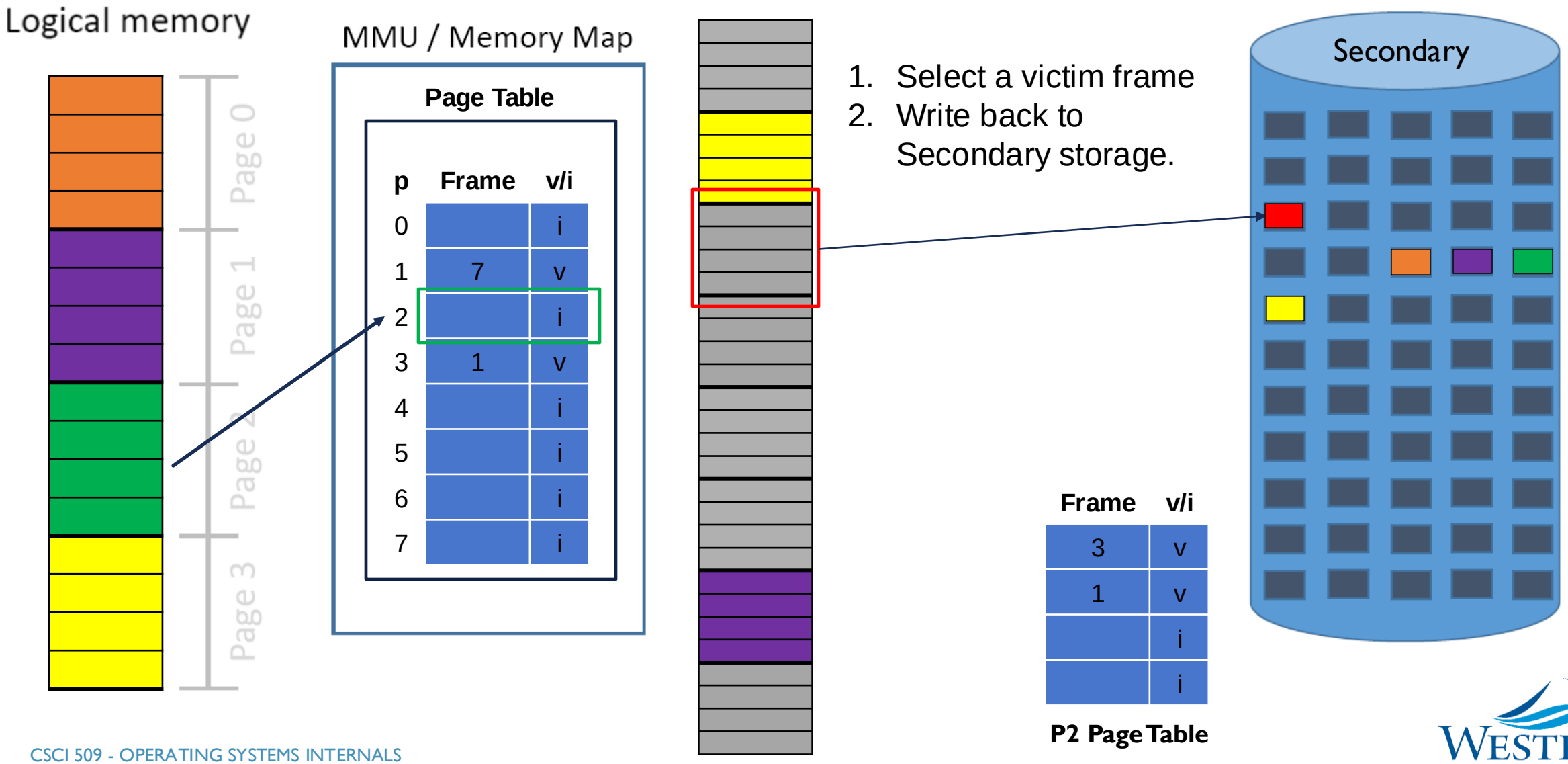
OPERATING SYSTEMS INTERNALS

CSCI 509

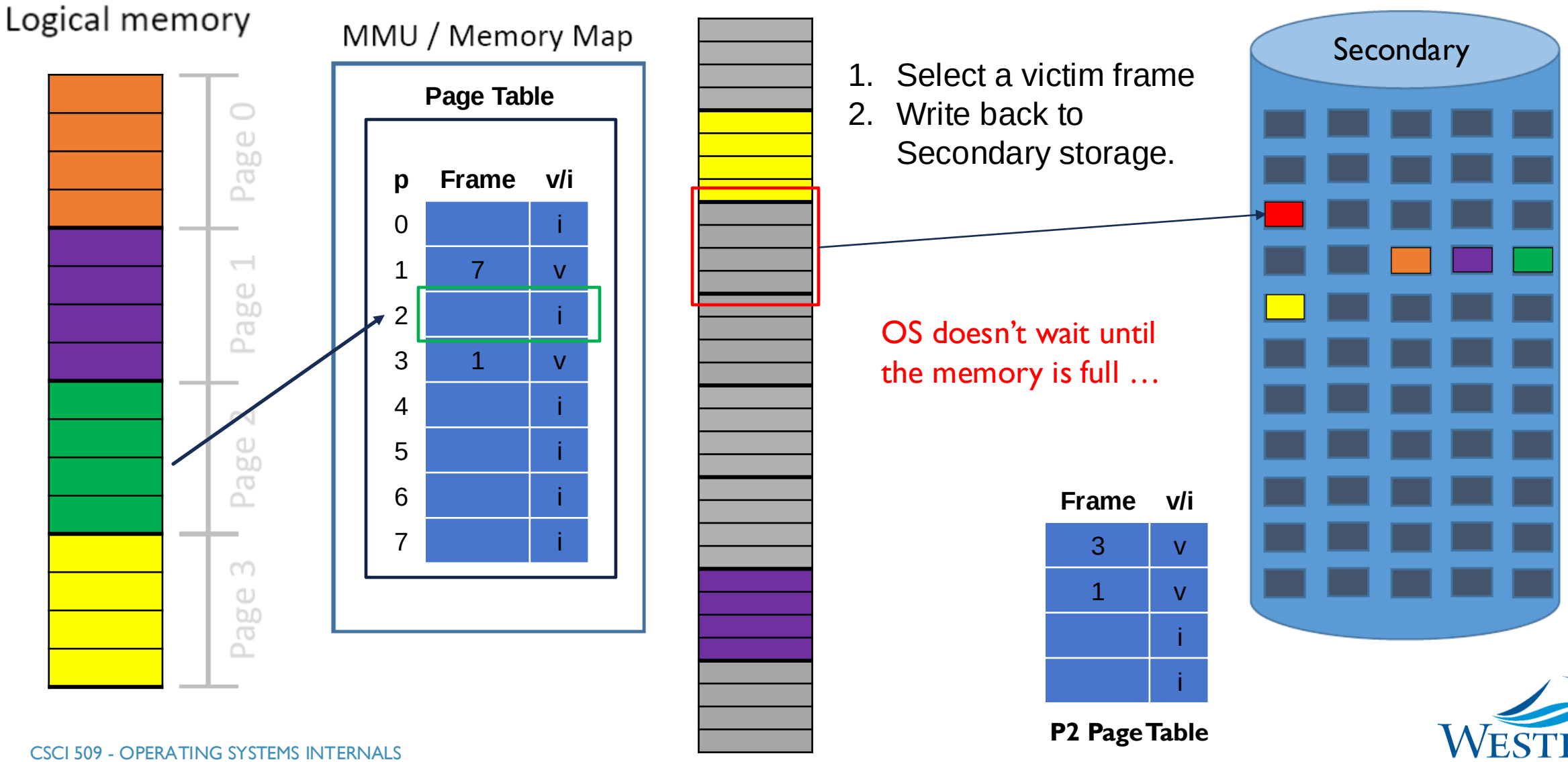
PERFORMANCE ENHANCING TECHNIQUES

- Frame Buffering
- Prefetching and Superfetching
- Prepaging
- Memory Compression

FRAME BUFFERING



FRAME BUFFERING



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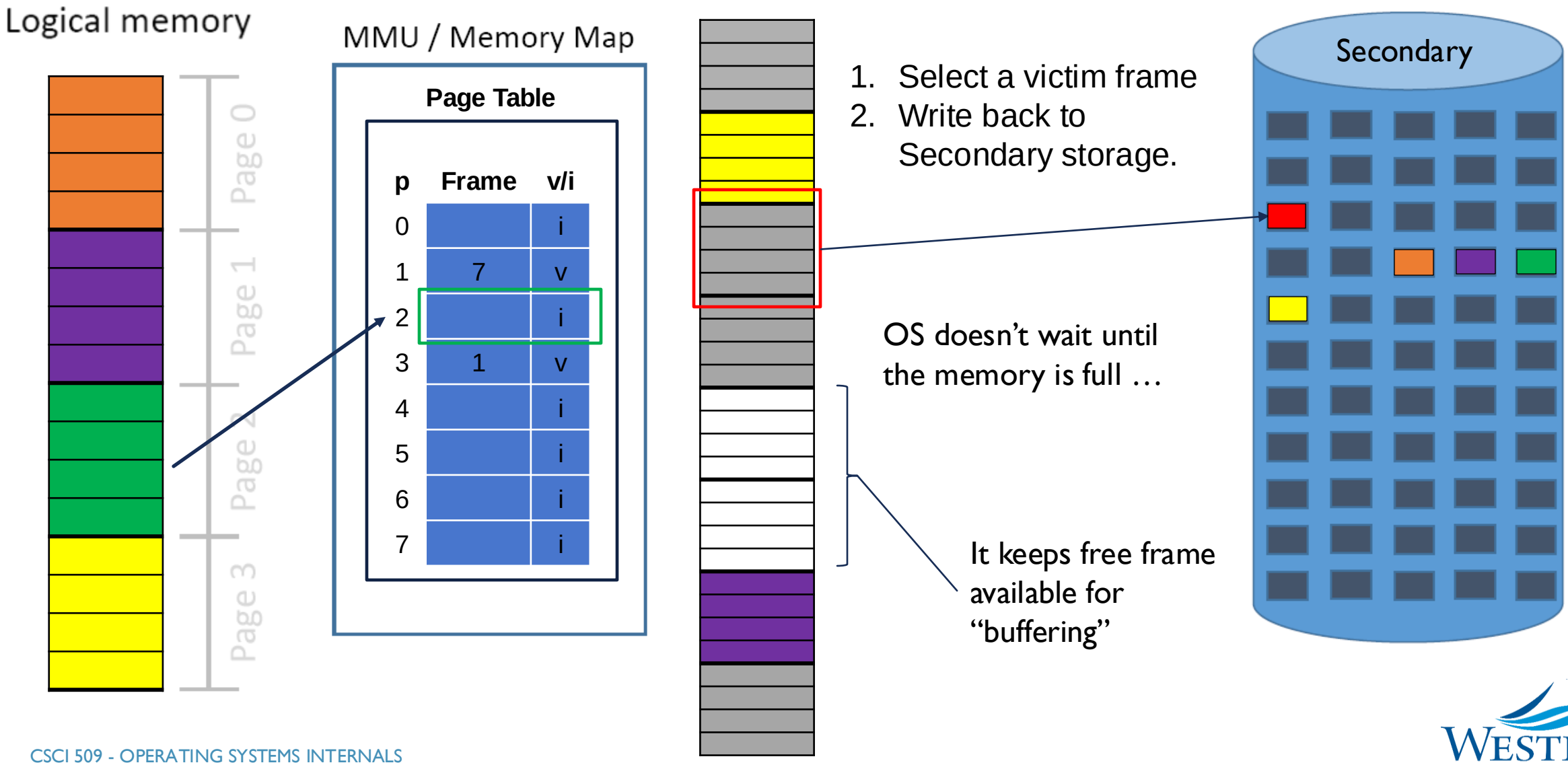

