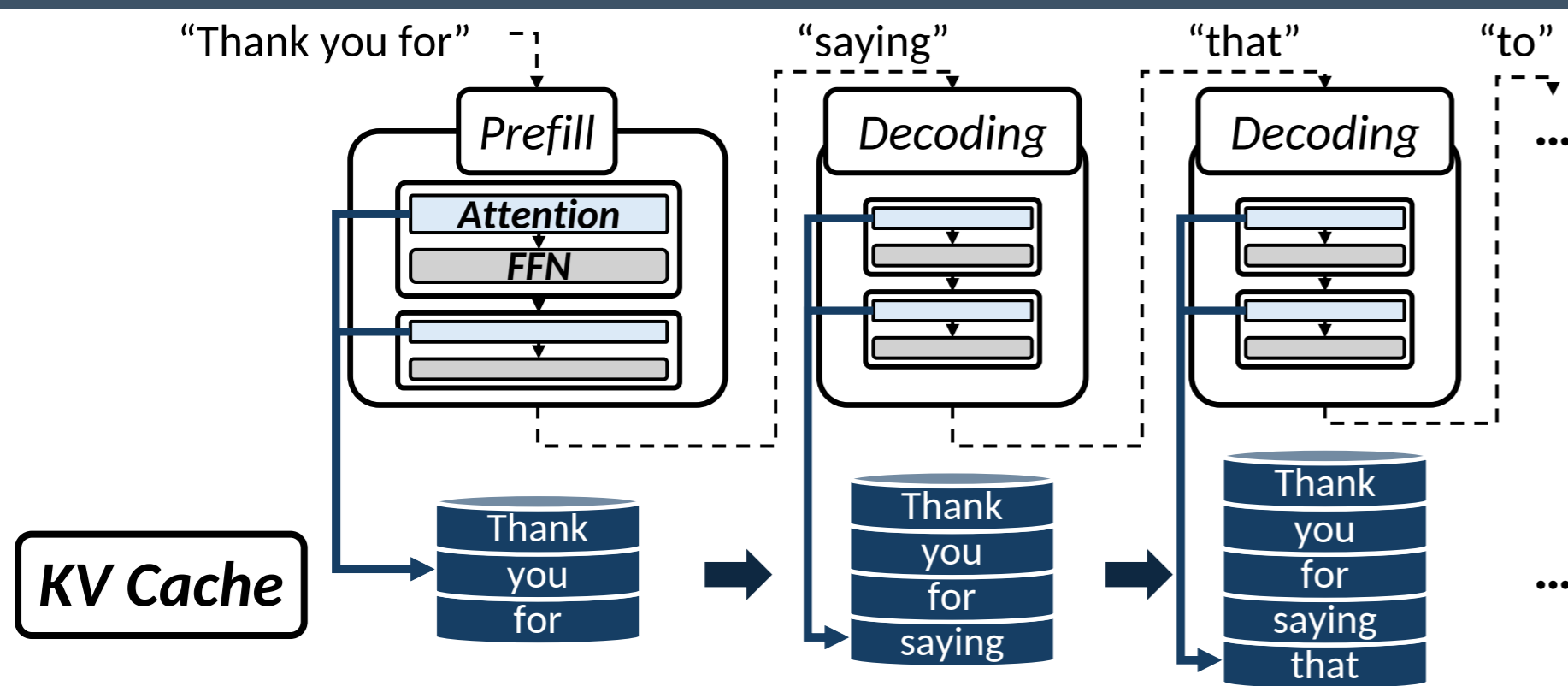# InfiniGen: Efficient Generative Inference of Large Language Models with Dynamic KV Cache Management

