

COEN241 - Cloud Computing

HW #2 Report - Your own serverless infrastructure (OpenFaaS)

Note:

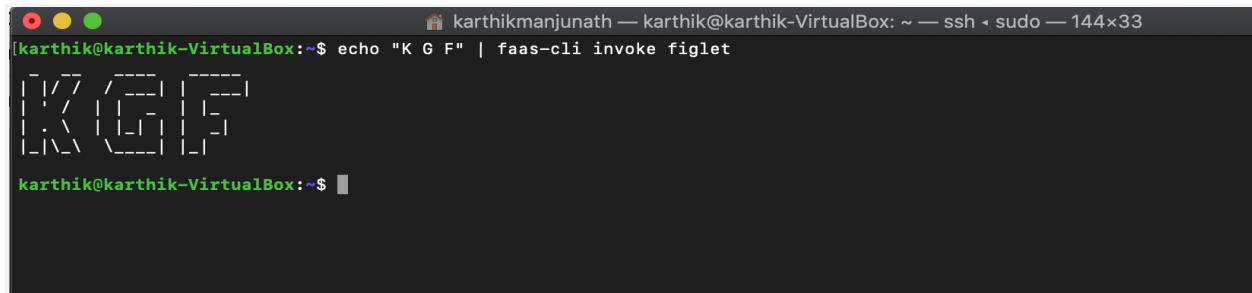
This assignment is completed with the help of Ubuntu 22.04 VM running on VirtualBox.
So OpenFaaS is installed using faasd.

1. Tasks

Q. Provide a screenshot of invoking the figlet function

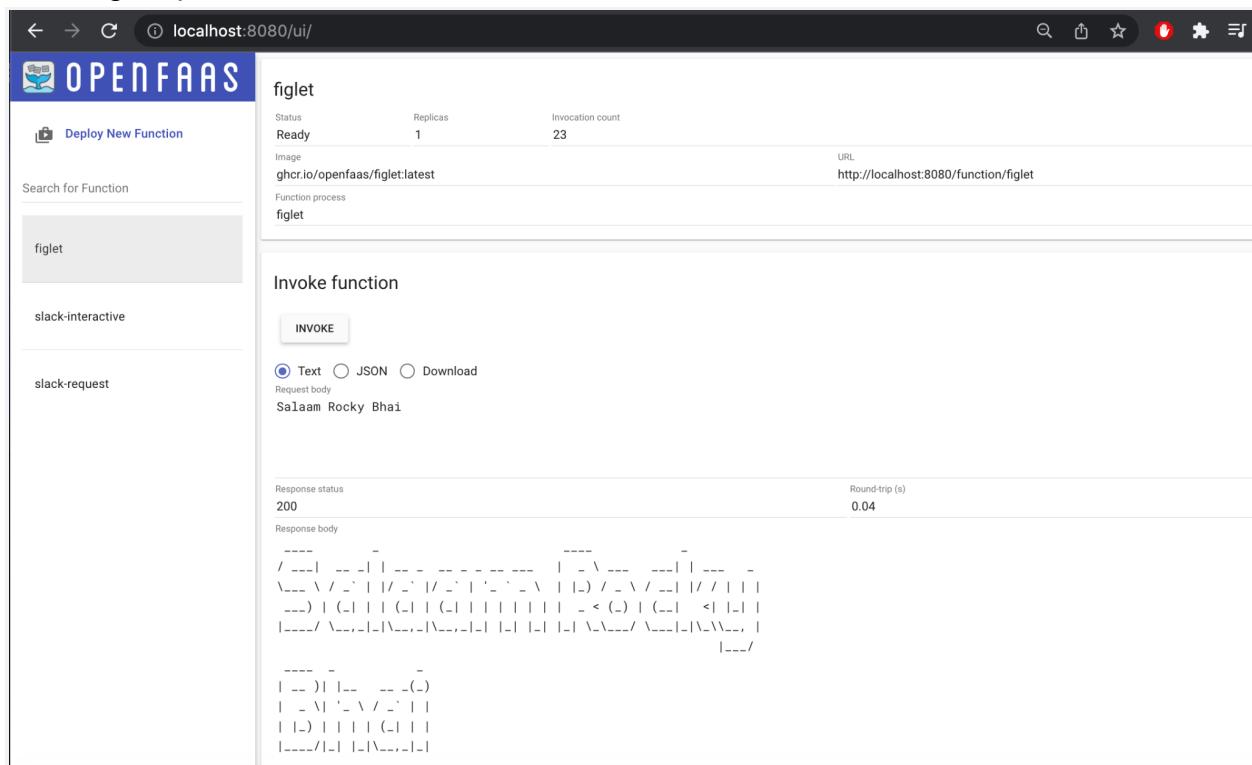
A.