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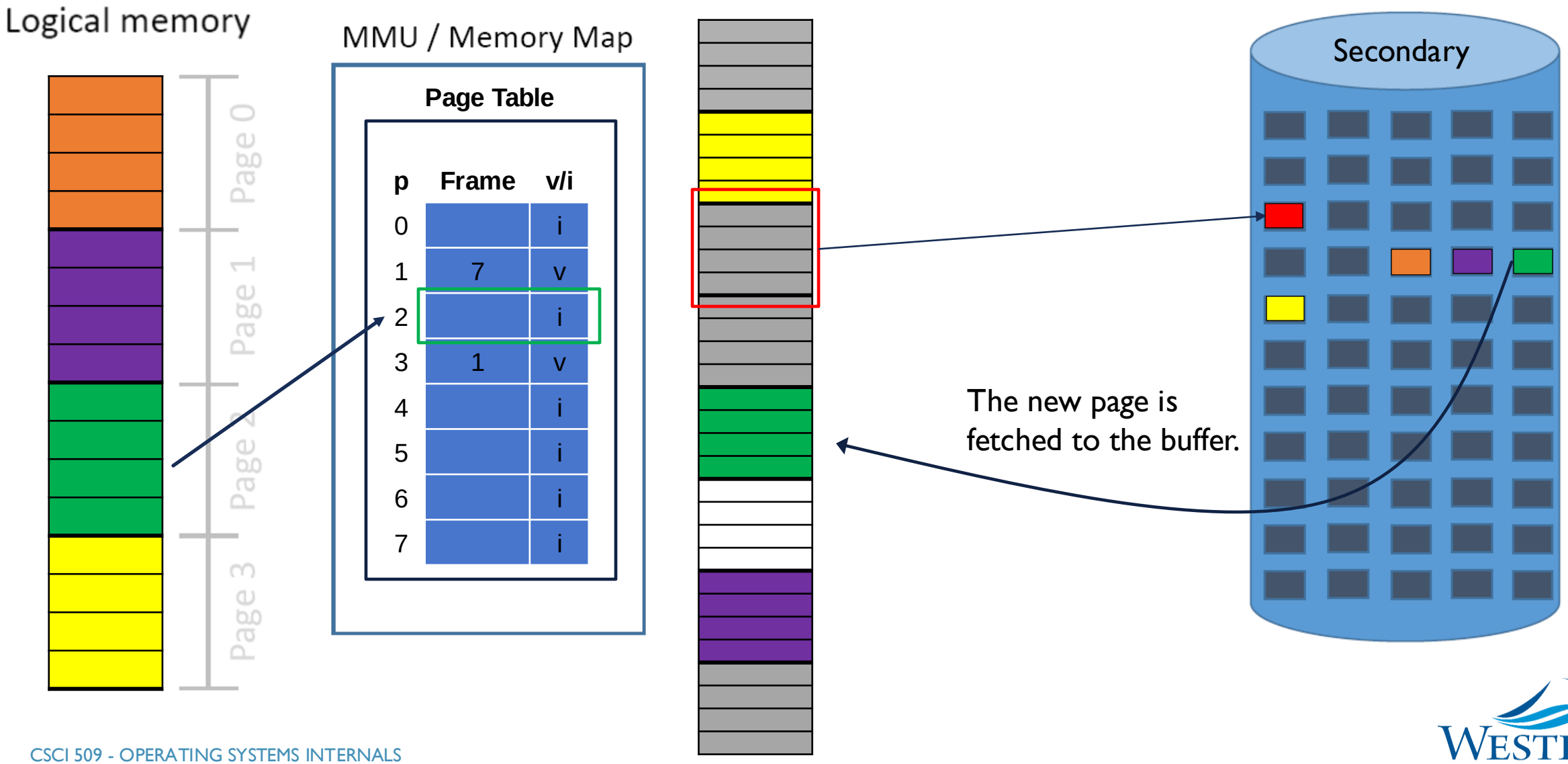

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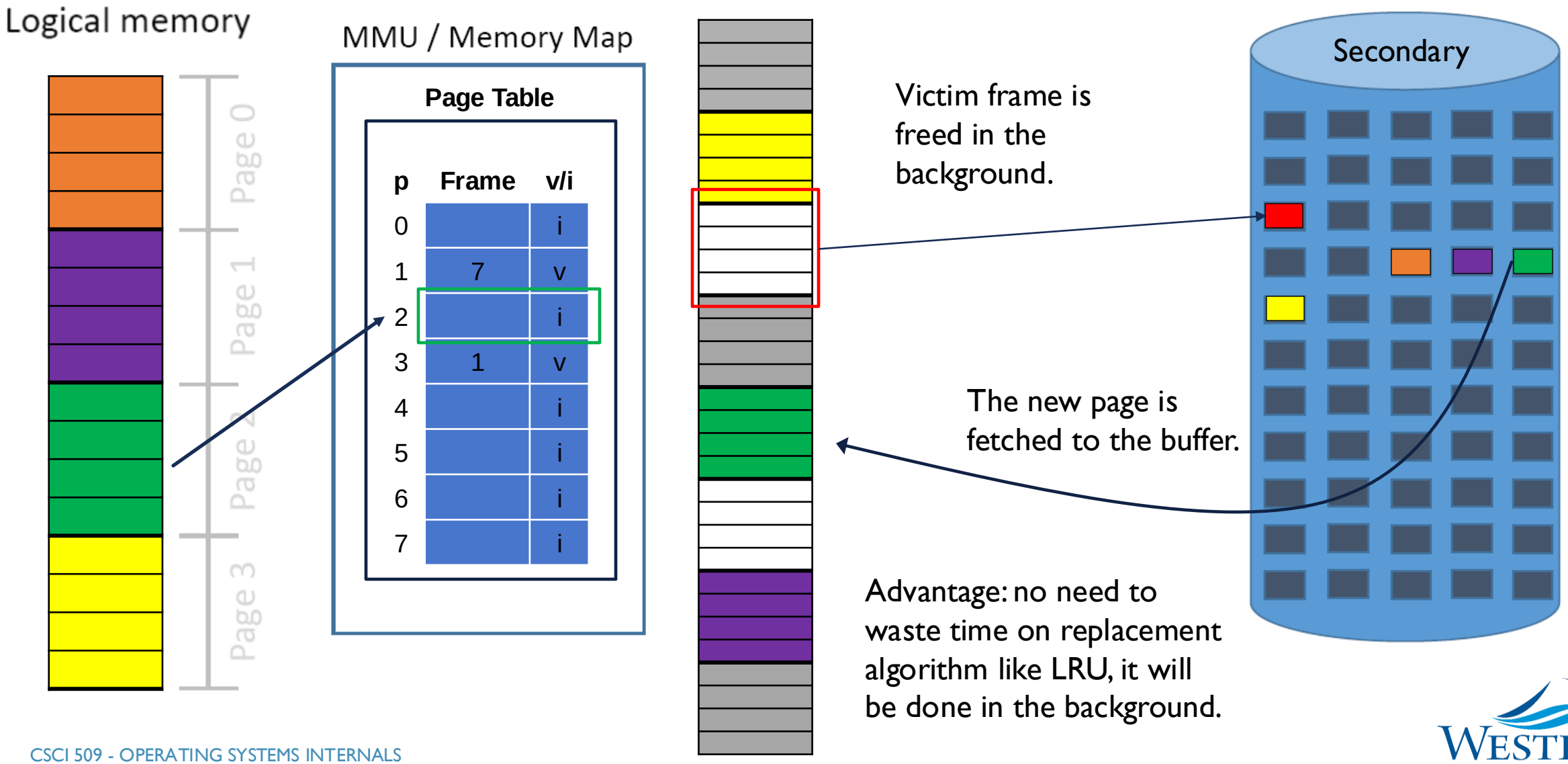
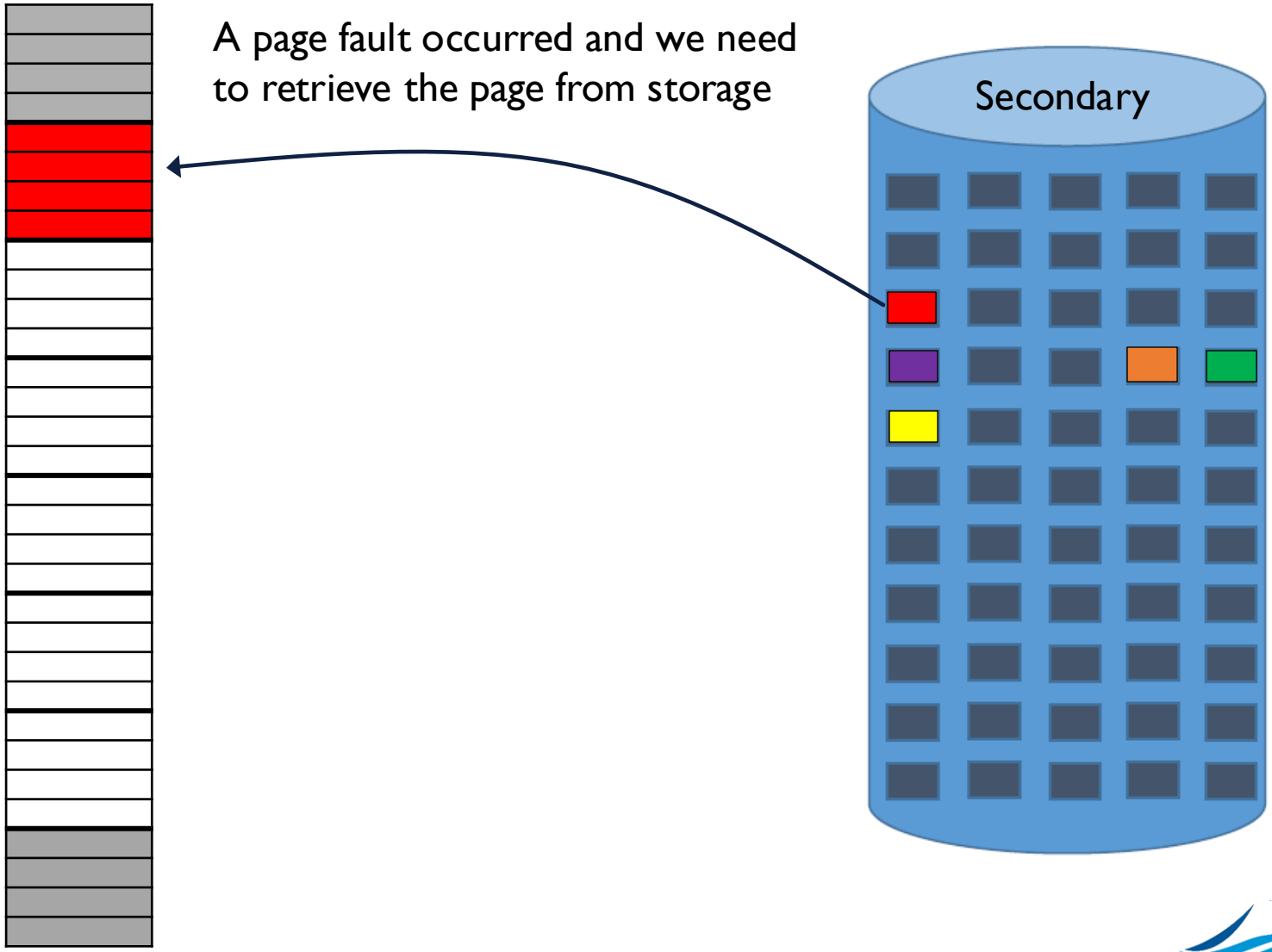
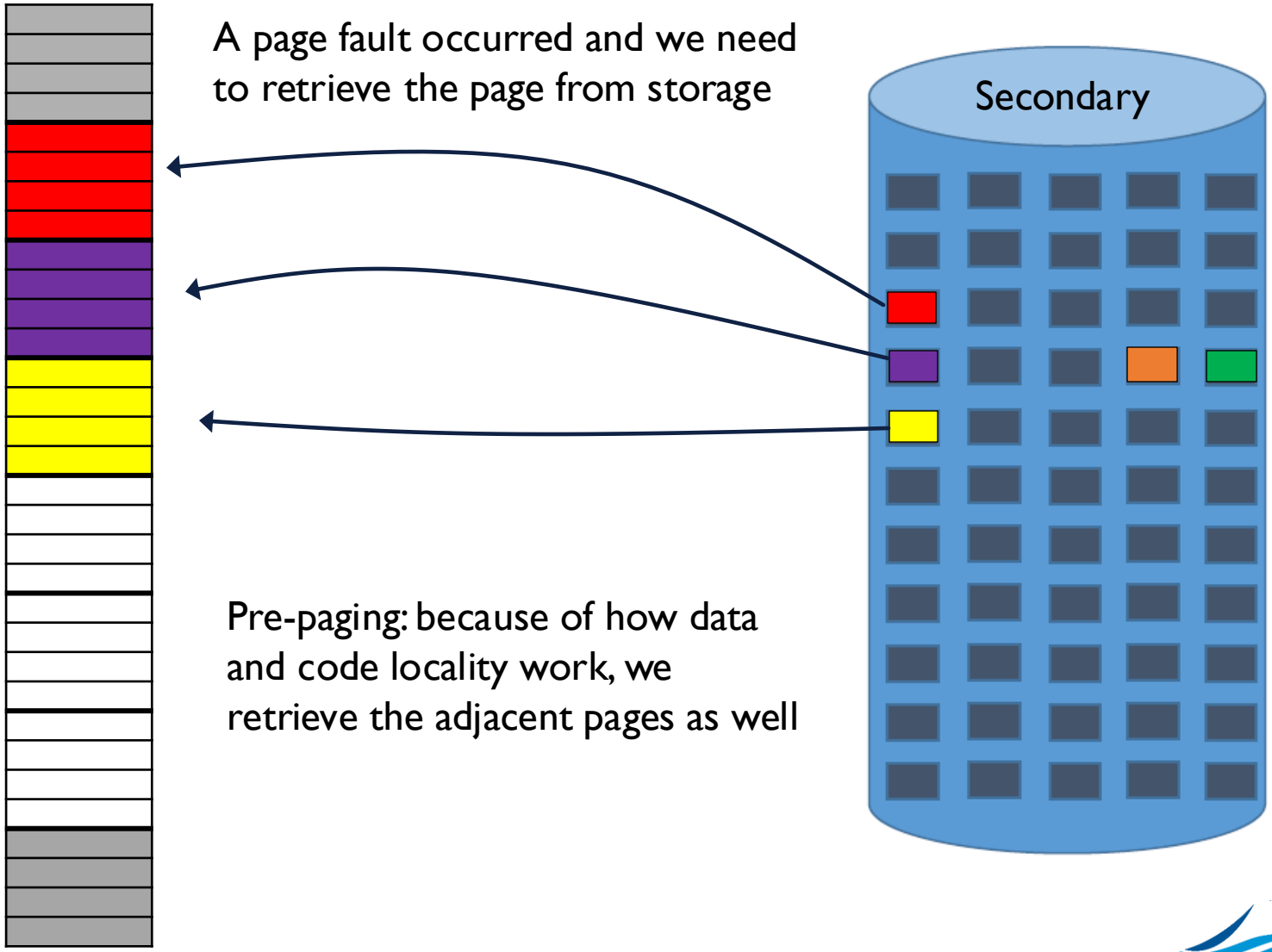


