THE INTEL 32-BIT ARCHITECTURE

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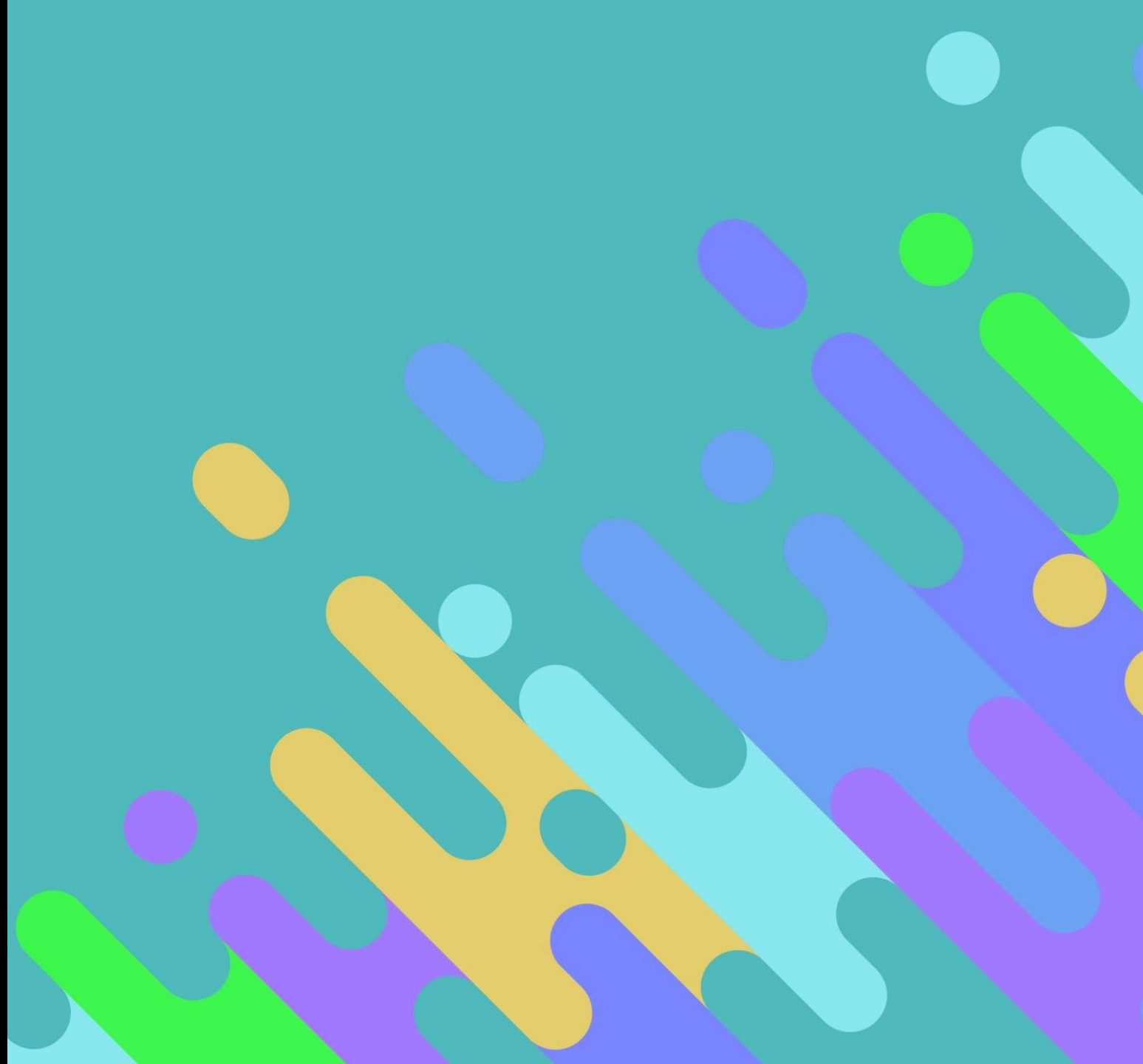
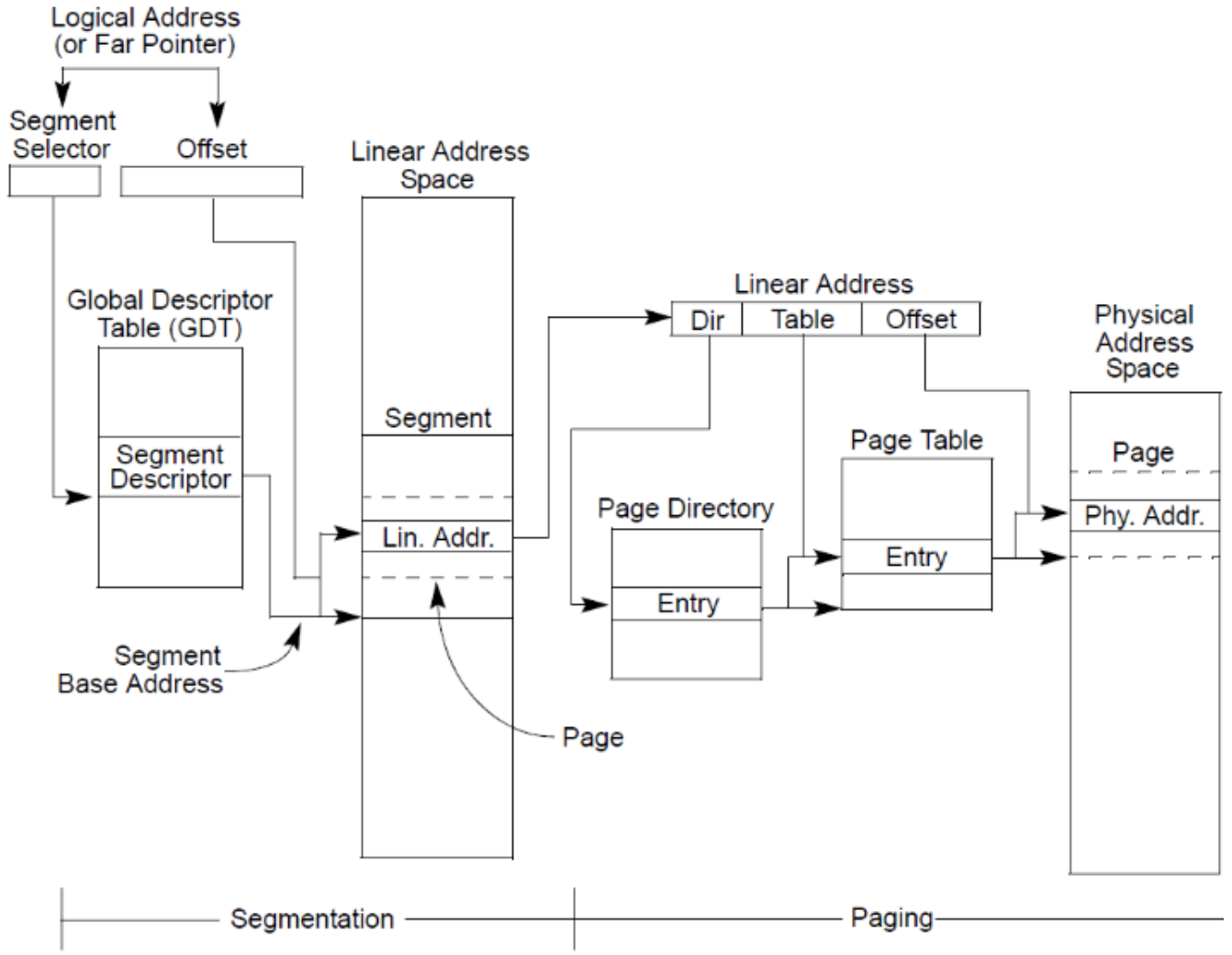


