

# Distributed Computing I

CSSE6400

Brae Webb

March 28, 2022



**Mathias Verras**

@mathiasverraes

There are only two hard problems in distributed systems: 2. Exactly-once delivery 1. Guaranteed order of messages 2. Exactly-once delivery

Focus

Reliability

Question

What makes software *unreliable*?

'Working' software

Satisfies the functional requirements

### Definition 1. Reliable Software

Continues to work correctly, even when things go wrong.

## Definition 2. Fault

Something goes wrong.

Death, taxes, and computer system failure are all inevitable to some degree.

*Plan for the event.*

- Howard and LeBlanc

Reliable software is

**Fault tolerant**



Problem

Individual computers fail *all the time*

Solution

Spread the risk of faults over *multiple  
computers*

## Spreading Risk

If you have software that works with *just one* computer, spreading the software over *two* computers *halves* the risk that your software will fail.

## Spreading Risk

If you have software that works with *just one* computer, spreading the software over *two* computers *halves* the risk that your software will fail.

Adding *10* computers reduces the risk by *10*.

## Spreading Risk

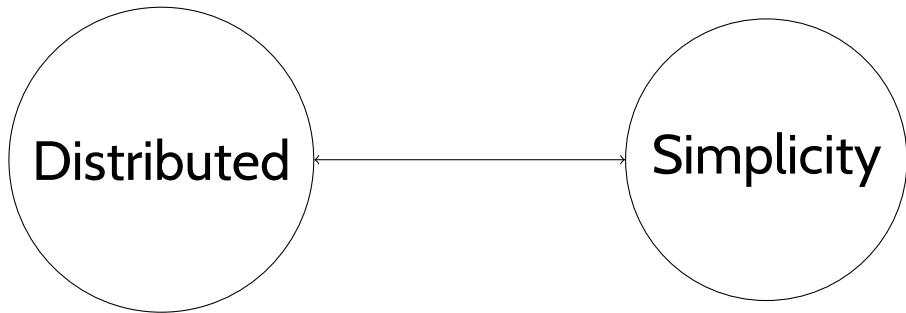
If you have software that works with *just one* computer, spreading the software over *two* computers *halves* the risk that your software will fail.

Adding *10* computers reduces the risk by *10*.

### Definition 3. Distributed Computing

Multiple software components that are on multiple computers, but run as a single system

## The Problem



A lot of modern software development focuses on dealing with the *complexity* of distributed systems.



Question

What makes distributed computing complex?

- Faults
- Asynchronous communication
- Monitoring
- And much more...

Fallacy #1

**The network is reliable**

Fallacy #2

Latency is zero

Fallacy #3

**Bandwidth is infinite**

Fallacy #4

The network is secure

Fallacy #5

The topology never changes

Fallacy #6

There is only one administrator



Fallacy #7

Transport cost is zero

Fallacy #8

The network is homogeneous