- Through command line - faas-cli



```
[karthik@karthik-VirtualBox:~$ echo "K G F" | faas-cli invoke figlet
  _/ /_ /---| |---|
 | \ | | | | |
 | \ \ \---| | |
[karthik@karthik-VirtualBox:~$ ]
```

- Through OpenFaaS UI



The screenshot shows the OpenFaaS UI interface at localhost:8080/ui/. On the left sidebar, there are two items: "Deploy New Function" and "Search for Function". Below these, there is a list of deployed functions: "figlet" (selected), "slack-interactive", and "slack-request".

The main panel displays the "figlet" function details:

- Status: Ready
- Replicas: 1
- Invocation count: 23
- Image: ghcr.io/openfaas/figlet:latest
- Function process: figlet
- URL: <http://localhost:8080/function/figlet>

Below this, under the "Invoke function" section, there is an "INVOKE" button and options for "Text" (selected), "JSON", and "Download". The request body is set to "Salaam Rocky Bhai".

The invoke history table shows one entry:

Response status	Round-trip (s)
200	0.04

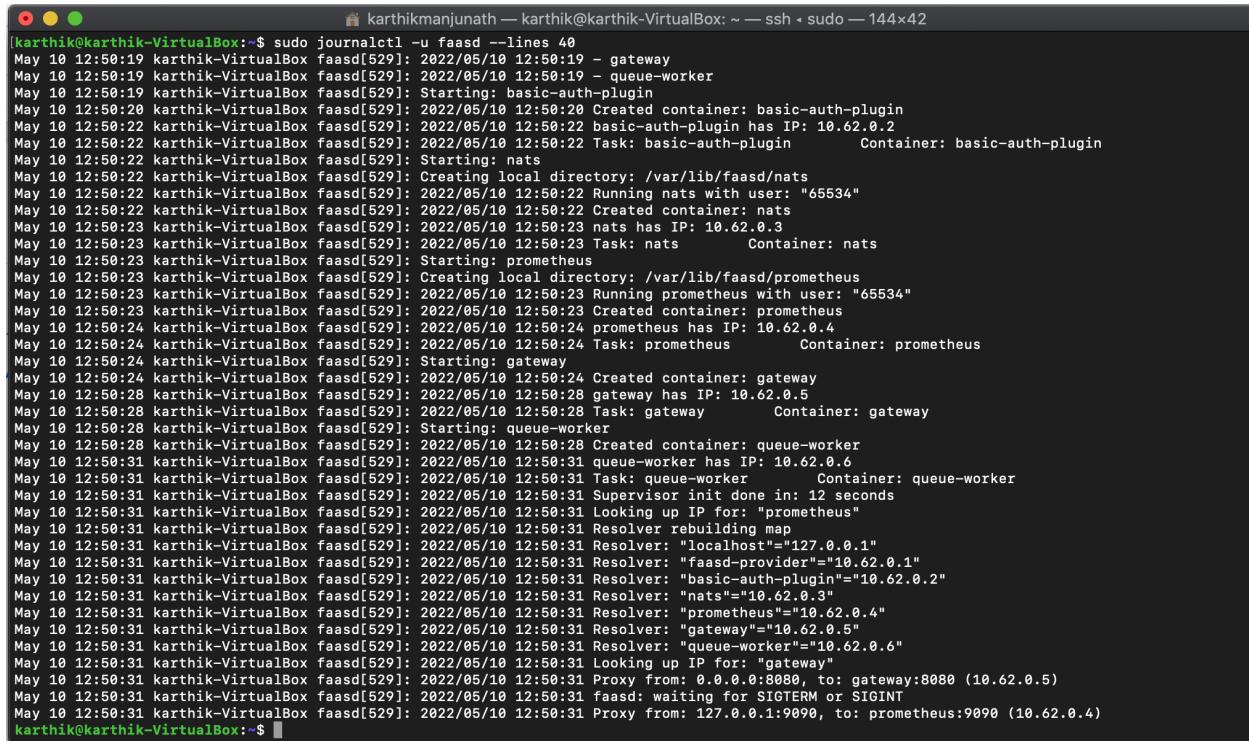
The response body is displayed as a large block of ASCII art representing the word "Salaam" in various fonts.