IA-32 HAS TWO COMPONENTS

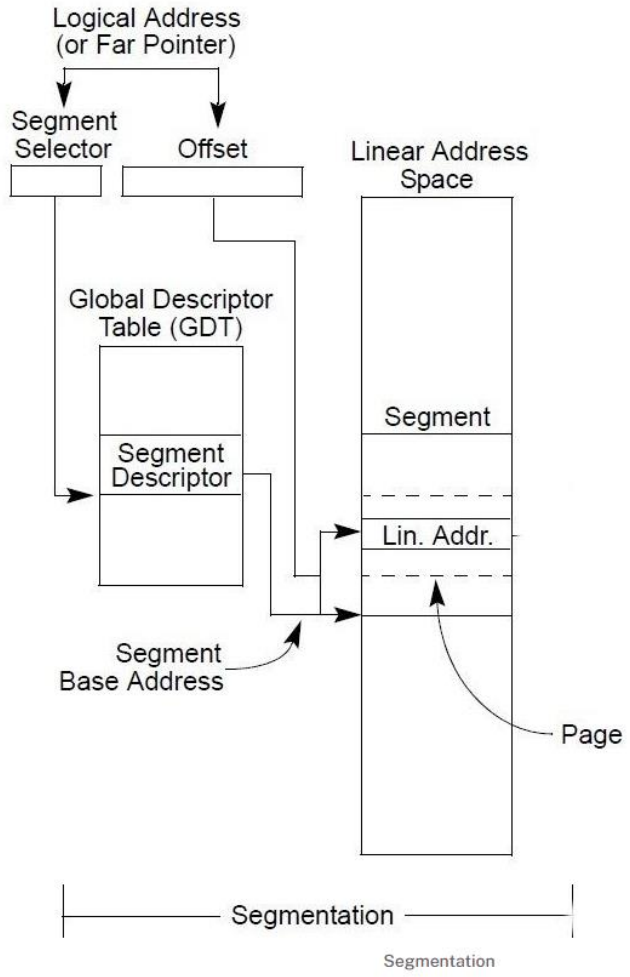
- Segmentation and Paging make up IA-32
- They work together to manage memory



Address conversion using Segmentation and paging

SEGMENTATION – LOGICAL ADDRESS

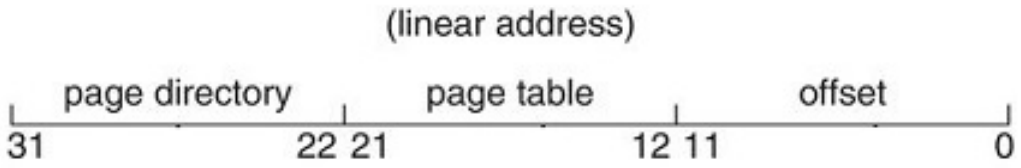
- Segmentation unit receives a logical address from the CPU that is divided into two partitions
  - First partition is private
    - Information kept in local descriptor table (LDT)
  - Second partition is shared among all processes
    - Information kept in global descriptor table (GDT)
- Logical address consists of a selector and an offset
  - Selector is a 16-bit number that gives the segment number and whether the location is in the LDT or GDT
  - Offset is a 32-bit number that specifies location of desired byte
- Uses the logical address to generate a linear address