Wonbeom Lee*, Jungi Lee*, Junghwan Seo, Jaewoong Sim
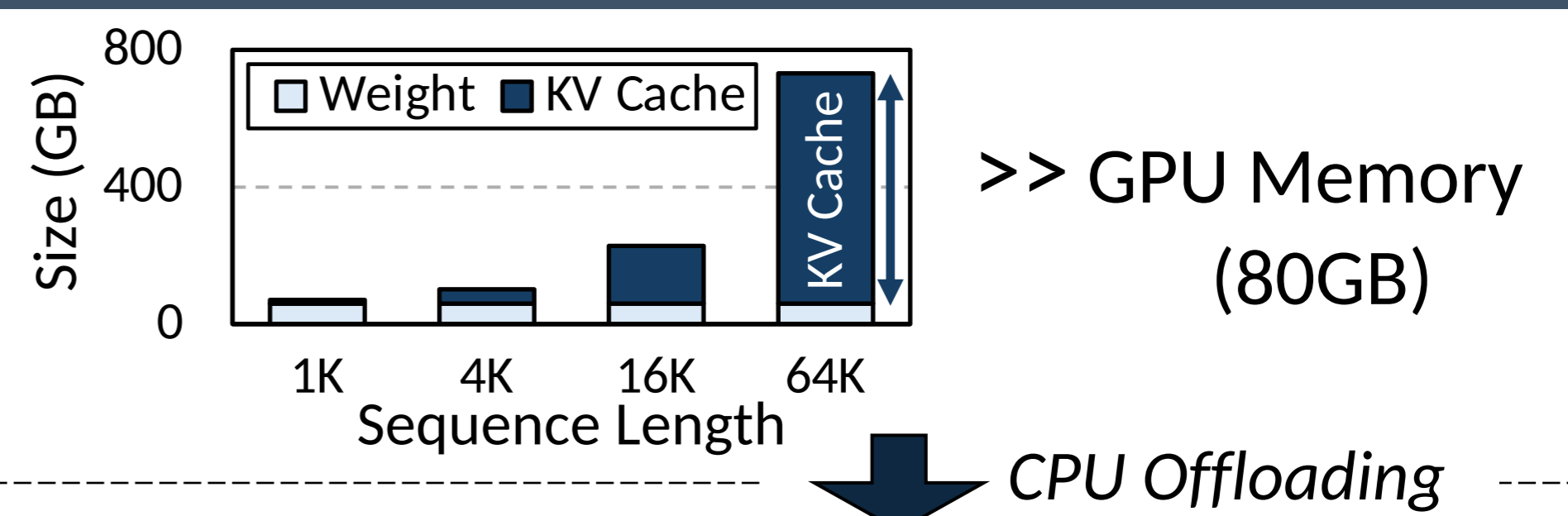
Seoul National University

## Motivation

### LLM Inference & KV Cache



LLMs **memoize** the keys and values of the preceding tokens in memory to generate a new token that aligns well with the context.
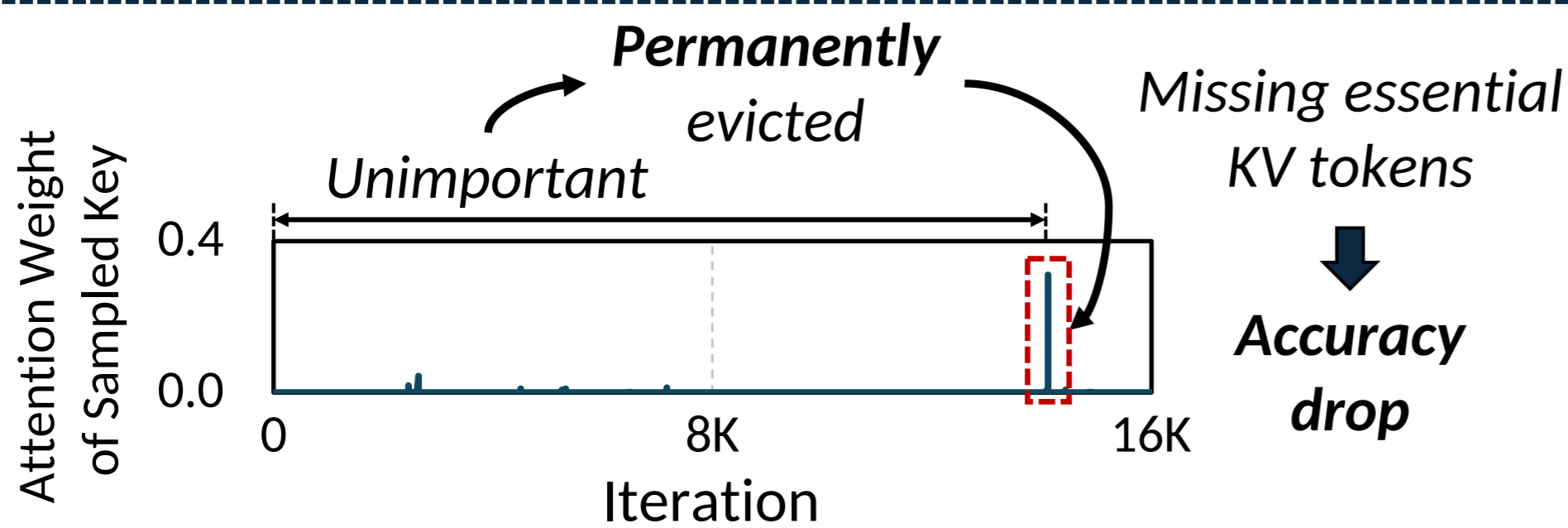
### KV Cache Size & Transfer Overhead