Q. Provide a screenshot of running the following command (10 pts)

\$ sudo journalctl -u faasd --lines 40

A.

It shows the journal entries of faasd tasks once faasd has started

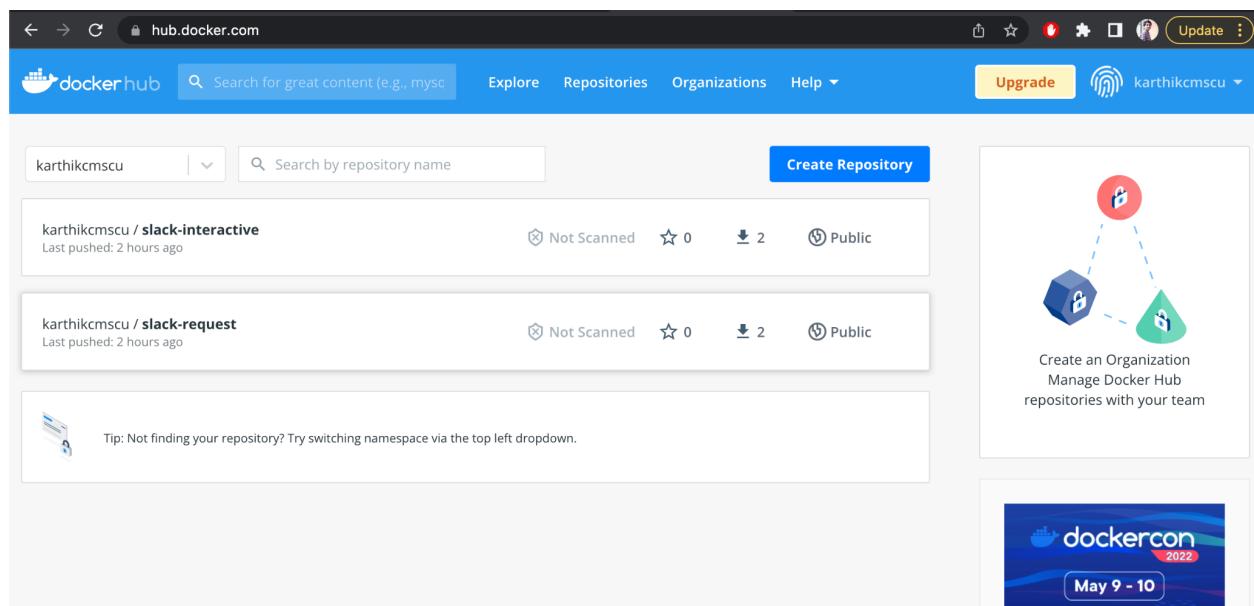
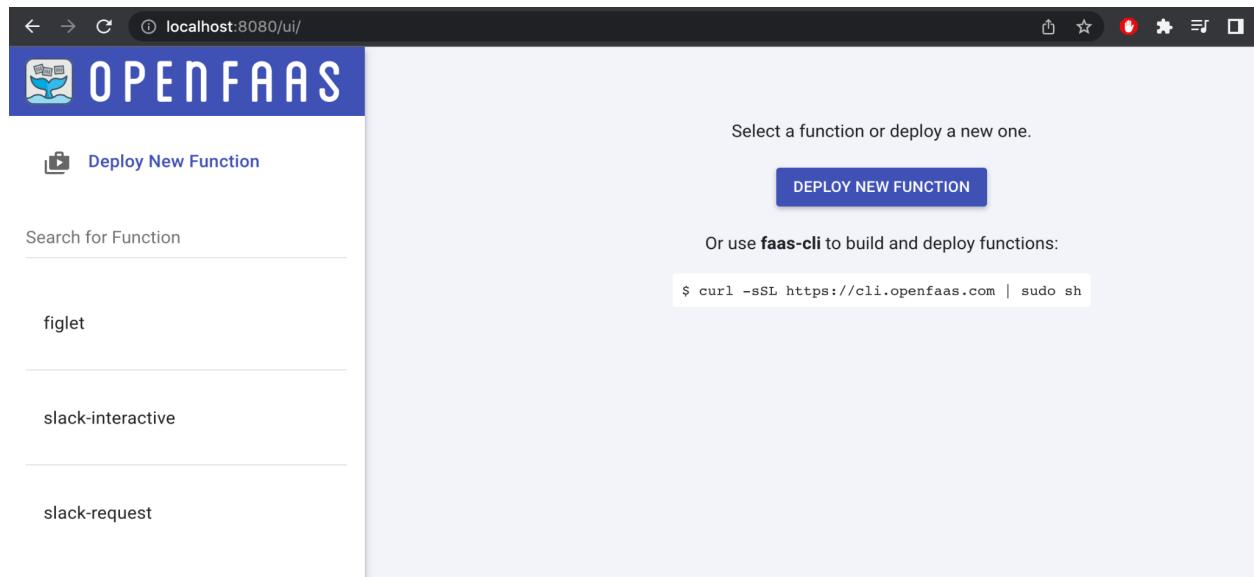


```
[karthik@karthik-VirtualBox:~]$ sudo journalctl -u faasd --lines 40
May 10 12:50:19 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:19 - gateway
May 10 12:50:19 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:19 - queue-worker
May 10 12:50:19 karthik-VirtualBox faasd[529]: Starting: basic-auth-plugin
May 10 12:50:20 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:20 Created container: basic-auth-plugin
May 10 12:50:22 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:22 basic-auth-plugin has IP: 10.62.0.2
May 10 12:50:22 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:22 Task: basic-auth-plugin Container: basic-auth-plugin
May 10 12:50:22 karthik-VirtualBox faasd[529]: Starting: nats
May 10 12:50:22 karthik-VirtualBox faasd[529]: Creating local directory: /var/lib/faasd/nats
May 10 12:50:22 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:22 Running nats with user: "65534"
May 10 12:50:22 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:22 Created container: nats
May 10 12:50:23 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:23 nats has IP: 10.62.0.3
May 10 12:50:23 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:23 Task: nats Container: nats
May 10 12:50:23 karthik-VirtualBox faasd[529]: Starting: prometheus
May 10 12:50:23 karthik-VirtualBox faasd[529]: Creating local directory: /var/lib/faasd/prometheus
May 10 12:50:23 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:23 Running prometheus with user: "65534"
May 10 12:50:23 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:23 Created container: prometheus
May 10 12:50:24 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:24 prometheus has IP: 10.62.0.4
May 10 12:50:24 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:24 Task: prometheus Container: prometheus
May 10 12:50:24 karthik-VirtualBox faasd[529]: Starting: gateway
May 10 12:50:24 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:24 Created container: gateway
