

Software at Scale

CSSE6400

Brae Webb

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Question

How many concurrent users can your software handle?

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Answer

Maybe **400**? Maximum.

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Answer

Maybe 400¹? Maximum.

¹HTTP server on a t2.micro EC2 instance

Definition 1. Stress Testing

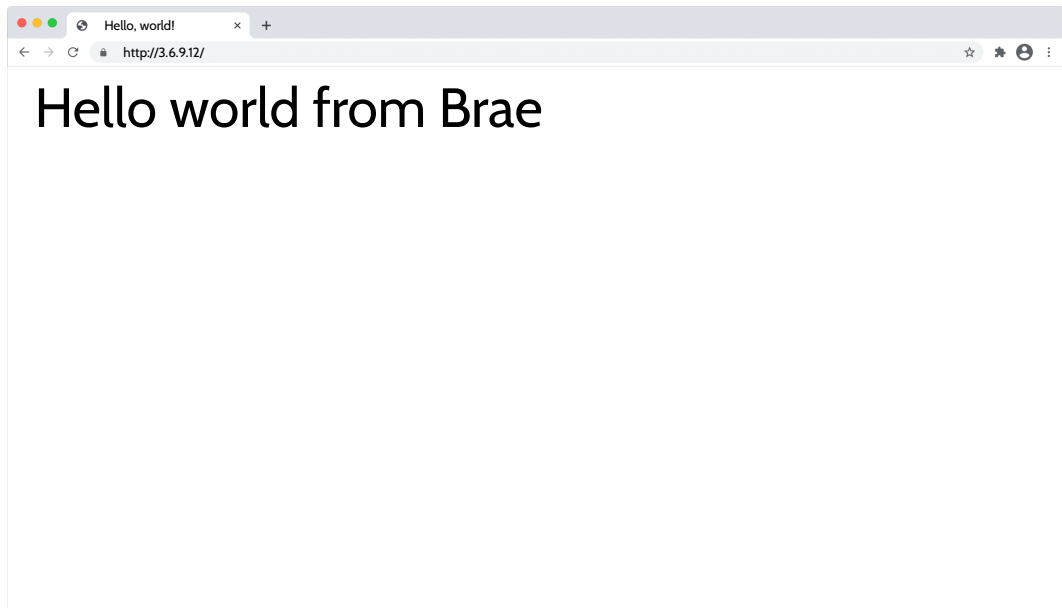
Measure the robustness of software by pushing usage to an extreme.

Demonstration

Let's build 'hello world'

Our Goal






```
» cat hello-server.tf
```

```
1 resource "aws_instance" "hello-server" {  
2     ami = "ami-04902260ca3d33422"  
3     instance_type = "t2.micro"  
4 }
```

```
» cat hello-server.tf
```

```
1 resource "aws_instance" "hello-server" {  
2     ami = "ami-04902260ca3d33422"  
3     instance_type = "t2.micro"  
  
5     user_data = file("${path.module}/setup.sh")  
6 }
```

```
» cat setup.sh
```

```
1  #!/bin/bash
2  yum -y install httpd
3  systemctl enable httpd
4  systemctl start httpd
5  echo '<html><title>Hello, world!</title><h1>Hello world from Brae</h1></html>' > /
    var/www/html/index.html
```

```
» cat hello-server.tf
```

```
1 resource "aws_instance" "hello-server" {
2     ami = "ami-04902260ca3d33422"
3     instance_type = "t2.micro"
4
5     user_data = file("${path.module}/setup.sh")
6
7     associate_public_ip_address = true
8     subnet_id = module.network.subnets[0].public.id
9     vpc_security_group_ids = [
10         module.network.http-port.id
11     ]
12 }
```

```
» cat hello-server.tf
```

```
1 resource "aws_instance" "hello-server" {
2     ami = "ami-04902260ca3d33422"
3     instance_type = "t2.micro"

5     user_data = file("${path.module}/setup.sh")

7     associate_public_ip_address = true
8     subnet_id = module.network.subnets[0].public.id
9     vpc_security_group_ids = [
10         module.network.http-port.id
11     ]

13     tags = {
14         Name = "hello-server"
15     }
16 }
```

Starting the server

```
1 >> terraform init
2 >> terraform plan
3 >> terraform apply
```

Before



After



Question

How much traffic can this website handle?

```
» cat stress-test.js
```

```
1 import http from 'k6/http';
2 import { check, sleep } from 'k6';

4 const IP = "http://3.6.9.12/";
5 export default function() {
6     const res = http.get(IP);
7     check(res, { 'status was 200': (r) => r.status == 200 });
8     sleep(1);
9 }
```

```
» cat stress-test.js
```

```
1  import http from 'k6/http';
2  import { check, sleep } from 'k6';

4  const IP = "http://3.6.9.12/";
5  export const options = {
6    stages: [
7      { duration: '2m', target: 100 },
8    ],
9  };
10 export default function() {
11   const res = http.get(IP);
12   check(res, { 'status was 200': (r) => r.status == 200 });
13   sleep(1);
14 }
```

