A decorative vertical bar on the left side of the slide. It consists of a dark teal background with a white dotted vertical line running through its center. To the right of this bar, there are several orange circles of varying sizes, arranged in a cluster. The largest circle is at the top, with several smaller ones below and to its right. The entire slide is framed by thin orange vertical lines on the far left and far right.

PRINCIPLES OF OPERATING SYSTEMS

LECTURE 14 : PAGE TABLES

Page Table Structure

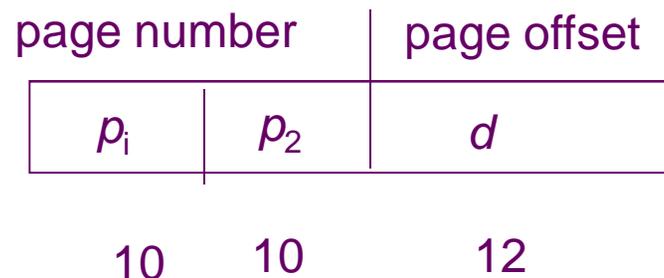
- Hierarchical Paging
- Hashed Page Tables
- Inverted Page Tables

Hierarchical Page Tables

- Break up the logical address space into multiple page tables.
- A simple technique is a two-level page table.

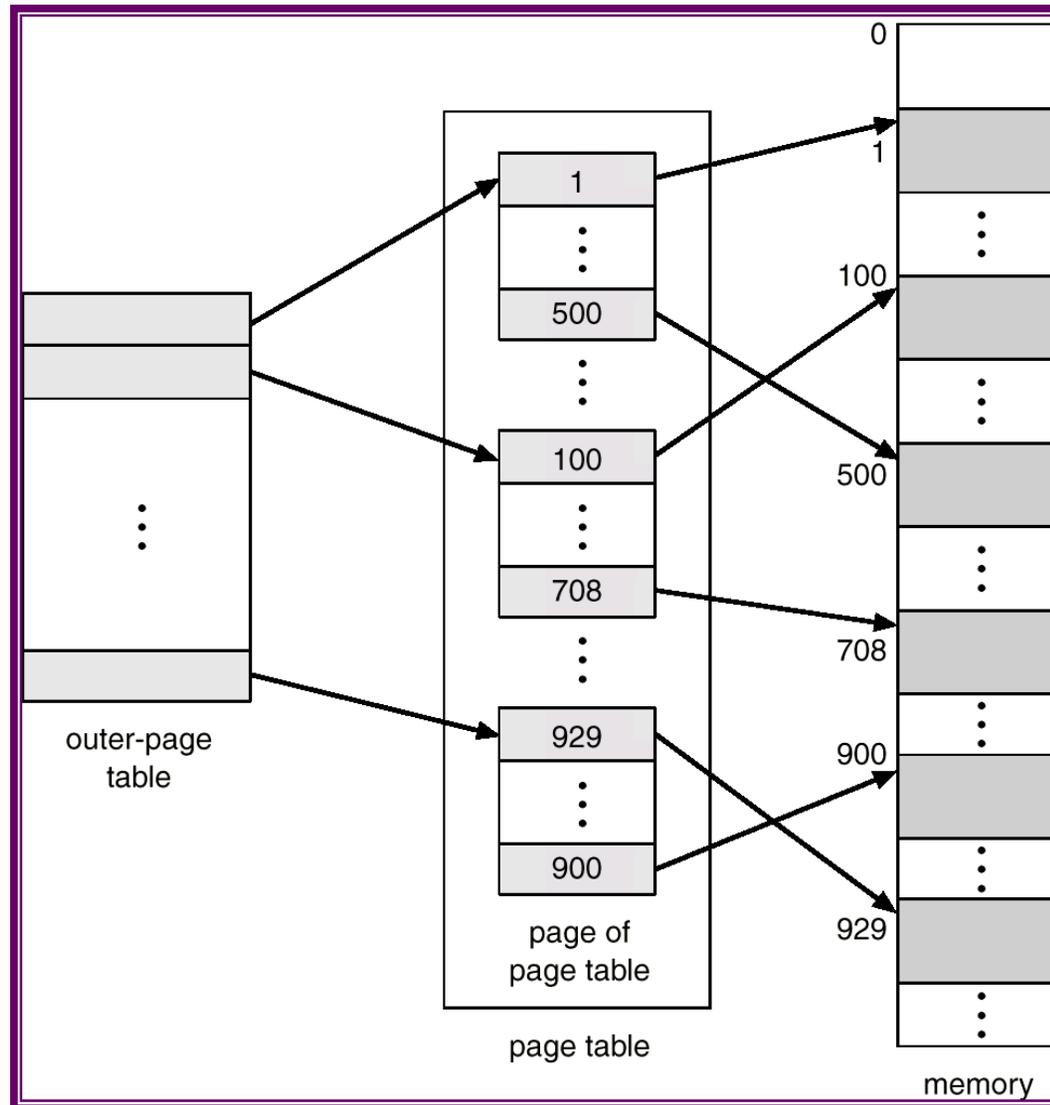
Two-Level Paging Example

- A logical address (on 32-bit machine with 4K page size) is divided into:
 - ☞ a page number consisting of 20 bits.
 - ☞ a page offset consisting of 12 bits.
- Since the page table is paged, the page number is further divided into:
 - ☞ a 10-bit page number.
 - ☞ a 10-bit page offset.
- Thus, a logical address is as follows:



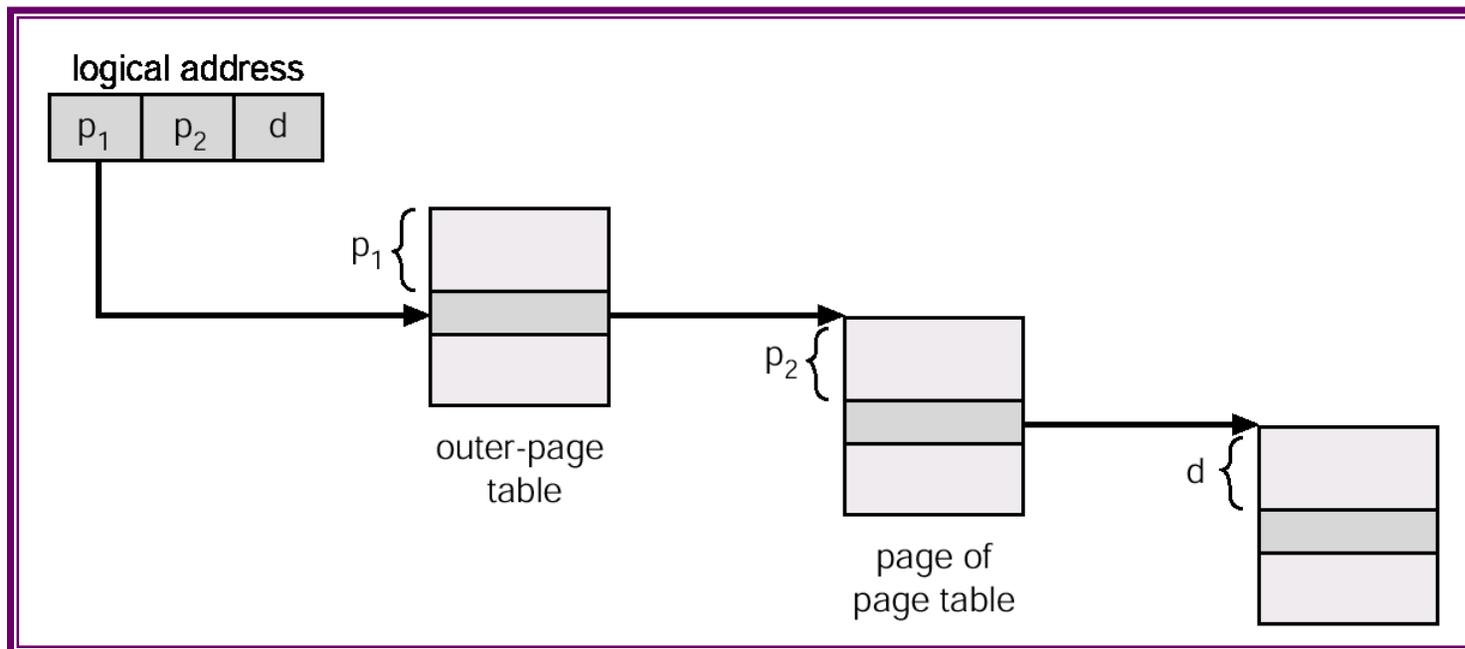
where p_i is an index into the outer page table, and p_2 is the displacement within the page of the outer page table.