May 10 12:50:28 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:28 gateway has IP: 10.62.0.5
May 10 12:50:28 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:28 Task: gateway Container: gateway
May 10 12:50:28 karthik-VirtualBox faasd[529]: Starting: queue-worker
May 10 12:50:28 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:28 Created container: queue-worker
May 10 12:50:31 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:31 queue-worker has IP: 10.62.0.6
May 10 12:50:31 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:31 Task: queue-worker Container: queue-worker
May 10 12:50:31 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:31 Supervisor init done in: 12 seconds
May 10 12:50:31 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:31 Looking up IP for: "prometheus"
May 10 12:50:31 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:31 Resolver rebuilding map
May 10 12:50:31 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:31 Resolver: "localhost"="127.0.0.1"
May 10 12:50:31 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:31 Resolver: "faasd-provider"="10.62.0.1"
May 10 12:50:31 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:31 Resolver: "basic-auth-plugin"="10.62.0.2"
May 10 12:50:31 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:31 Resolver: "nats"="10.62.0.3"
May 10 12:50:31 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:31 Resolver: "prometheus"="10.62.0.4"
May 10 12:50:31 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:31 Resolver: "gateway"="10.62.0.5"
May 10 12:50:31 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:31 Resolver: "queue-worker"="10.62.0.6"
May 10 12:50:31 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:31 Looking up IP for: "gateway"
May 10 12:50:31 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:31 Proxy from: 0.0.0.0:8080, to: gateway:8080 (10.62.0.5)
May 10 12:50:31 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:31 faasd: waiting for SIGTERM or SIGINT
May 10 12:50:31 karthik-VirtualBox faasd[529]: 2022/05/10 12:50:31 Proxy from: 127.0.0.1:9090, to: prometheus:9090 (10.62.0.4)
karthik@karthik-VirtualBox:~$
```