PRE-PAGING

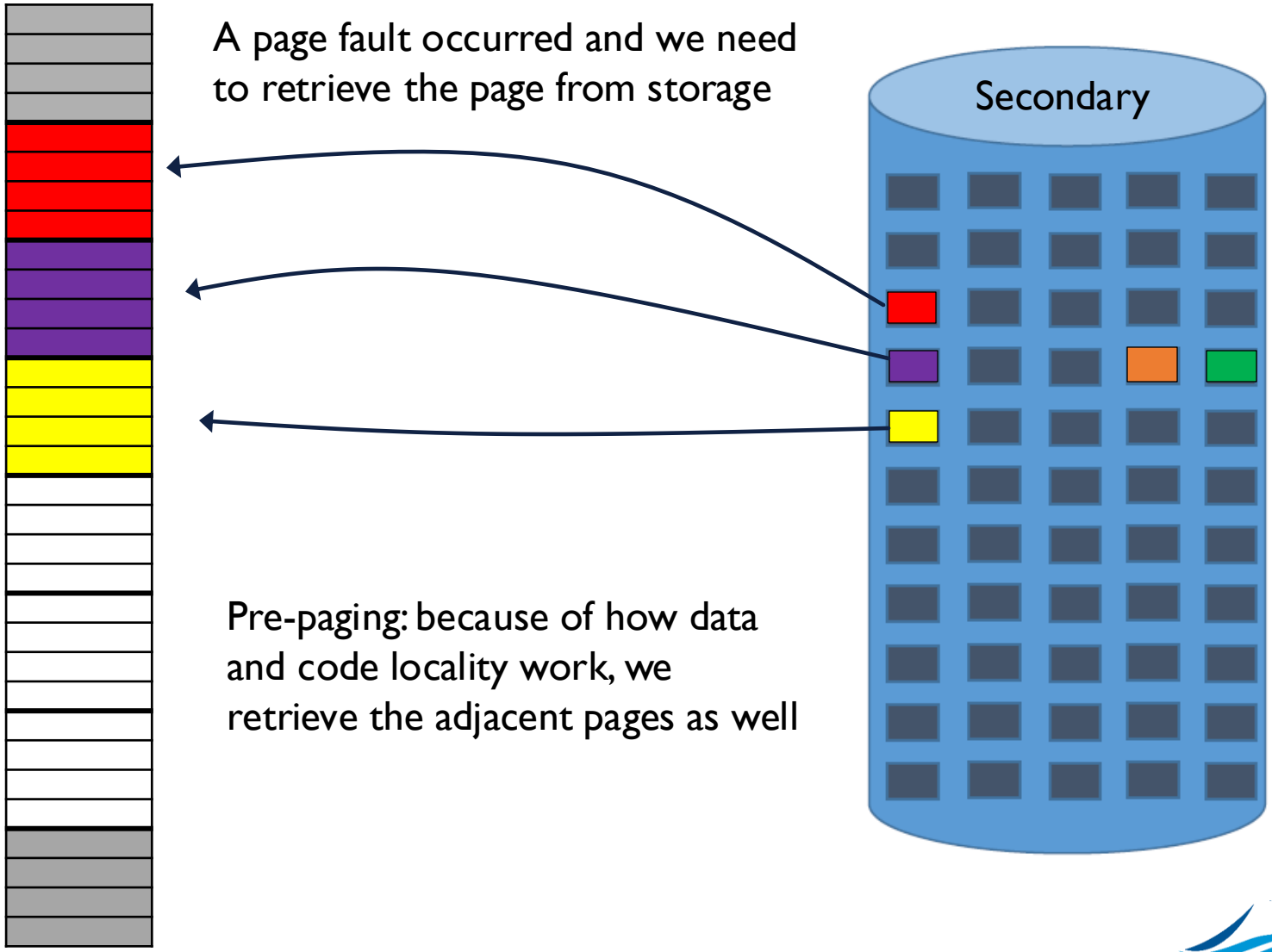

A page fault occurred and we need to retrieve the page from storage
Secondary

PRE-PAGING



PRE-PAGING

- Significantly reduces the page fault frequency.
- Most program code access is sequential and same for some data.
- Pre-paging is done by most operating systems instead of *demand paging* where pages are only brought on demand, one by one.



PREFETCHING AND SUPER FETCHING

- Prefetching: Windows track the files/libraries that a program use and fetch them when a program is launched, without waiting for page faults or file access.

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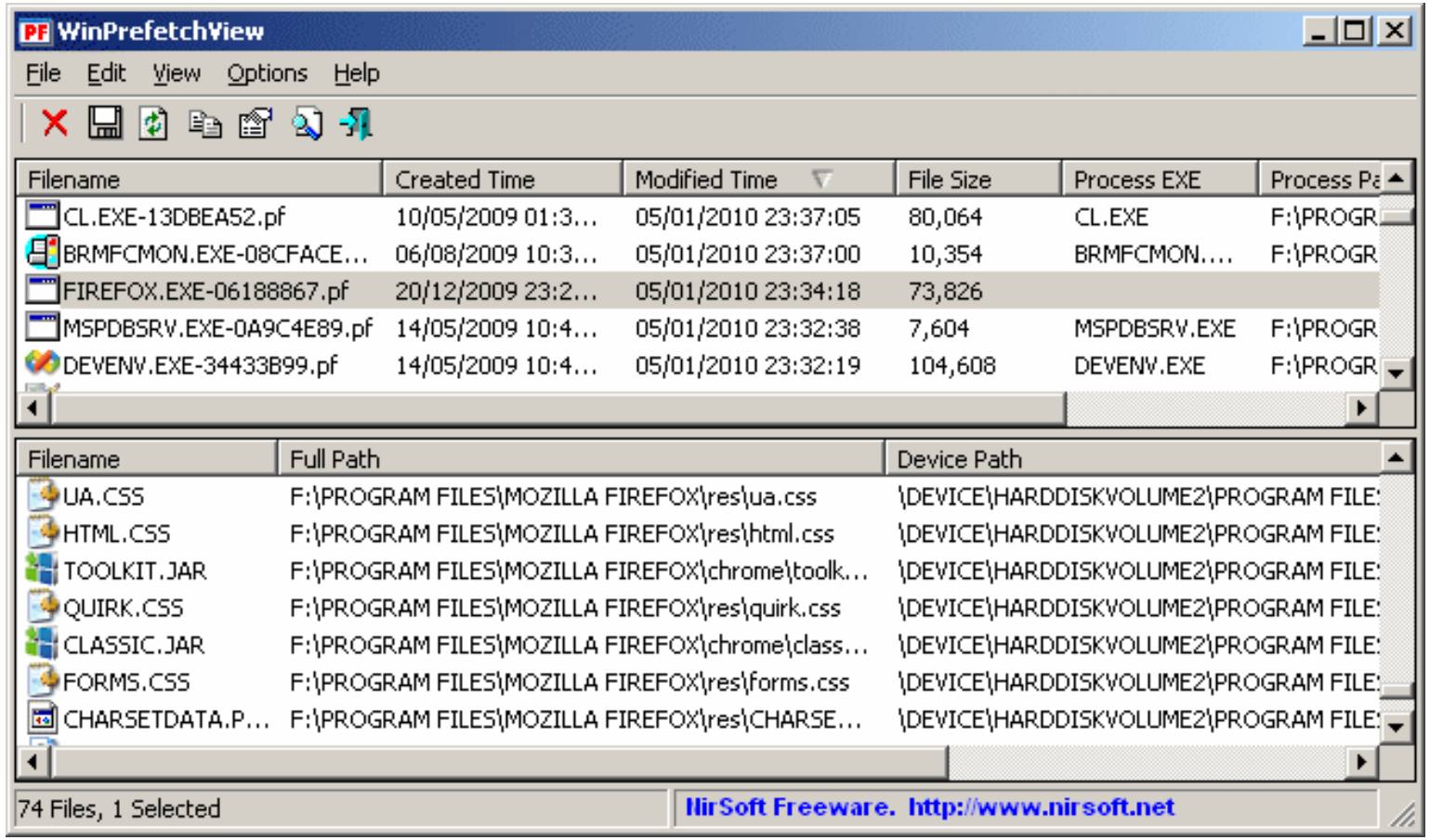