Two-Level Page-Table Scheme



Address-Translation Scheme

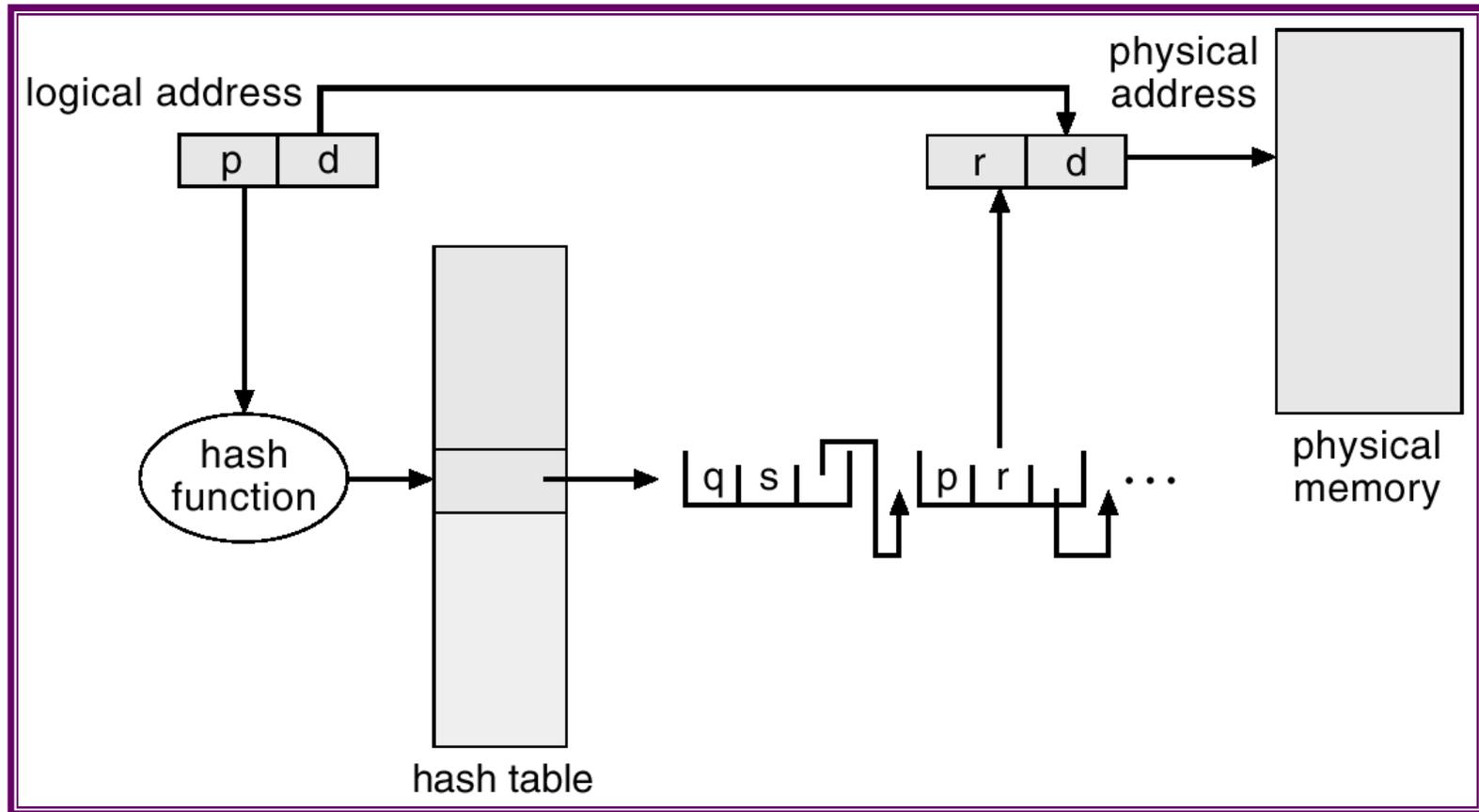
- Address-translation scheme for a two-level 32-bit paging architecture



Hashed Page Tables

- Common in address spaces > 32 bits.
- The virtual page number is hashed into a page table. This page table contains a chain of elements hashing to the same location.
- Virtual page numbers are compared in this chain searching for a match. If a match is found, the corresponding physical frame is extracted.

Hashed Page Table



Inverted Page Table

- One entry for each real page of memory.
- Entry consists of the virtual address of the page stored in that real memory location, with information about the process that owns that page.
- Decreases memory needed to store each page table, but increases time needed to search the table when a page reference occurs.
- Use hash table to limit the search to one — or at most a few — page-table entries.

Inverted Page Table Architecture