Offloading can enable longer sequences exploiting large CPU memory, but lead to a **significant slowdown** due to the **limited PCIe bandwidth**.
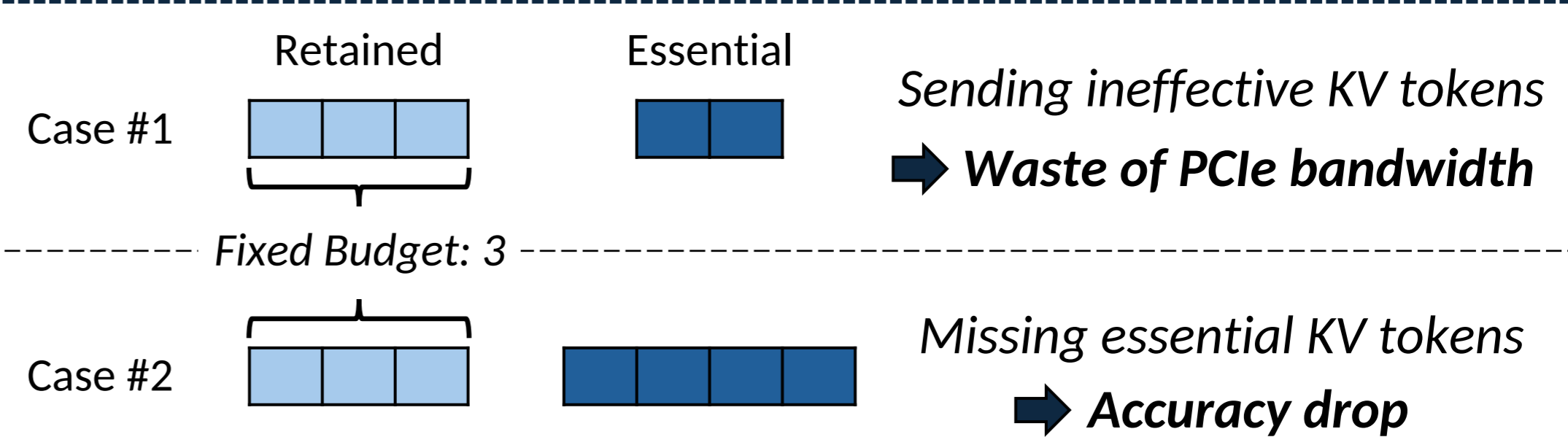
## Challenges

