

15-410

“...What could possibly go wrong...”

Paradise Lost
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Outline

When to use `if ()` vs. `while ()`

Consider the lowly worker thread

```
void
worker(void *ignored)
{
    workitem *work;
    while (work = find_work())
        perform(work);
    thr_exit((void *) 0);
}
```

What's Wrong With This Picture?

```
workitem *
find_work(void)
{
    workitem *w;
    mutex_lock(&m);
    if (going_out_of_business)
        w = (workitem *) 0;
    else
        w = (workitem *) dequeue(q);
    mutex_unlock(&m);
    return (w);
}
```

Better?

```
mutex_lock (&m);
if (going_out_of_business)
    w = (workitem *) 0;
else {
    if (!(w = (workitem *) dequeue(q)))
        cond_wait (&new_work, &m);
    w = (workitem *) dequeue(queue);
}
mutex_unlock (&m);
return (w);
```

What We Hope For

| <i>find_work()</i> | <i>queue_work()</i> |
|--|--------------------------------------|
| <code>mutex_lock (&m);</code> | |
| <code>if (!..dequeue(..))</code> | |
| <code>cond_wait (&new, &m);</code> | |
| | <code>mutex_lock (&m);</code> |
| | <code>enqueue (...)</code> |
| | <code>cond_signal (&new);</code> |
| | <code>mutex_unlock (&m);</code> |
| <code>w = dequeue(..);</code> | |
| <code>mutex_unlock (&m);</code> | |

What Went Wrong?

What went wrong?

What Went Wrong?

What went wrong?

- Nothing!

What Went Wrong?

What went wrong?

- Nothing!

But what if there is *another* thread?

Not Exactly What We Hope For

| <i>find_work()</i> | <i>queue_work()</i> | <i>find_work()</i> |
|---|-----------------------------------|--------------------------------|
| <code>lock (&m) ;</code> | | |
| <code>if (!..deq(..))</code> | | |
| <code>cwait (&new, &m) ;</code> | | |
| | <code>lock (&m) ;</code> | |
| | <code>enqueue (...)</code> | |
| | <code>csignal (&new) ;</code> | |
| | <code>unlock (&m) ;</code> | |
| | | <code>lock (&m) ;</code> |
| | | <code>if (!..deq(..))</code> |
| | | <code>unlock (&m) ;</code> |
| <code>w = deq(..) ...</code> | | <code>return (w) ;</code> |
| <code>return (0) ;</code> | | |

Have We Seen This Before?

What went wrong?

- Protected world state wasn't ready for us
- We went to sleep
- Somebody prepared the world for us to run
- We ran
 - We *assumed* nobody else had run
 - We *assumed* the world state was still ready for us

To “if()” Or Not To “if()”?

```
mutex_lock (&m);
if (going_out_of_business)
    w = (workitem *) 0;
else {
    while (!(w = (workitem *) dequeue(q)))
        cond_wait (&new_work, &m);
}
mutex_unlock (&m);
return (w);
/* further restructuring left as exercise */
```

Summary

if vs. while

- **If somebody can revoke your happiness, you'd better check**