

A Tale of Two Assembly Codes*



**Oregon State
University**

Mike Bailey

mjb@cs.oregonstate.edu



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Computer Graphics

* With apologies to Charles Dickens

```
int NumInThreadTeam;
int NumAtBarrier;
int NumGone;

void InitBarrier( int n )
{
    NumInThreadTeam = n;
    NumAtBarrier = 0;
}

void WaitBarrier( )
{
    omp_set_lock( &Lock );
    {
        NumAtBarrier++;
        if( NumAtBarrier == NumInThreadTeam )
        {
            NumGone = 0;
            NumAtBarrier = 0;
            // let all other threads return before this one unlocks:
            while( NumGone != NumInThreadTeam-1 );
            omp_unset_lock( &Lock );
            return;
        }
    }
    omp_unset_lock( &Lock );

    while( NumAtBarrier != 0 );
    #pragma omp atomic
    NumGone++;
}
```

Assembly Code with -O3

```
NumGone = 0;
NumAtBarrier = 0;
// let all other threads return before this one unlocks:
while( NumGone != NumInThreadTeam-1 );
```



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```
subq $8, %rsp
.cfi_def_cfa_offset 16
movl $Lock, %edi
call omp_set_lock
movl NumAtBarrier(%rip), %eax
addl $1, %eax
cmpl NumInThreadTeam(%rip), %eax
movl %eax, NumAtBarrier(%rip)
je .L145
movl $Lock, %edi
call omp_unset_lock
movl NumAtBarrier(%rip), %eax
testl %eax, %eax
je .L139
.L140:
jmp .L140
.L139:
lock addl $1, NumGone(%rip)
addq $8, %rsp
ret
.L145:
cmpl $1, %eax
movl $0, NumGone(%rip)
movl $0, NumAtBarrier(%rip)
je .L146
.L142:
jmp .L142
.L146:
movl $Lock, %edi
addq $8, %rsp
.cfi_def_cfa_offset 8
jmp omp_unset_lock
```

Tip #4 -- Sending a Message to the Optimizer: The *volatile* Keyword

The *volatile* keyword is used to let the compiler know that another thread might be changing a variable “in the background”, so don’t make any assumptions about what can be optimized away.

```
int val = 0;  
  
...  
  
while( val != 0 );
```

A good compiler optimizer will *eliminate* this code because it “knows” that, for all time, $val == 0$

```
volatile int val = 0;  
  
...  
  
while( val != 0 );
```

The ***volatile*** keyword tells the compiler optimizer that it cannot count on val being $\neq 0$ here

Assembly Code with -O3

```
NumGone = 0;
NumAtBarrier = 0;
// let all other threads return before this one unlocks:
while( NumGone != NumInThreadTeam-1 );
```



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```
subq $8, %rsp
.cfi_def_cfa_offset 16
movl $Lock, %edi
call omp_set_lock
movl NumAtBarrier(%rip), %eax
addl $1, %eax
cmpl NumInThreadTeam(%rip), %eax
movl %eax, NumAtBarrier(%rip)
je .L145
movl $Lock, %edi
call omp_unset_lock
movl NumAtBarrier(%rip), %eax
testl %eax, %eax
je .L139
.L140:
jmp .L140
.L139:
lock addl $1, NumGone(%rip)
addq $8, %rsp
ret
.L145:
cmpl $1, %eax
movl $0, NumGone(%rip)
movl $0, NumAtBarrier(%rip)
je .L146
.L142:
jmp .L142
.L146:
movl $Lock, %edi
addq $8, %rsp
.cfi_def_cfa_offset 8
jmp omp_unset_lock
```

```
volatile int NumInThreadTeam;
volatile int NumAtBarrier;
volatile int NumGone;

void InitBarrier( int n )
{
    NumInThreadTeam = n;
    NumAtBarrier = 0;
}

void WaitBarrier( )
{
    omp_set_lock( &Lock );
    {
        NumAtBarrier++;
        if( NumAtBarrier == NumInThreadTeam )
        {
            NumGone = 0;
            NumAtBarrier = 0;
            // let all other threads return before this one unlocks:
            while( NumGone != NumInThreadTeam-1 );
            omp_unset_lock( &Lock );
            return;
        }
    }
    omp_unset_lock( &Lock );

    while( NumAtBarrier != 0 );
    #pragma omp atomic
    NumGone++;
}
```

Assembly Code with *volatile* and –O3

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```
subq $8, %rsp
movl $Lock, %edi
call omp_set_lock
movl NumAtBarrier(%rip), %eax
addl $1, %eax
movl %eax, NumAtBarrier(%rip)
movl NumAtBarrier(%rip), %edx
movl NumInThreadTeam(%rip), %eax
cmpl %eax, %edx
je .L128
movl $Lock, %edi
call omp_unset_lock
.L126:
    movl NumAtBarrier(%rip), %eax
    testl %eax, %eax
    jne .L126
    lock addl $1, NumGone(%rip)
    addq $8, %rsp
    ret
.L128:
    movl $0, NumGone(%rip)
    movl $0, NumAtBarrier(%rip)
.L124:
    movl NumInThreadTeam(%rip), %edx
    movl NumGone(%rip), %eax
    subl $1, %edx
    cmpl %eax, %edx
    jne .L124
    movl $Lock, %edi
    addq $8, %rsp
    jmp omp_unset_lock
```

```
.L142:
    jmp .L142
```



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I should read my own notes more often... 😊