### Dynamic Nature of Attention Patterns across Iterations

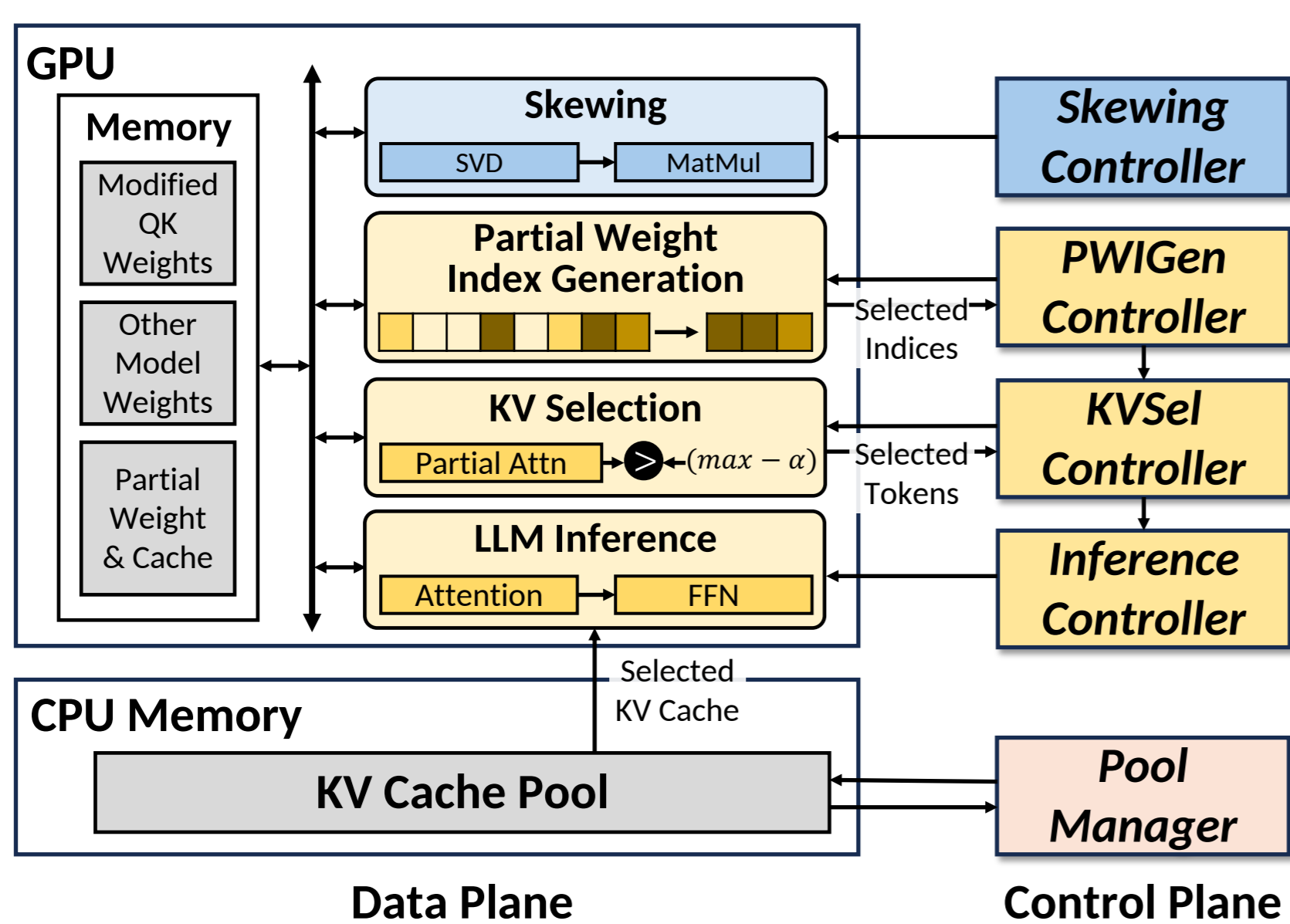Prior approaches **permanently evict** unimportant tokens.