The list of files is saved in a Prefetch file that can be viewed

SUERPFETCHING

- Superfetching: OS keeps track of programs/libraries frequently used and keeps them in memory.

PREFETCHING AND SUPER FETCHING

- Prefetching: Windows track the files/libraries that a program use and fetch them when a program is launched, without waiting for page faults or file access.

→

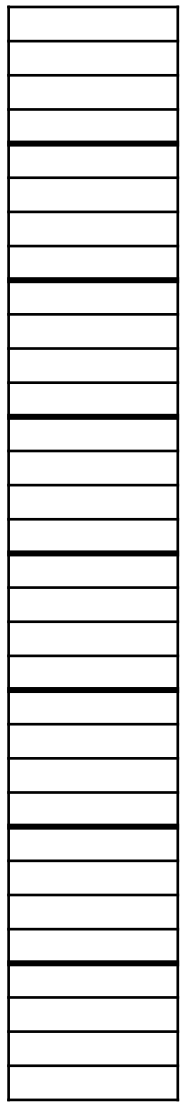
- Program runs ➔ Prefetch files to memory.
- OS keeps a history of files frequently requested by the program.

- Superfetching: OS keeps track of programs/libraries frequently used and keeps them in memory.

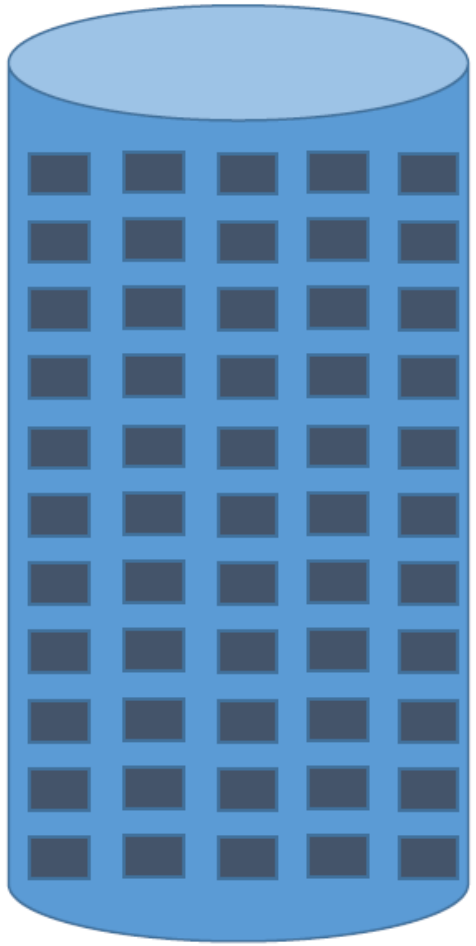
→

- Operating System runs➔ Prefetch programs and libraries that are often used.
- OS keeps a history of frequently used programs and library.

MEMORY COMPRESSION

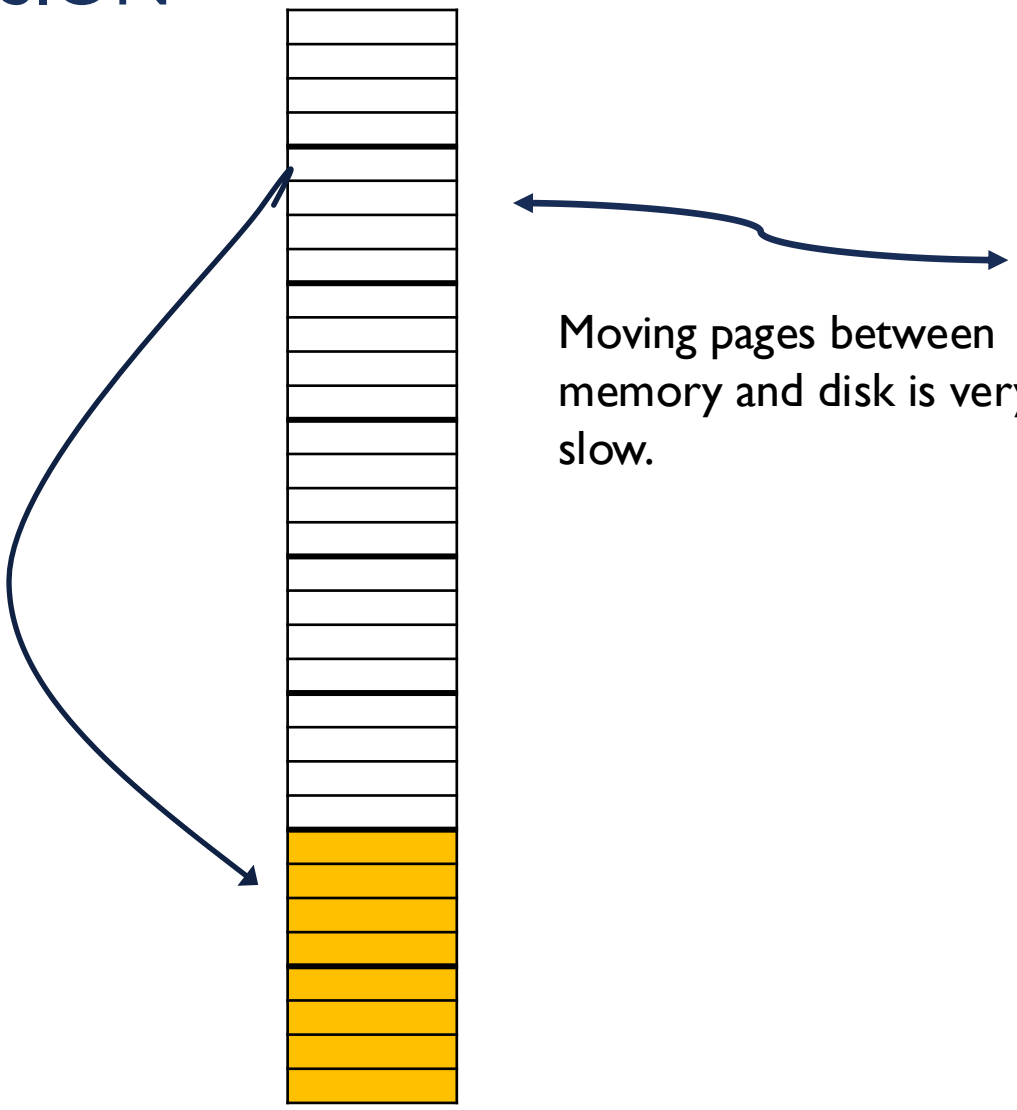


Moving pages between memory and disk is very slow.



MEMORY COMPRESSION

Instead of moving to disk, we compress the pages and move them to a compressed block in memory.



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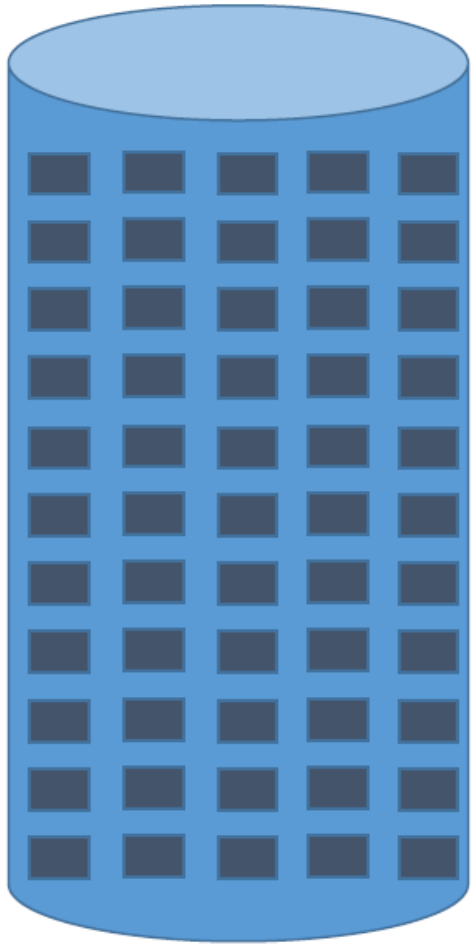

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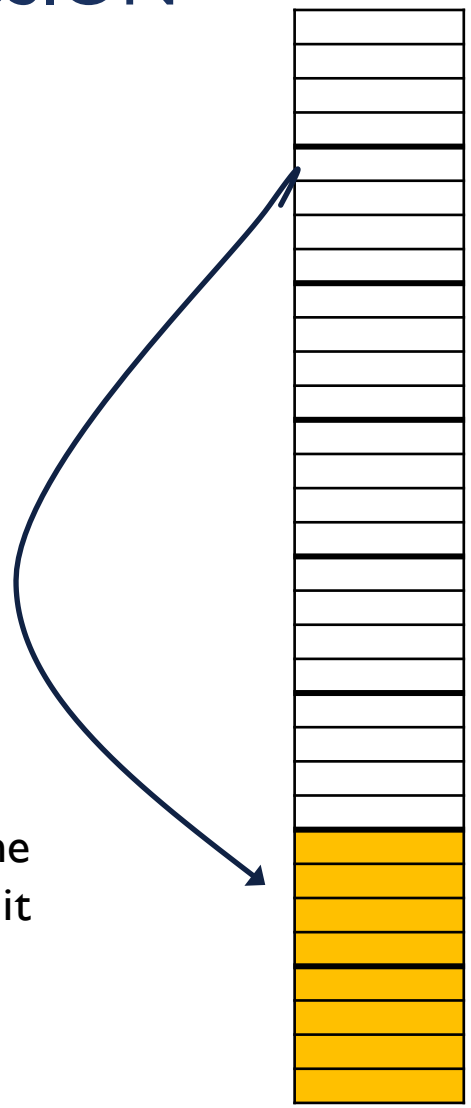