Q. Provide a screenshot of your OpenFaaS gateway AFTER deploying figlet, slack-handler and slack-interactive functions

A.

UI screenshot of OpenFaaS Gateway which is available at localhost:8080/ui on the guest VM. This lists all the functions deployed on the OpenFaaS



Q. Provide a screenshot of invoking slack-request and slack-interactive functions
A.

1. slack-request

a) Invoking function through OpenFaaS CLI

```
[karthik@karthik-VirtualBox:~] karthik@karthik-VirtualBox:~ — ssh - sudo — 146x42
[karthik@karthik-VirtualBox:~] $ echo "{\"name\": \"Rocky\"}" | faas-cli invoke slack-request
{"text": "Serverless Message", "attachments": [{"fields": [{"short": true, "value": "100", "title": "Amazing Level"}], "author_icon": "", "image_url": "https://avatars.githubusercontent.com/u/21160378?s=40&u=0d1b308c87e0c544e695529945a13f82e192e40&v=4", "author_name": "https://github.com/karthik-cm/COEN241-CloudComputing", "title": "The Awesome world of Cloud Computing! COEN 241"}, {"text": "COEN 241 is the most awesome class ever!", "title": "About COEN 241"}, {"title": "Would you recommend COEN 241 to your friends?", "color": "#3AA3E3", "actions": [{"text": "Of Course!", "type": "button", "name": "recommend", "value": "recommend"}, {"text": "Most Definitely!", "type": "button", "name": "definitely", "value": "definitely"}]}, {"callback_id": "response123", "fallback": "Would you recommend COEN 241 to your friends?", "attachment_type": "default"}]
[karthik@karthik-VirtualBox:~]
```

b) Invoking function through OpenFaaS UI

The screenshot shows the OpenFaaS UI interface. On the left, there's a sidebar with categories: Deploy New Function, Search for Function, figlet, slack-interactive, and slack-request (which is currently selected). The main area displays the 'slack-request' function details:

- Status: Ready
- Replicas: 1
- Invocation count: 9
- Image: docker.io/karthikcmscu/slack-request:latest
- Function process: python index.py
- URL: http://localhost:8080/function/slack-request

Below this, there's an 'Invoke function' section with an 'INVOKE' button. Underneath it, there are options for Request body: Text (radio button), JSON (radio button, selected), and Download. The JSON request body is set to: {"name": "Rocky"}. Further down, the response status is 200, and the response body is displayed as a JSON object:

```
{
  "text": "Serverless Message",
  "attachments": [
    {
      "fields": [
        {
          "short": true,
          "value": "100",
          "title": "Amazing Level"
        }
      ],
      "author_icon": "",
      "image_url": "https://avatars.githubusercontent.com/u/21160378?s=40&u=0d1b308c87e0c544e695529945a13f82e192e40&v=4",
      "author_name": "https://github.com/karthik-cm/COEN241-CloudComputing"
    }
  ]
}
```

```

Response status: 200
Round-trip (s): 0.131
Response body:
{
  "text": "Serverless Message",
  "attachments": [
    {
      "fields": [
        {
          "short": true,
          "value": "100",
          "title": "Amazing Level"
        }
      ],
      "author_icon": "",
      "image_url": "https://avatars.githubusercontent.com/u/21160378?s=400&u=0d1b308c87e0c544e695529945a13f82e192e408&v=4",
      "author_name": "https://github.com/karthik-cm/COEN241-CloudComputing",
      "title": "The Awesome world of Cloud Computing! COEN 241"
    },
    {
      "text": "COEN 241 is the most awesome class ever!.",
      "title": "About COEN 241"
    },
    {
      "title": "Would you recommend COEN 241 to your friends?",
      "color": "#3AA3E3",
      "actions": [
        {
          "text": "Of Course!",
          "type": "button",
          "name": "recommend",
          "value": "recommend"
        },
        {
          "text": "Most Definitely!",
          "type": "button",
          "name": "definitely",
          "value": "definitely"
        }
      ],
      "callback_id": "response123",
      "fallback": "Would you recommend COEN 241 to your friends?",
      "attachment_type": "default"
    }
  ]
}