### Adjusting the Number of KV across Layers and Queries

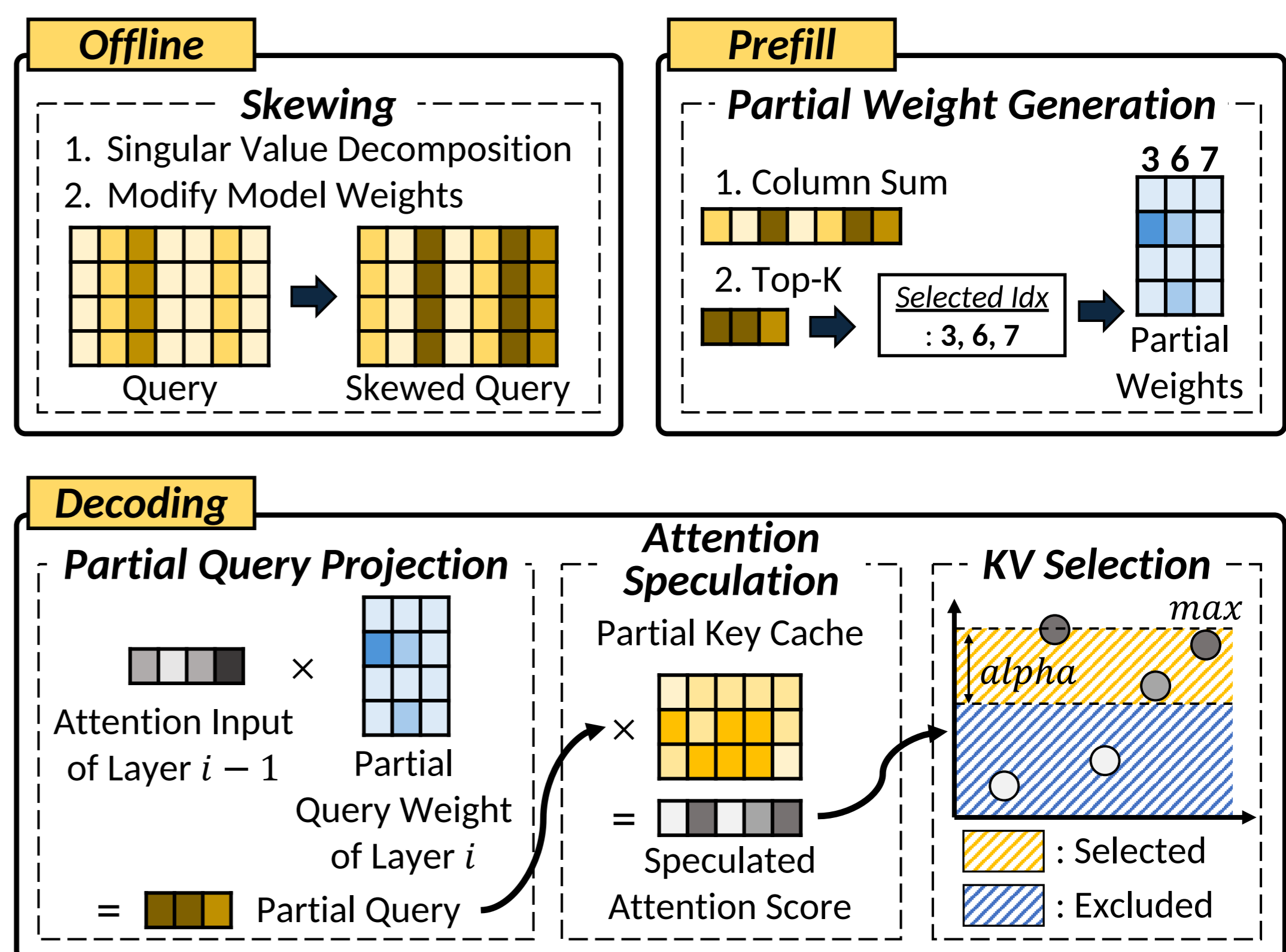Prior approaches use a **fixed KV cache size budget**.
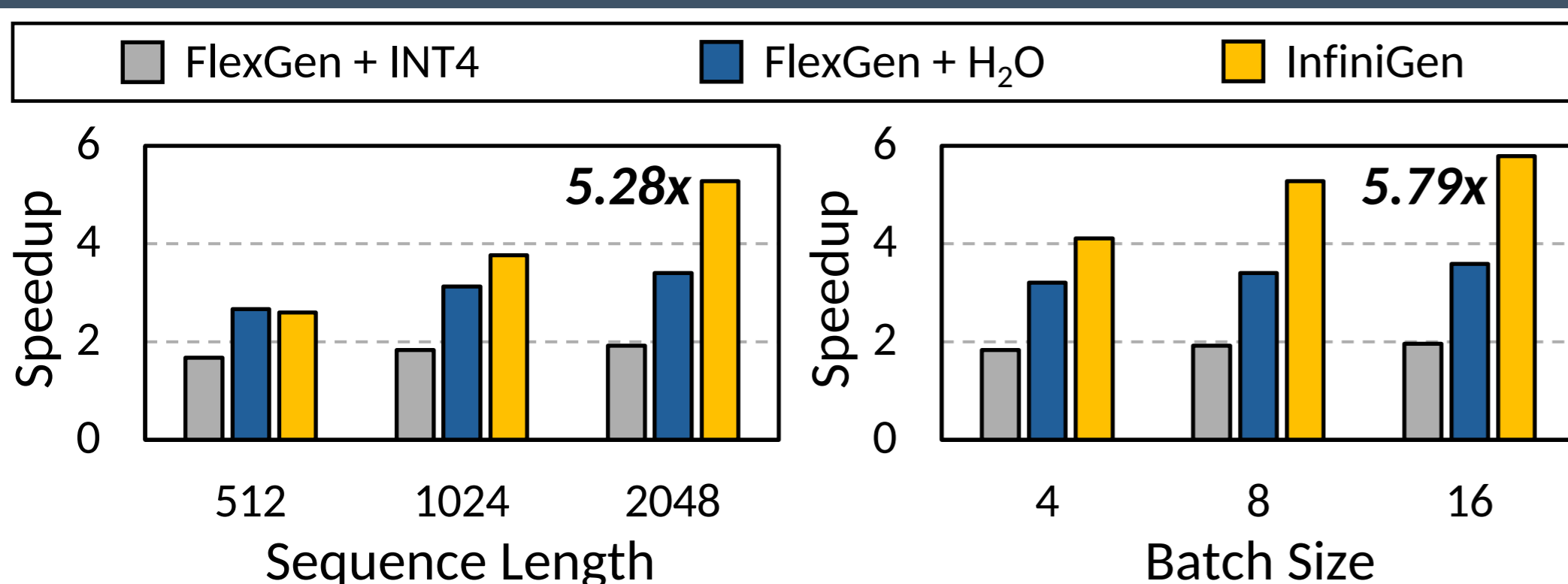


