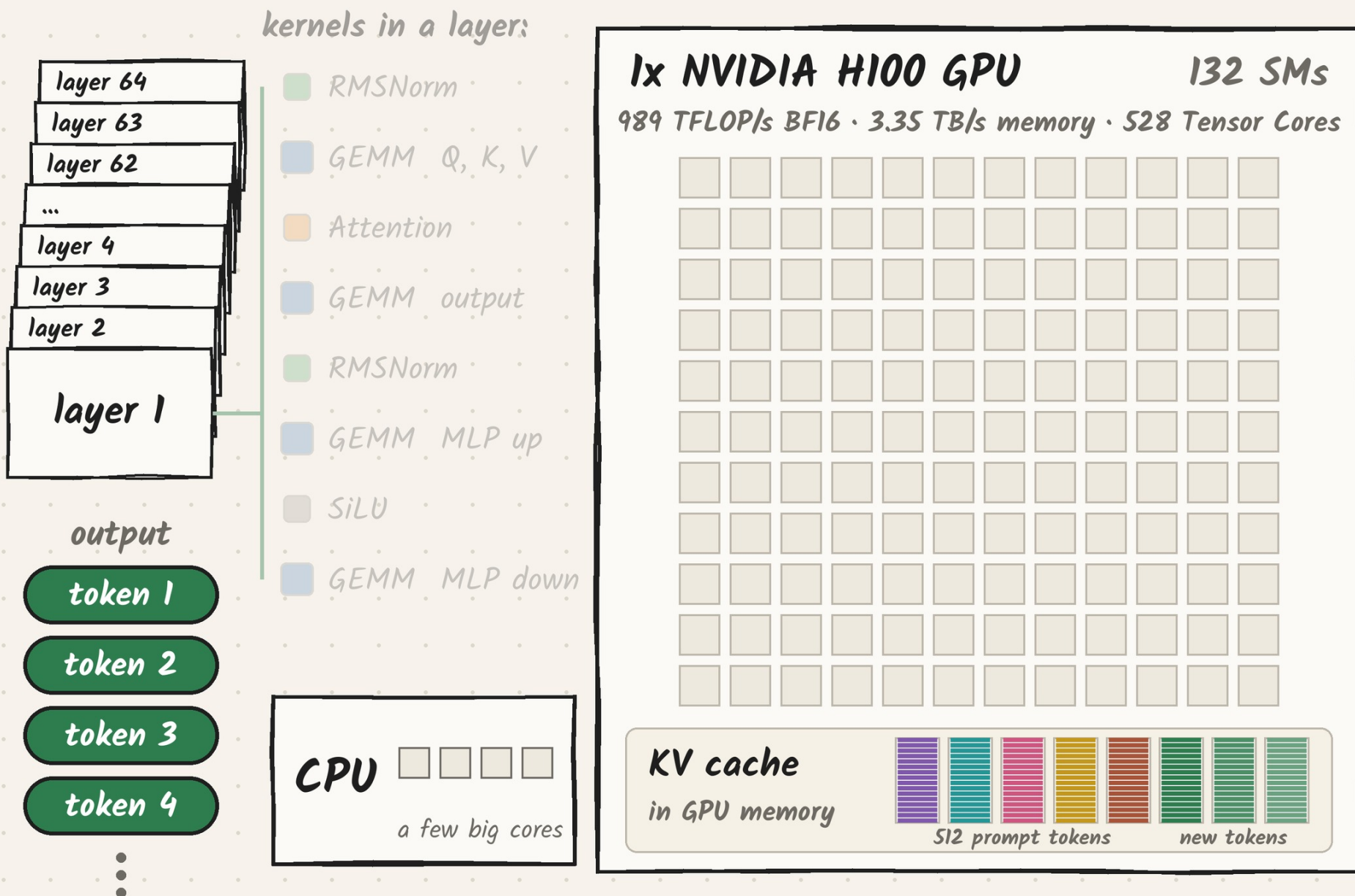
new tokens

12/13

Decode: only the new token goes in, with
K, V of 512 prompt tokens from KV cache, stored in prefill

AI through the lens of a GPU

how Qwen3.8-27B makes tokens on 1x NVIDIA H100 GPU



13/13

One decode step: 902 kernels

20.55 ms per token, 48.7 tokens/s