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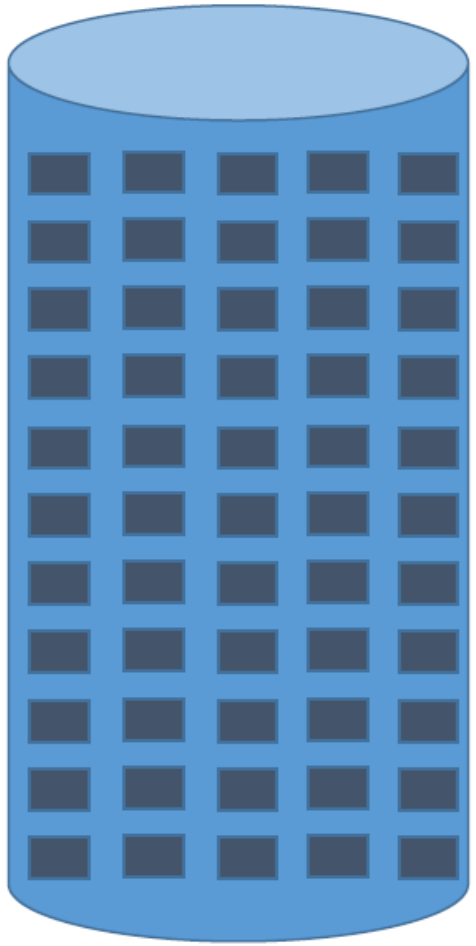
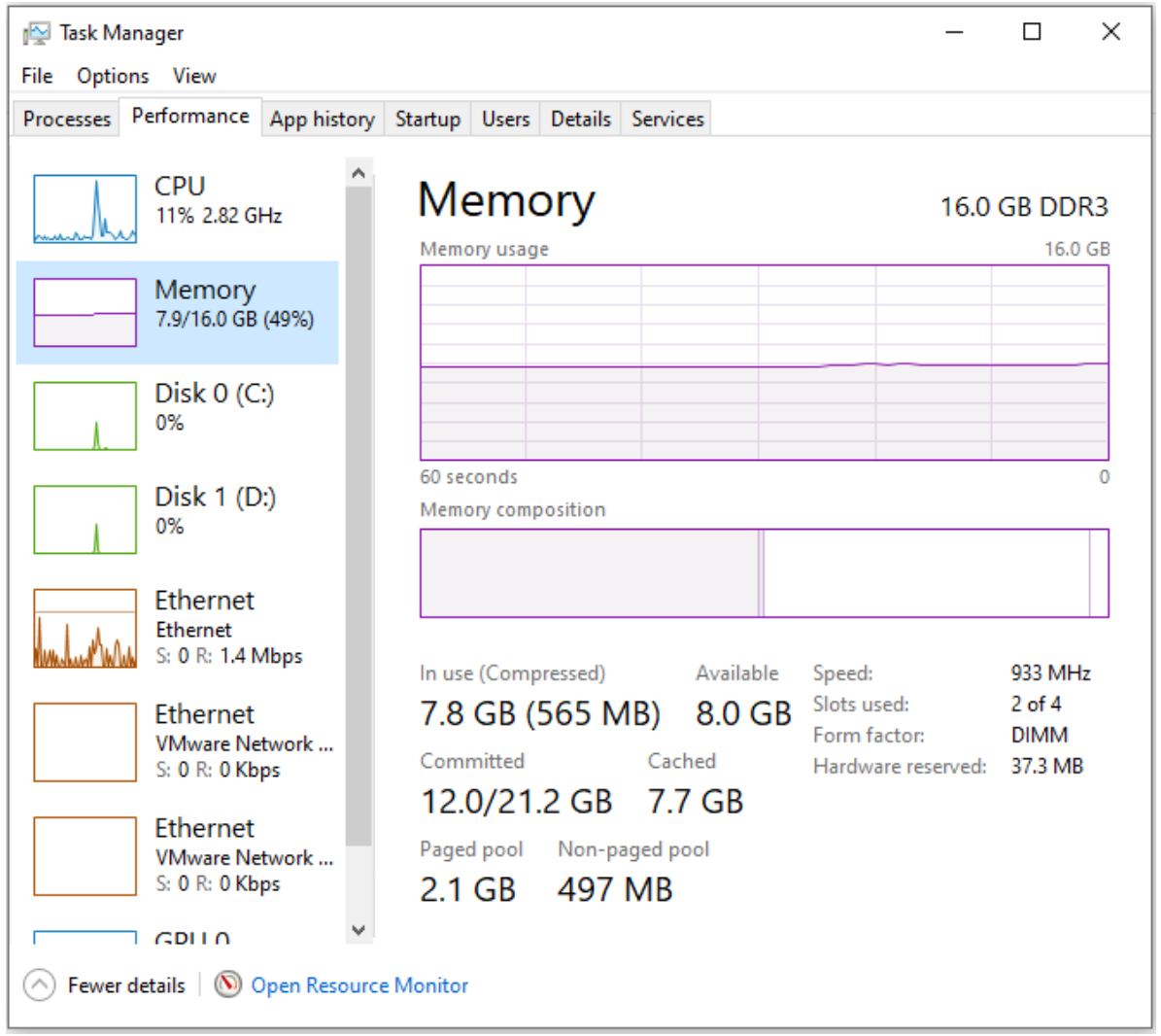


Instead of moving to disk, we compress the pages and move them to a compressed block in memory.

Compressing and Decompressing the pages is much faster than retrieving it from disk.

WINDOWS MEMORY



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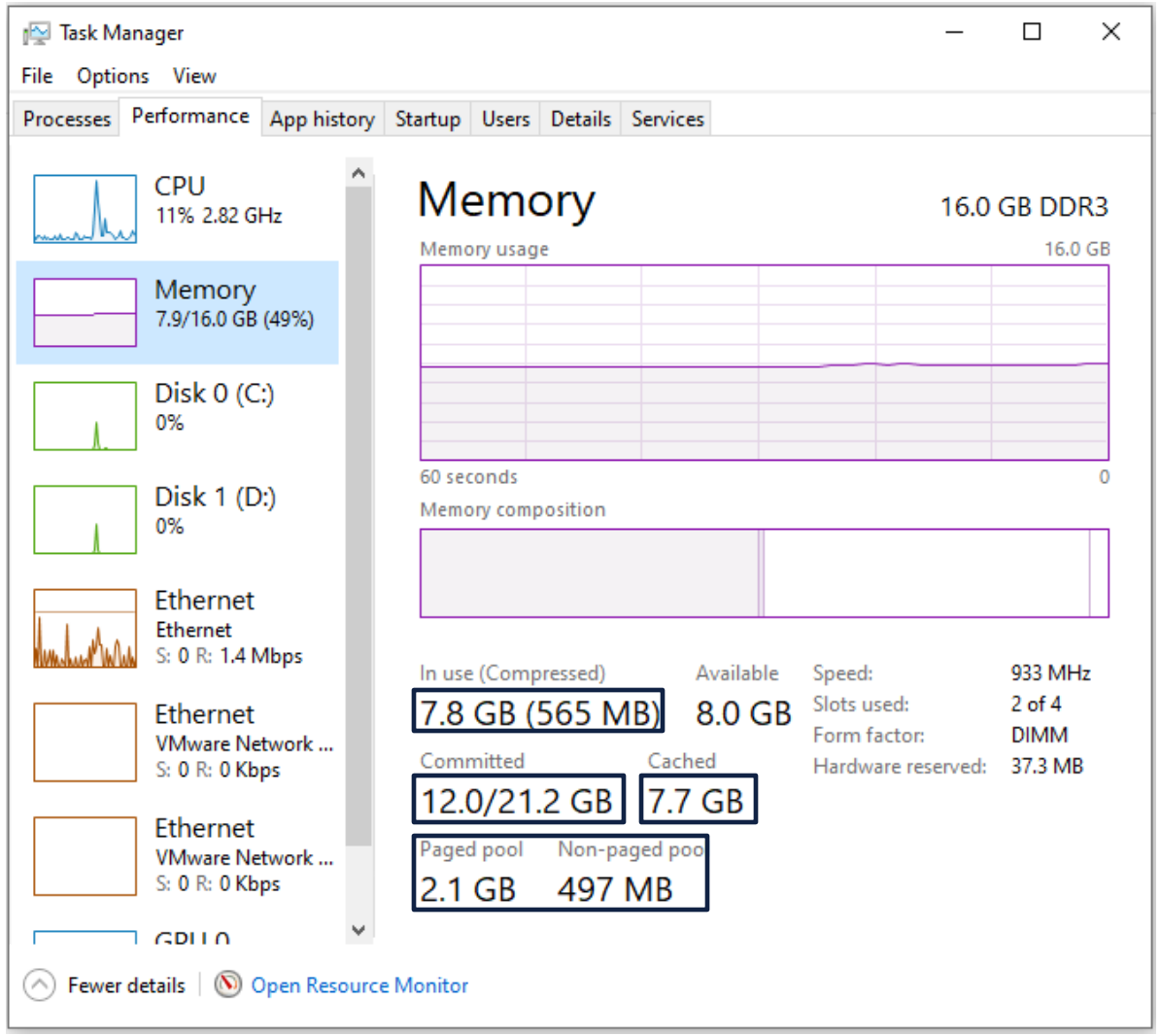
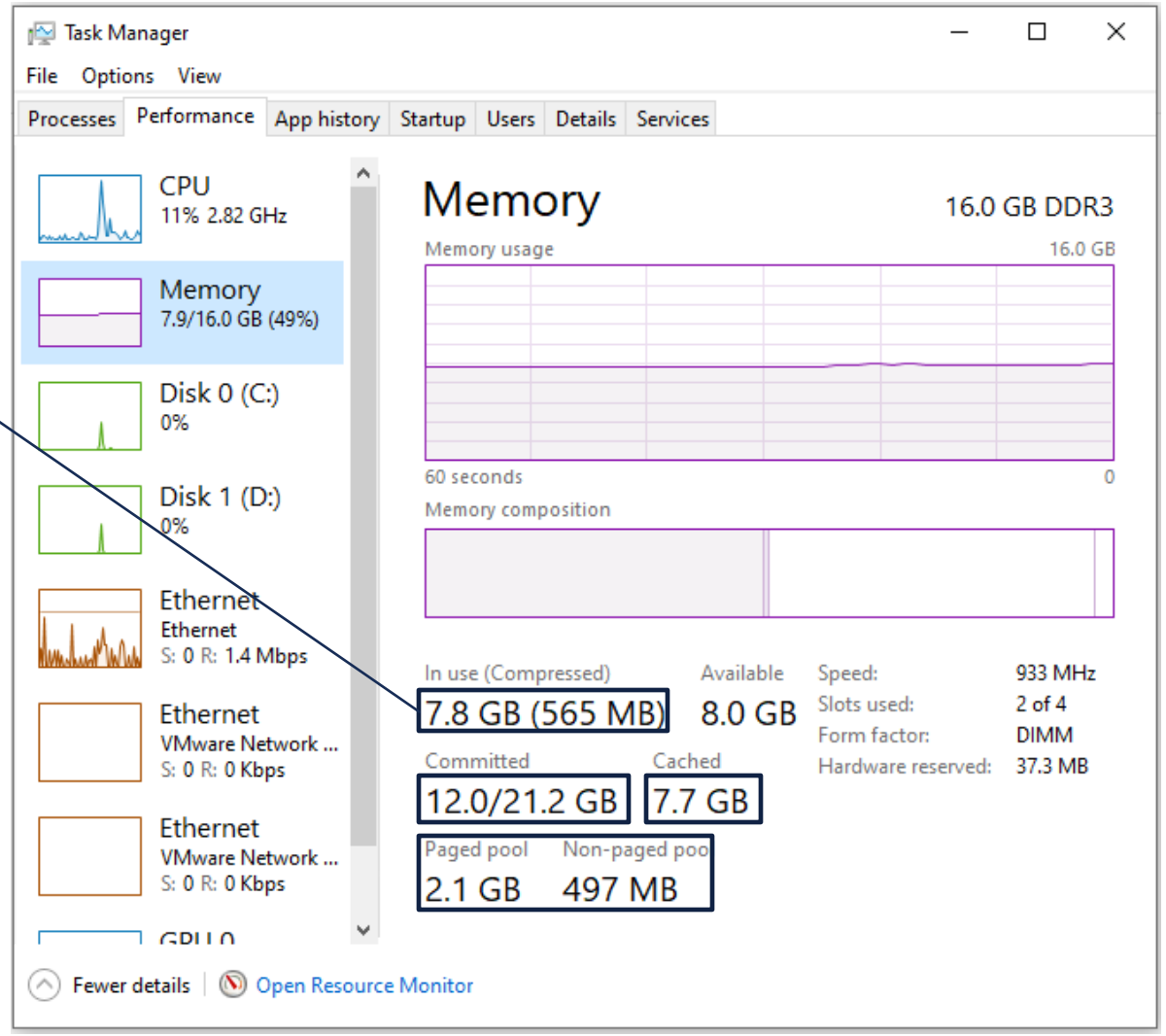