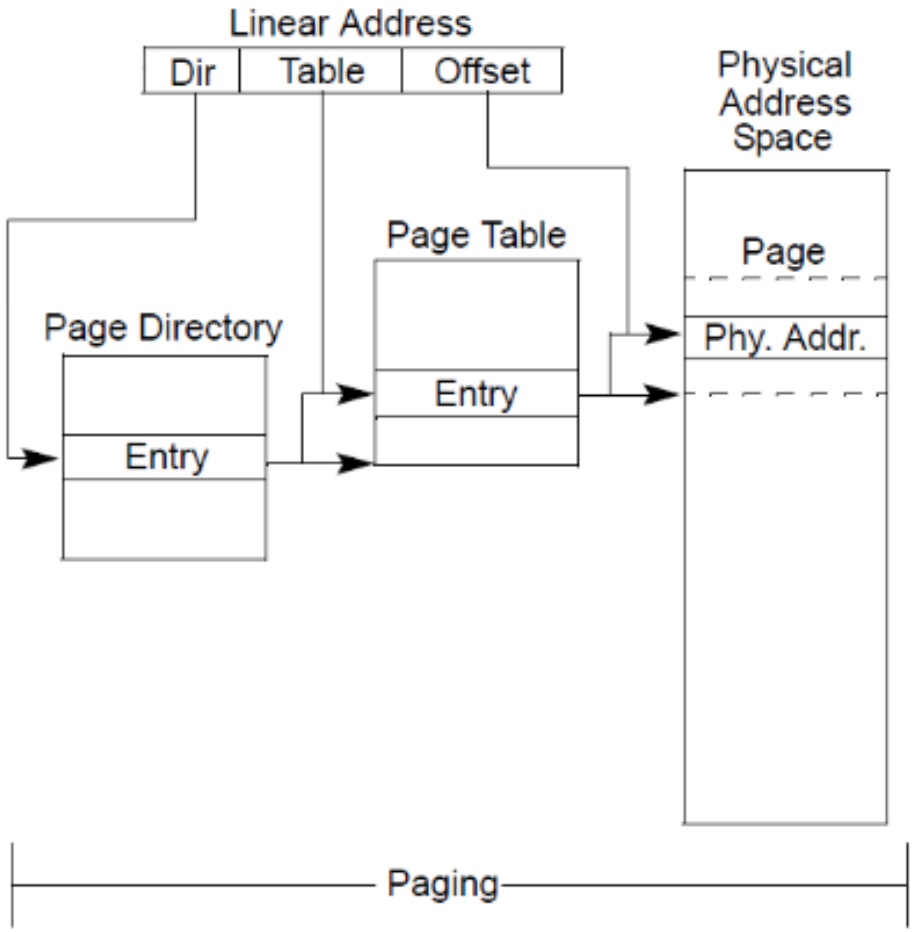


Segmentation

SEGMENTATION – LINEAR ADDRESS

- The logical address is used to generate a 32-bit linear address
- Segment register points to the appropriate entry in the LDT or GDT to provide base and limit information about the segment
  - Limit is used to check if address is valid
- If the address is valid then the value of the offset is added to the value of the base



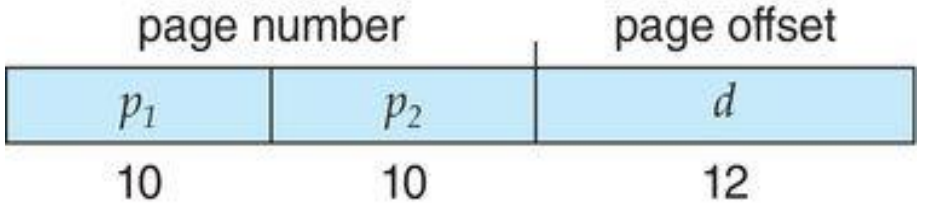


PAGING

- The paging unit receives the Linear Address from Segmentation
- Converts the linear address into a physical address or an address to memory (RAM)
- Maps logical memory to physical memory for better memory management
- Reduces internal fragmentation using pages that are a fixed size.
- Pages can be 4 KB or 4 MB

LINEAR ADDRESS

- The 10 left-most bits go to the Page Directory
- The middle 10 bits go to the Page Table
- The 12 right-most bits go to the page



INVERTED PAGING IN WINDOWS

- Windows uses inverted paging
- Inverted paging tracks all physical pages rather than each process having a page table and keeping track of all possible logical pages
- Inverted paging stores the page table in a hash table rather than an array
- This technique decreases the memory needed to store each page table but increases the time needed to search the table when a page reference occurs

Free Open Source OS

- Tribblix
- FreeBSD
- OpenBSD
- NetBSD
- Debian
- MX Linux
- Devuan
- CentOS
- Slackware
- Tiny Core Linux
- Alpine Linux
- Gentoo

TRIBBLIX

- A free open-source operating system
- Uses IA-32 architecture
- Created by Peter Tribble
- Was derived from OpenSolaris, OpenIndiana, and Illumos.
- Retro style, designed to mimic older operating system's layouts but is blended with modern components

WORKS CITED

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- https://www.geeksforgeeks.org/paging-in-operating-system/#
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- https://itsfoss.com/32-bit-os-list/
- http://www.tribblix.org/