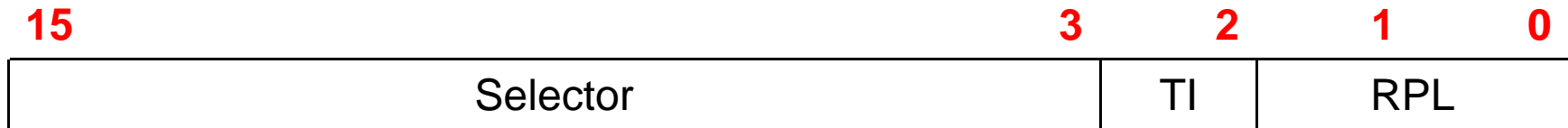

COMPUTER ORGANIZATION (IS F242)

LECT 08: COMPUTER ORGANIZATION

Segment Register in protected mode



Selector

Selects one descriptor from 2^{13} descriptors in either the global or the local descriptor table

RPL = Requested Privilege level where 00 is the highest and 11 is the lowest

TI=0, Global descriptor table

TI=1, Local descriptor table

If the requested privilege level matches or is higher in priority than the privilege level set by the access rights byte, access is granted

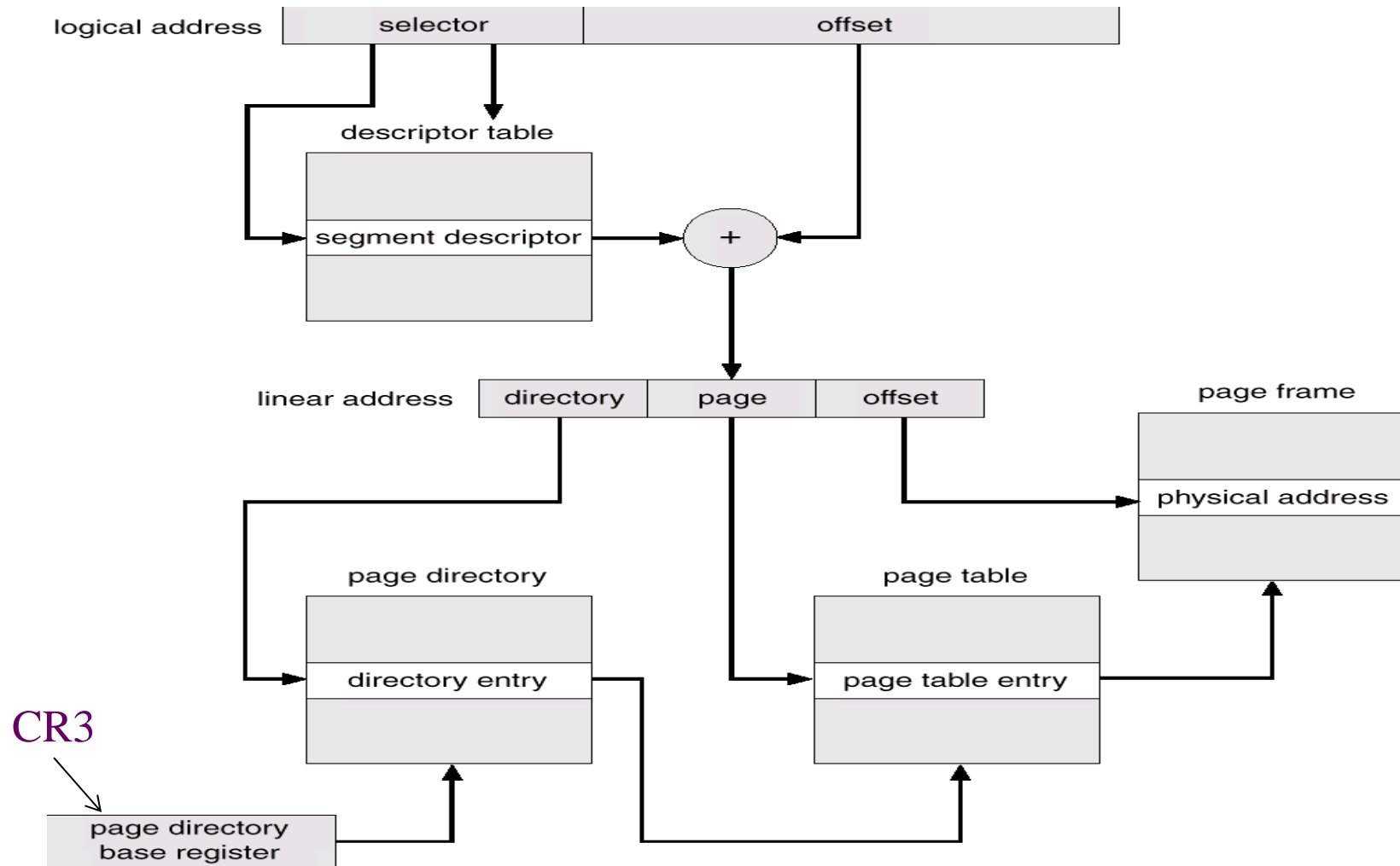
Program invisible registers

- GDTR – Global Descriptor Table Register
 - Contain base address of the descriptor table and its limits (limit is 16 bits – 64KB)
- IDTR – Interrupt Descriptor Table Register
 - Contain base address of the descriptor table and its limits (limit is 16 bits – 64KB)
- Location of Local Descriptor Table is selected from the Global Descriptor Table
 - One of the global descriptors is set up to address the local descriptor table

Program invisible registers

- LDTR (Local Descriptor Table Register) is loaded with a selector
 - The selector accesses global descriptor table and loads the address, limit and access rights of the local descriptor table in to the cache portion of the LDTR.
- TR (Task Register) holds a selector which accesses a descriptor that defines a task.
- Memory Paging and Paging registers
 - CR0, CR1, CR2, CR3, CR4

Intel 80386 address translation



Pentium Numeric Data Types & Formats

- 8 bit Byte
- 16 bit word
- 32 bit double word
- 64 bit quad word
- Addressing is by 8 bit unit
- A 32 bit double word is read at addresses divisible by 4

Data Types in Pentium

■ General

- ❑ Byte, word, doubleword and quadword with binary contents

■ Integer

- ❑ Signed binary value (byte, word, doubleword, quadword) using 2's complement representation

■ Ordinal

- ❑ Unsigned integer contained in a Byte, word, doubleword and quadword.

■ Unpacked Binary Coded Decimal (BCD)

- ❑ A representation of a BCD digit in the range 0 through 9, with one digit in each type