WINDOWS MEMORY

Physical Memory occupied by both paged and non-paged memory.

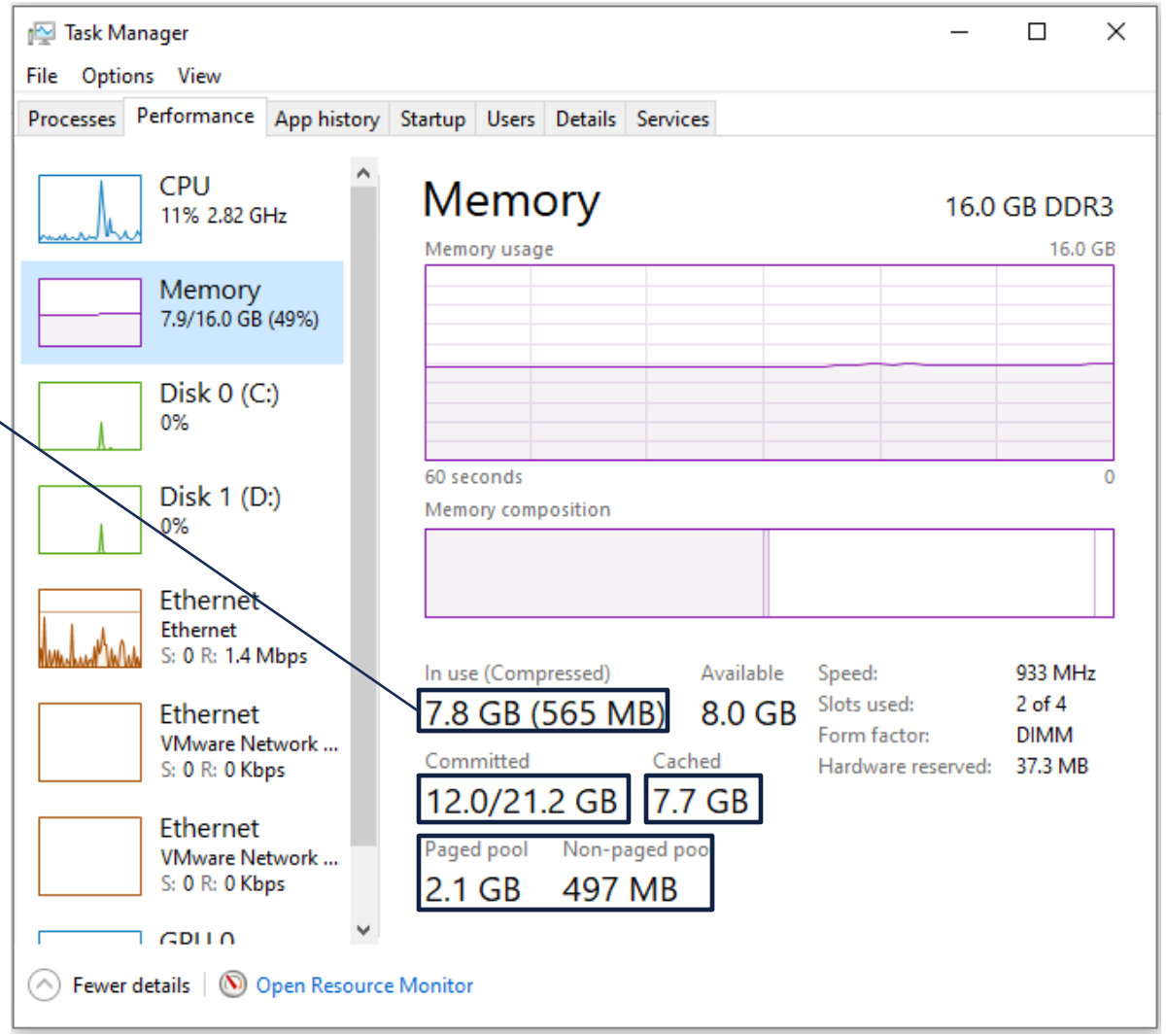
How much of that is compressed memory?



WINDOWS MEMORY

Physical Memory occupied by both paged and non-paged memory.

How much of that is compressed memory? 565 MB



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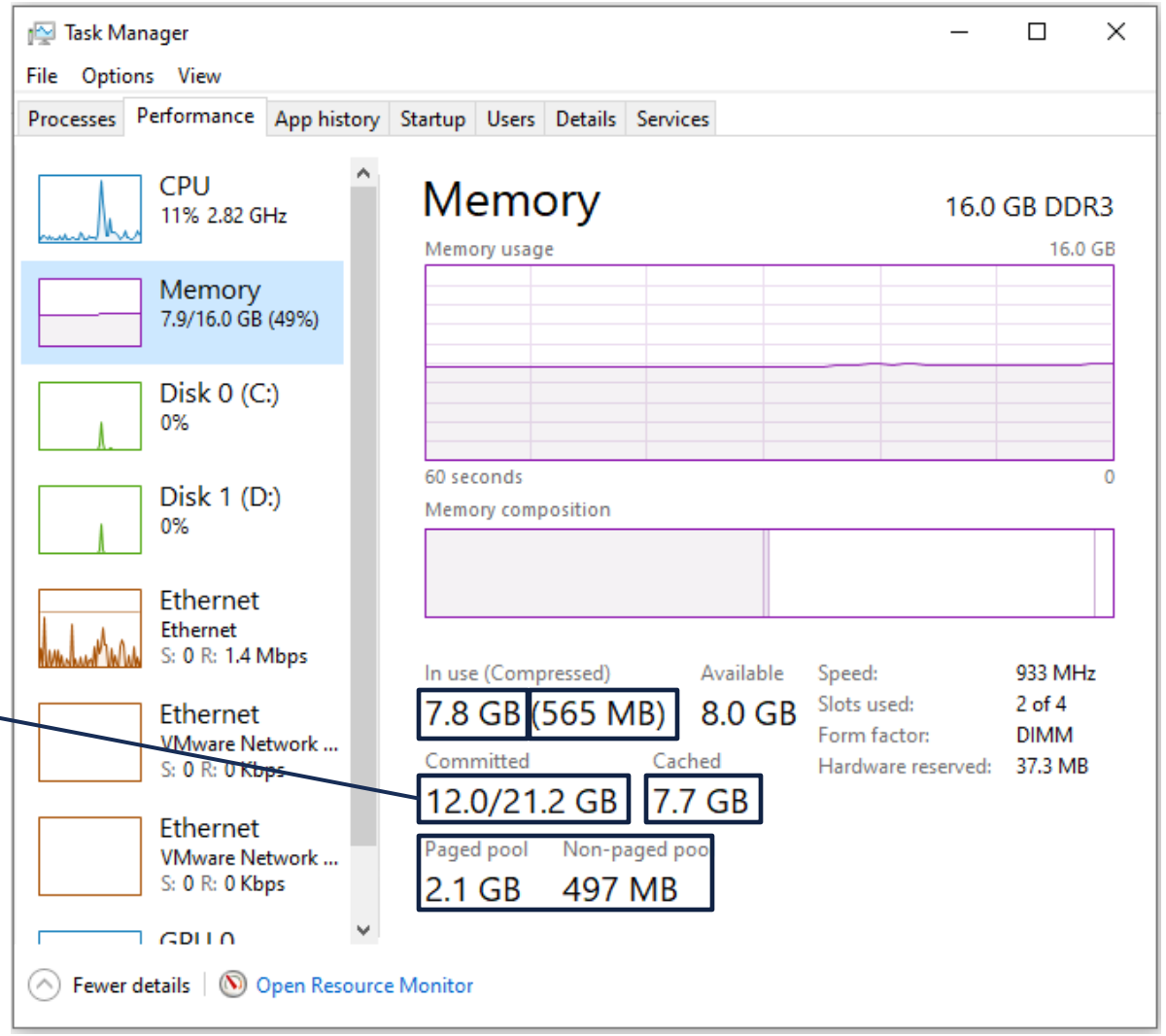
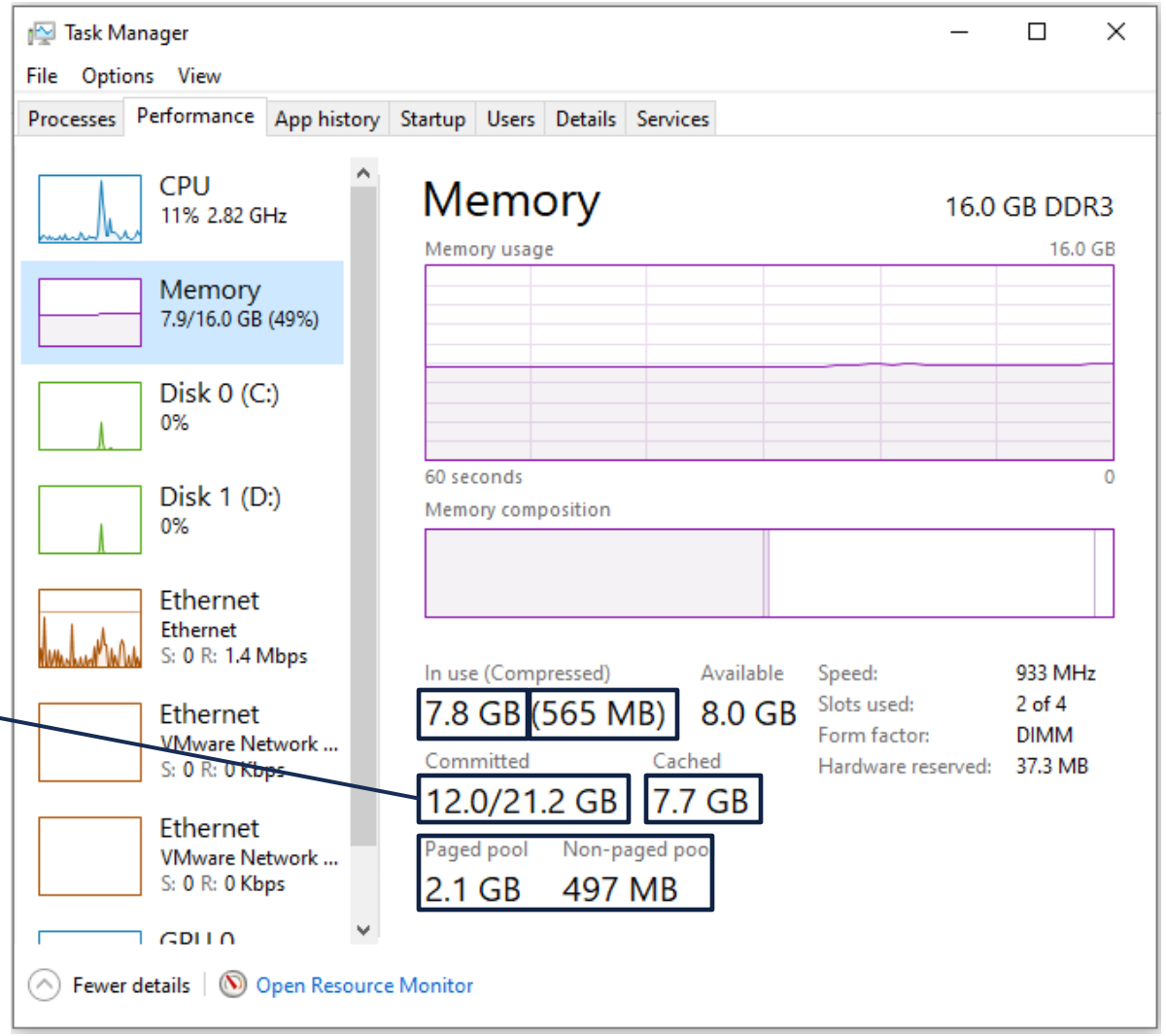


