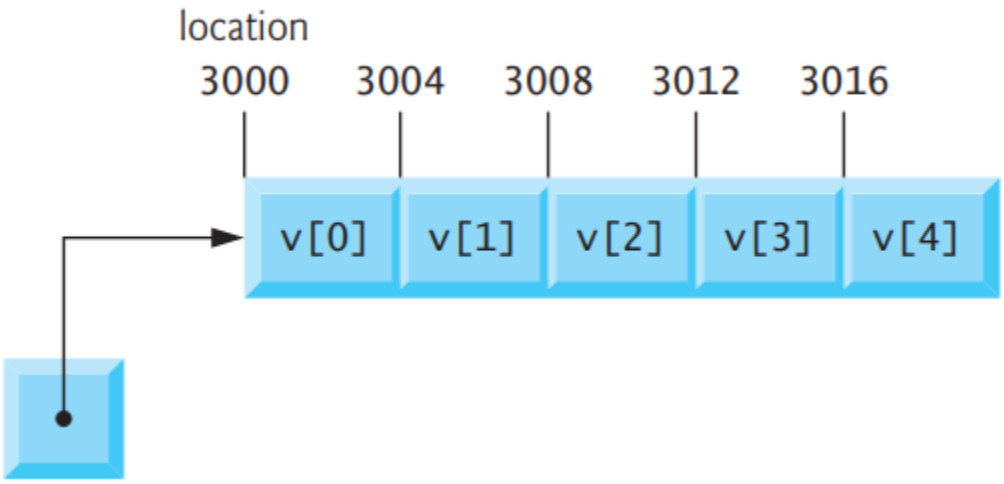
Pointer Arithmetic

C++ enables certain arithmetic operations on pointers. *Pointer arithmetic is appropriate only for pointers that point to built-in array elements.*

Some of the operations that can be done to pointer include:

- A pointer may be incremented (++) or decremented (--)
- An integer may be added to a pointer (+ or +=) or subtracted from a pointer (- or -=)
- One pointer may be subtracted from another of the same type

For example, let's say that we declare an array **v[5]** and the first element, the zeroth element, is at address 3000. Since any memory location is 4-bytes long, a pointer **vPtr** points to the first element of **v**, which it is 3000.



But as we know, the value of **vPrt** is 3000 and sice it is a number, we can add or subtract integers to that number. But pointer arithmetic is not just as integer arithmetic is. Every memory cell is 4-bytes long as stated earlier, and as we can see from the image above, the next cell from 3000 is not 3001, it is 3004. So, when we add 1 to **vPtr**,

we are referring to the next cell adjacent to 300 which is 3004. In other words, adding an integer to a pointer is

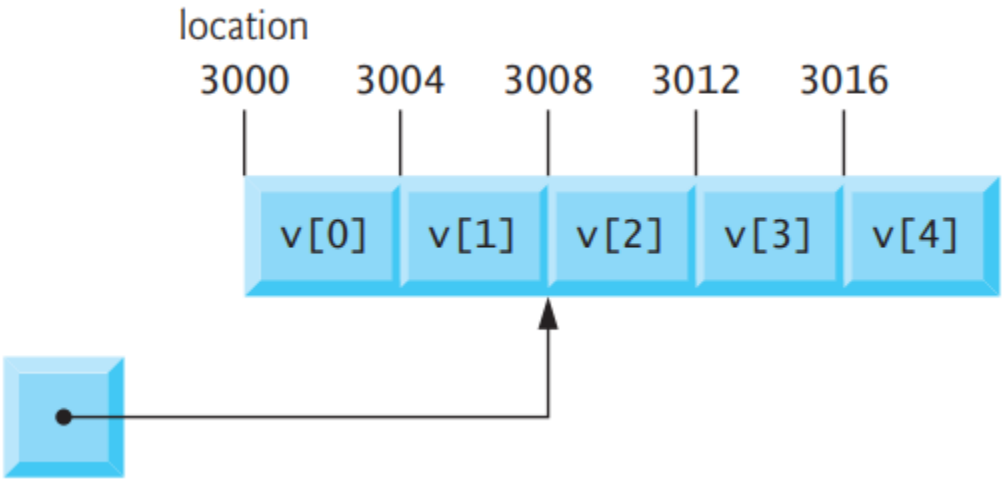
*Value of pointer + N = value of pointer + N*4*

Thus, if we add 5 to a pointer whose value is 2000 we end up with

*2000 + 5*4 = 2020*

Note that not all computer have 4-byte width memory. If we are working on a 8-byte long memory computer, the cited formula changes and we must multiply the integer that we want to add or subtract by the width of the memory in bytes, in this case, 8.

Let's make an example. In a 4-byte long memory, **vPtr** + 2 yields 3008, since we are adding 2 memory cells from the first to the third, and the third memory cell has a memory address 3008:



There is one caveat ot this pointer arithmetic. Since we are dealing with memory allocations that must be contiguous, this arithmetic is only meaningful when the operands are also contiguous, and since we have no guarantee that two variables are

placed contiguous, we cannot assume that adding or subtracting pointers will yield a valid logical result.

Reference

C++ How to Program, 10th Edition. Deitel (2017) pages 398-400.