Data Types in Pentium

- **Packed Binary Coded Decimal (BCD)**
 - ❑ A representation of two BCD digits in the range 0 through 99
- **Near Pointer**
 - ❑ A 32-bit effective address that represents the offset with in a segment (Used for all pointers in a nonsegmented memory & for references with in a segment in segmented memory)
- **Bit Field**
 - ❑ Consecutive sequence of bits (position of each bit is considered as in independent unit)
- **Byte String**
 - ❑ A contiguous sequence of bytes, words or doublewords containing from zero to $2^{32} - 1$ bytes
- **Floating Point (IEEE 754 standard)**



Byte unsigned integer



Word unsigned integer



Doubleword unsigned integer



Quadword unsigned integer



Byte signed integer



Word signed integer



Doubleword signed integer



Quadword signed integer



Single precision floating point



Double precision floating point



Double extended precision floating point

Big and Little Endian Representations

- Endianness refers to the order that the individual bytes (not bits) of a multibyte data element is stored in memory.
 - Little endian LSB
 - Big endian MSB
- Little endian memory map for the data 12345678H

0	1	2	3
78	56	34	12

- Big endian memory map for the data 12345678H

0	1	2	3
12	34	56	78

Big and Little Endian Representations

- Big Endian stores the most significant byte first, then the next significant byte and so on.
- Little endian stores the bytes in the opposite order (least significant first).
- Example of Little Endian machines
 - Intel 80x86, Pentium, VAX, Alpha
- Example of Big Endian machines
 - IBM 370/390, Motorola 680x0, Sun SPARC, RISC machines
- Example of Big Endian (Supports big endian and little endian modes)
 - Power PC

When to Care About Little and Big Endian

- For typical programming, the endianness of the CPU is not significant.
- The most common time that it is important is when binary data is transferred between different computer systems.
- Since ASCII data is single byte, endianness is not an issue for it.