Virtual Memory allocated/requested.

Q:Why is it greater than the "In use" memory?

WINDOWS MEMORY

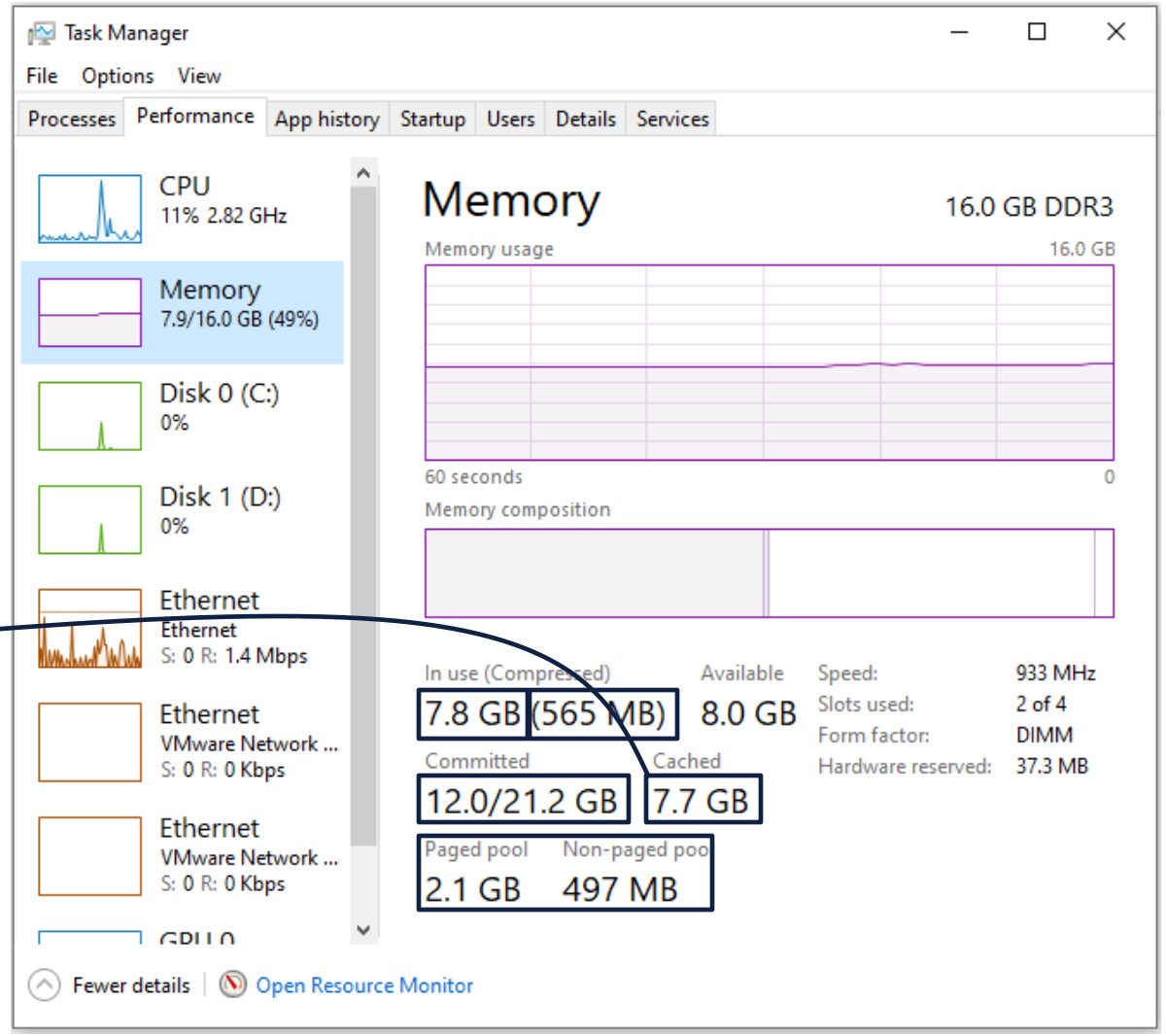


Virtual Memory allocated/requested.

Q:Why is it greater than the "In use" memory?

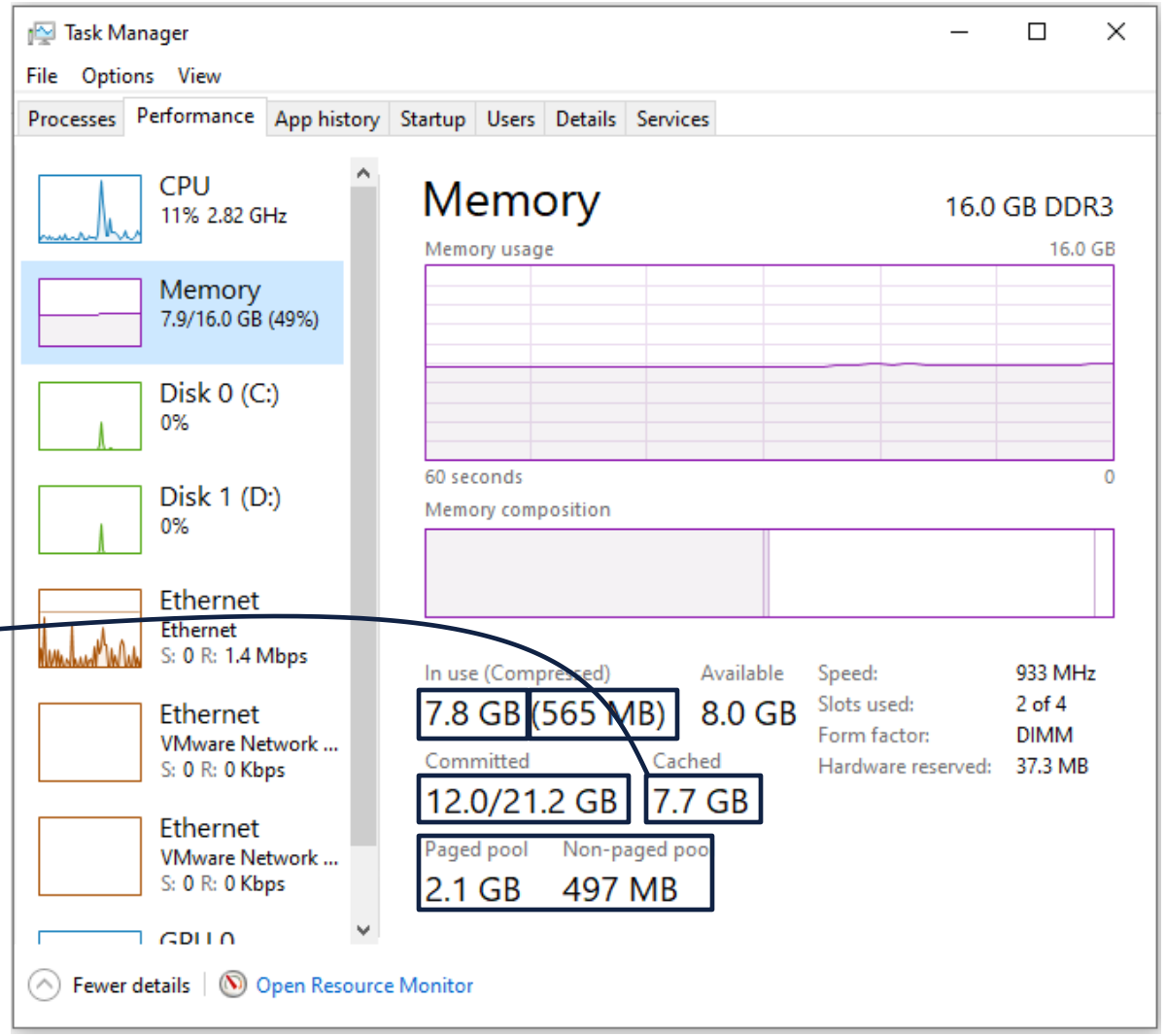
This is virtual, some of the pages are on disk and not in memory.

WINDOWS MEMORY



Cached memory (prefetch/superfetch).