Run the tests

```
1 >> k6 run stress-test.js
```

Looks good so far

```
1  status was 200
2  100% - 347867 / 0

4  checks.....: 100%
5  data_received.....: 100 MB 44 kB/s
6  data_sent.....: 27 MB 12 kB/s
7  iterations.....: 347997 152.552084/s
8  vuS.....: 1 min=1 max=400
```

Let's upgrade the traffic

```
» cat stress-test.js
```

```
1 export const options = {
2   stages: [
3     { duration: '2m', target: 100 },
4     { duration: '5m', target: 100 },
5     { duration: '2m', target: 200 },
6     { duration: '5m', target: 200 },
7     { duration: '2m', target: 300 }, // around the breaking point
8     { duration: '5m', target: 300 },
9     { duration: '2m', target: 400 }, // beyond the breaking point
10    { duration: '5m', target: 400 },
11    { duration: '2m', target: 0 }, // scale down
12  ],
13 };
```

And run the tests again

```
1 >> k6 run stress-test.js
```

Oh no...

```
1 status was 200
2 99% - 347867 / 130

4 checks.....: 99.96%
5 data_received.....: 100 MB 44 kB/s
6 data_sent.....: 27 MB 12 kB/s
7 iterations.....: 347997 152.552084/s
8 vuS.....: 1 min=1 max=400
```


Back to square one



Question

How can we fix this?

Question

How can we fix this?

Answer

More servers?

```
» cat hello-server.tf
```

```
1 resource "aws_instance" "hello-server" {
2     ami = "ami-04902260ca3d33422"
3     instance_type = "t2.micro"

5     user_data = file("${path.module}/setup.sh")

7     associate_public_ip_address = true
8     subnet_id = module.network.subnets[0].public.id
9     vpc_security_group_ids = [
10         module.network.http-port.id
11     ]

13     tags = {
14         Name = "hello-server"
15     }
16 }
```

```
» cat hello-scale.tf
```

```
1 resource "aws_instance" "hello-server" {
2     count = 4

4     ami = "ami-04902260ca3d33422"
5     instance_type = "t2.micro"
6     user_data = file("${path.module}/setup.sh")

8     associate_public_ip_address = true
9     subnet_id = module.network.subnets[count.index].public.id
10    vpc_security_group_ids = [
11        module.network.http-port.id
12    ]

14    tags = {
15        Name = "hello-server-${count.index}"
16    }
17 }
```

Definition 2. Target Group

A collection of EC2 instances.

More specifically, a collection of network connection points to EC2 instances.

An empty HTTP target group

```
» cat hello-scale.tf
```

```
1 resource "aws_lb_target_group" "hello-target" {  
2     name = "hello-target-group"  
3     port = 80  
4     protocol = "HTTP"  
5     vpc_id = module.network.vpc.id  
6 }
```

Definition 3. Health Check

Monitors attributes of hardware or software to detect deficiencies.

Add a health check

```
» cat hello-scale.tf
```

```
1 resource "aws_lb_target_group" "hello-target" {
2     name = "hello-target-group"
3     port = 80
4     protocol = "HTTP"
5     vpc_id = module.network.vpc.id
6
7     health_check {
8         port = 80
9         protocol = "HTTP"
10        timeout = 5
11        interval = 10
12    }
13 }
```

Add our instances to the target group

```
» cat hello-scale.tf
```

```
1 resource "aws_lb_target_group_attachment" "hello-target-link" {  
2     count = length(aws_instance.hello-server)  
3     target_group_arn = aws_lb_target_group.hello-target.arn  
4     target_id = aws_instance.hello-server[count.index].id  
5     port = 80  
6 }
```

Definition 4. Load Balancer

A networking tool to route and distribute traffic to targets.

Create a load balancer

```
» cat hello-scale.tf
```

```
1 resource "aws_lb" "hello-balancer" {
2   name = "hello-balancer"
3   internal = false
4   load_balancer_type = "application"
5   subnets = [
6     module.network.subnets[0].public.id,
7     module.network.subnets[1].public.id,
8     module.network.subnets[2].public.id,
9     module.network.subnets[3].public.id
10  ]
11   security_groups = [
12     module.network.http-port.id
13  ]
14 }
```

Route load balancer traffic to the target group

```
» cat hello-scale.tf
```

```
1 resource "aws_lb_listener" "app" {
2     load_balancer_arn = aws_lb.hello-balancer.arn
3     port = "80"
4     protocol = "HTTP"
5
6     default_action {
7         type = "forward"
8         target_group_arn = aws_lb_target_group.hello-target.arn
9     }
10 }
```

We're live!



Hello world from Brae

Exercise

Use *k6* to determine the new *load limits*

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