## InfiniGen

### InfiniGen Design



1. (Offline) Modify model weights in *Skewing Controller*
2. Speculate and prefetch KV tokens in *PWIGen/KVSel Controller*
3. Manage KV cache pool on CPU memory in *Pool Manager*

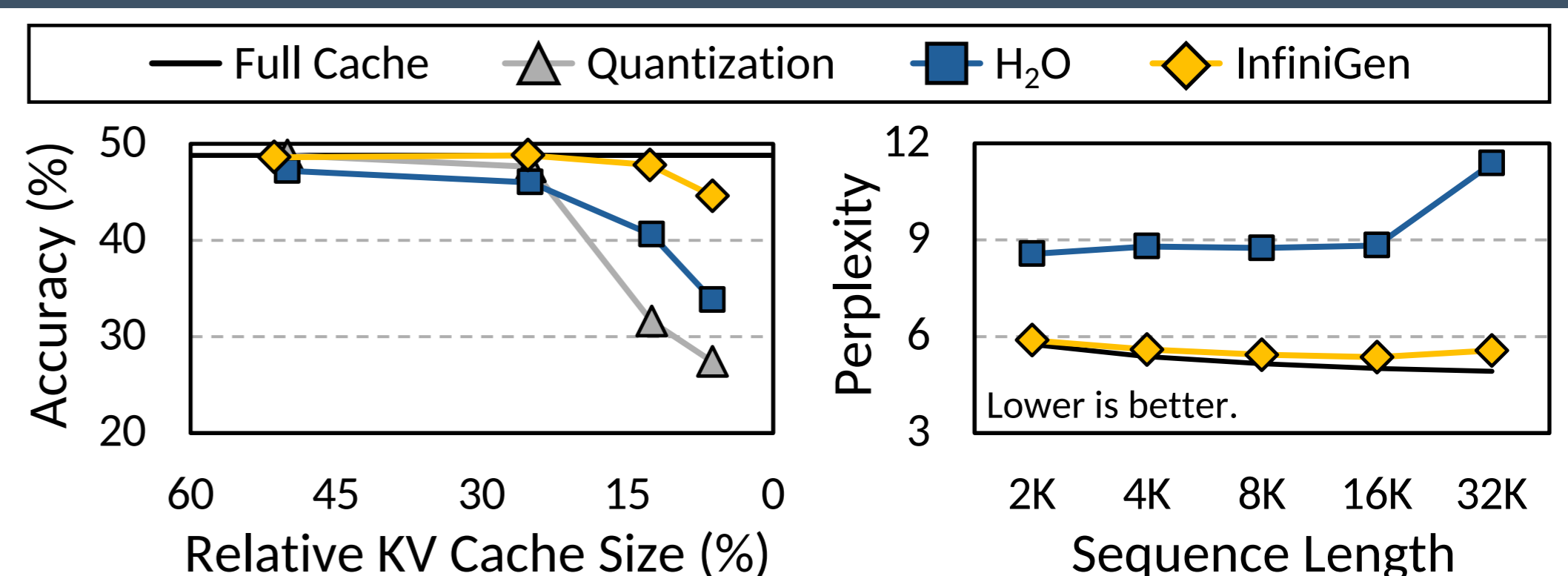### Efficient KV Cache Prefetching



## Results

### Speedup over Modern Offloading-based Inference System



→ InfiniGen shows a *shorter inference latency!*

### Accuracy



→ InfiniGen consistently offers **better accuracy!**