WINDOWS MEMORY

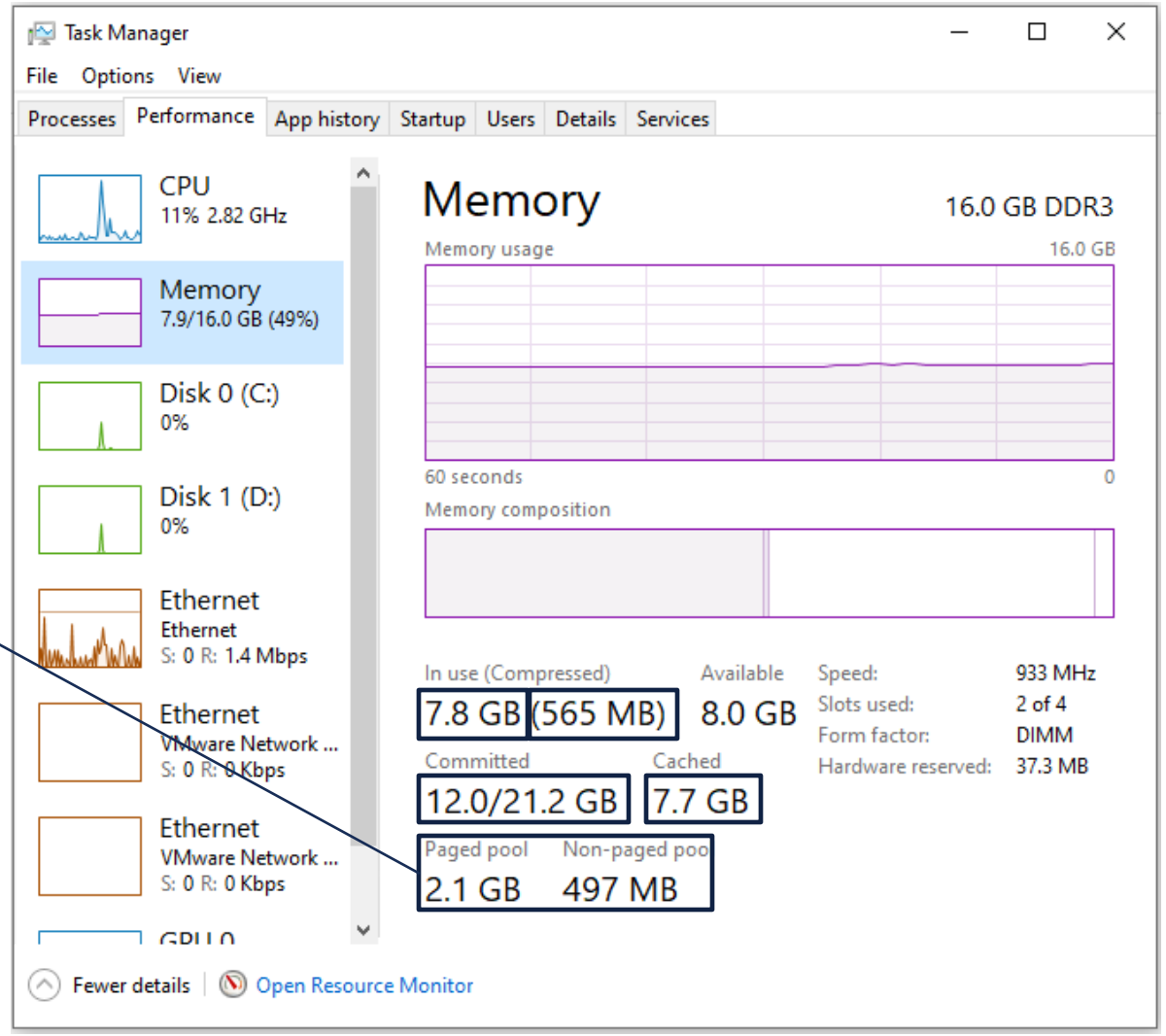


Cached memory (prefetch/superfetch).

Utilize free frames …
Cached pages can be overwritten without need for replacement or write back.

WINDOWS MEMORY

Kernel Memory
Paged and non-paged.



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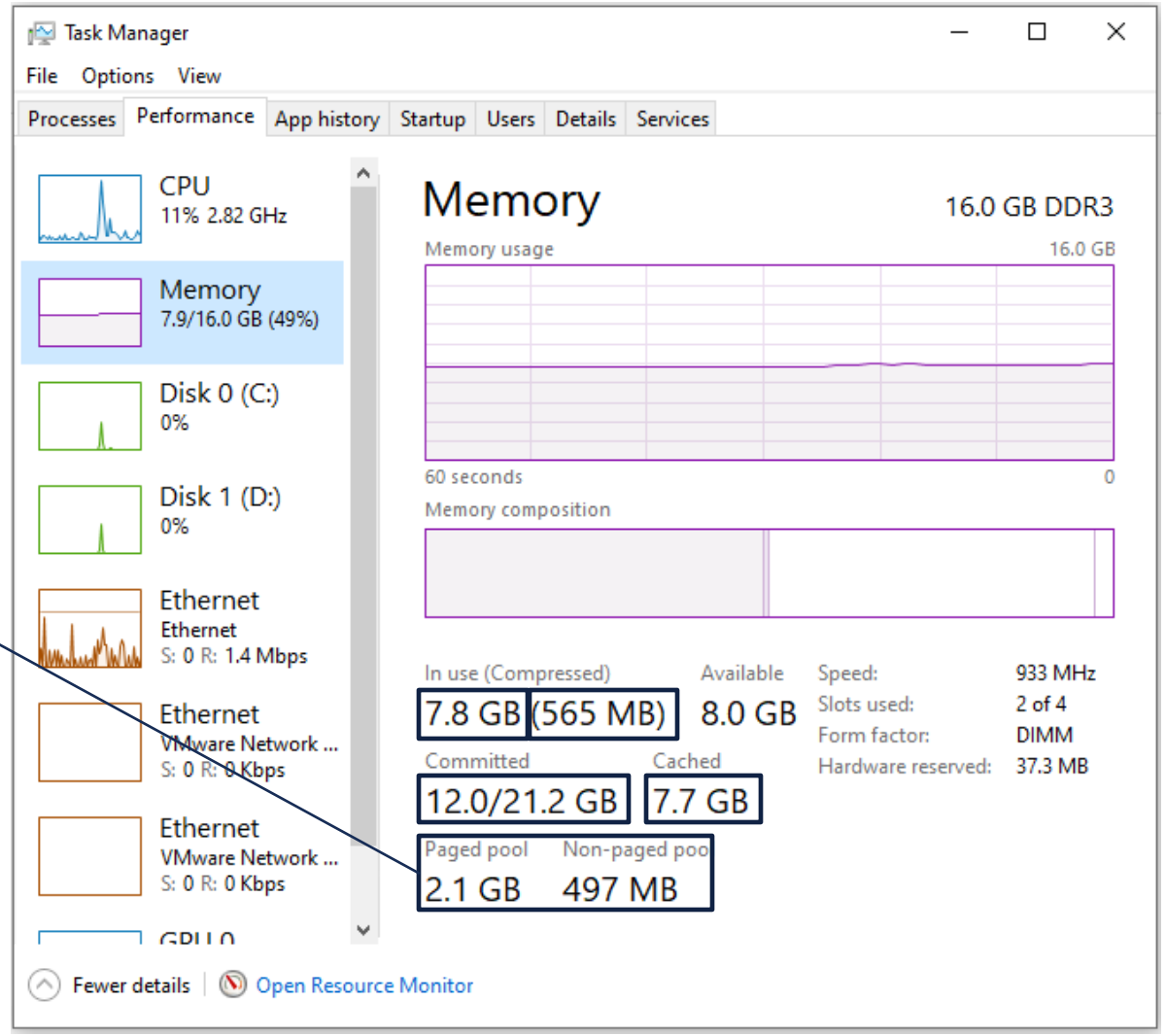
Kernel Memory
Paged and non-paged.

Q: Why does the kernel need direct memory access (non-paged)?



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Kernel Memory
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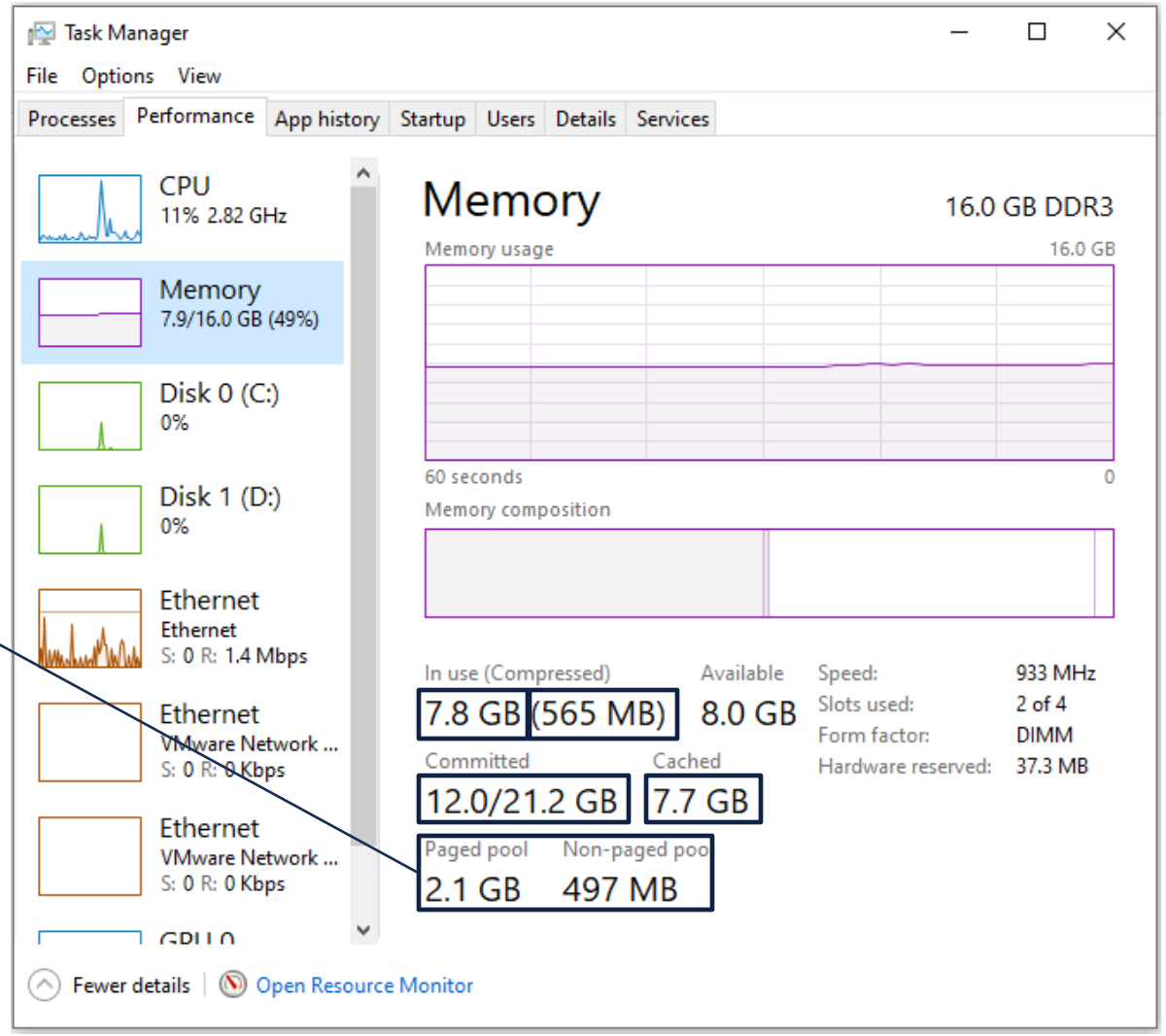

Q: Why does the kernel need direct memory access (non-paged)?

- Kernel needs non-pages memory for critical services like interrupt handling.
- You can't have page a fault while servicing a page fault …