```

2. slack-interactive

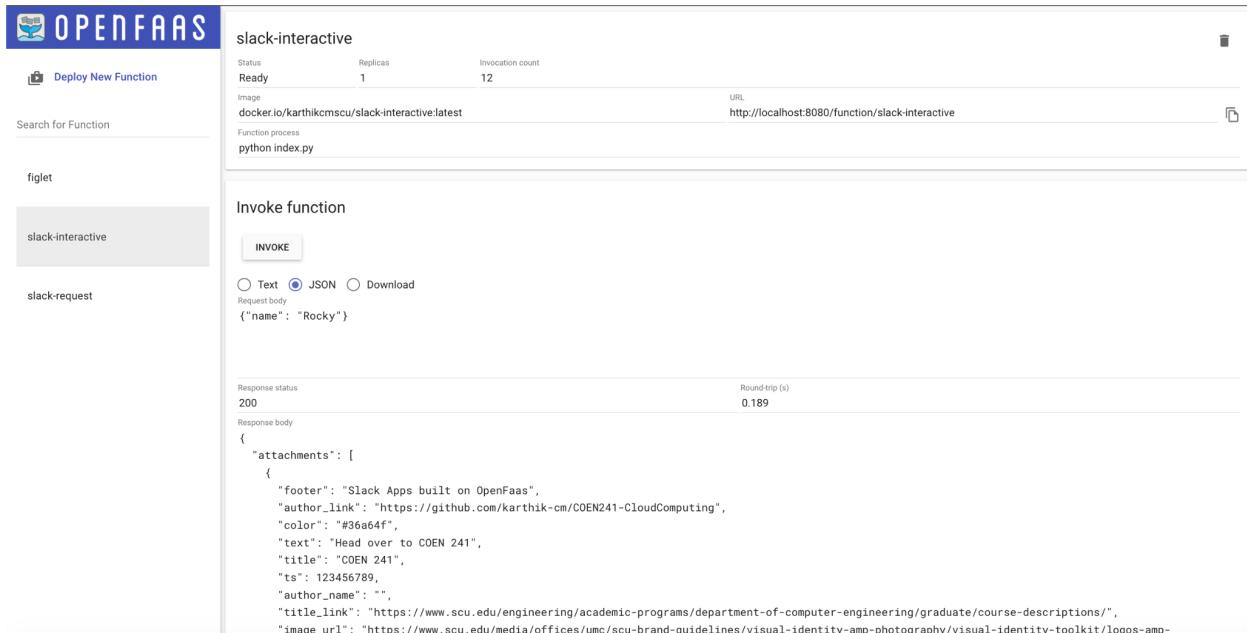
a) Invoking function through OpenFaaS CLI

```

karthik@karthik-VirtualBox:~$ echo "{\"name\": \"Rocky\"} | faas-cli invoke slack-interactive
{"attachments": [{"footer": "Slack Apps built on OpenFaaS", "author_link": "https://github.com/karthik-cm/COEN241-CloudComputing", "color": "#36a64f", "text": "Head over to COEN 241", "ts": 123456789, "author_name": "", "title_link": "https://www.scu.edu/engineering/academic-programs/department-of-computer-engineering/graduate/course-descriptions/", "image_url": "https://www.scu.edu/media/offices/umc/scu-brand-guidelines/visual-identity-and-photography/visual-identity-toolkit/logos-and-seals/Mission-Dont3.png", "response_type": "ephemeral", "replace_original": true, "footer_icon": "https://a.slack-edge.com/45901/marketing/img/_rebrand/meta/slack_hash_256.png", "pretext": "Ahh yeah! Great choice, COEN 241 is absolutely amazing!", "fallback": "Required plain-text summary of the attachment.", "thumb_url": "https://www.scu.edu/engineering/academic-programs/department-of-computer-engineering/graduate/course-descriptions/", "author_icon": "https://avatars.githubusercontent.com/u/21160378?s=400&u=0d1b308c87e0c544e695529945a13f82e192e408&v=4"}]}
karthik@karthik-VirtualBox:~$ 

```

b) Invoking function through OpenFaaS UI



The screenshot shows the OpenFaaS UI interface. At the top, there's a navigation bar with the OpenFaaS logo and a "Deploy New Function" button. Below the navigation, there's a search bar labeled "Search for Function". On the left, there's a sidebar with two items: "slack-interactive" and "slack-request". The main area is titled "slack-interactive" and shows its status as "Ready" with 1 replica and 12 invocations. It displays the Docker image as "docker.io/karthikcmcu/slack-interactive.latest" and the function process as "python index.py". The URL for the function is listed as "http://localhost:8080/function/slack-interactive". Below this, there's a section titled "Invoke function" with an "INVOKE" button. Underneath the button, there are three radio buttons: "Text", "JSON" (which is selected), and "Download". A "Request body" field contains the JSON payload: {"name": "Rocky"}. The response status is shown as 200, with a round-trip time of 0.189 seconds. The response body is a JSON object containing an attachment with various Slack message parameters.



This screenshot shows the same OpenFaaS UI interface, but with a different request body in the "Request body" field. The JSON payload now includes an "image_url": "https://www.scu.edu/media/offices/umc/scu-brand-guidelines/visual-identity-amp-photography/visual-identity-toolkit/logos-amp-seals/Mission-Dont3.png". The rest of the interface and response details remain the same as the first screenshot.

2. Questions

After performing the tasks in step 5 answer the following questions.

1. What is the command to invoke the slack-request function ?

a. Via Curl

Ans. curl http://127.0.0.1:8080/function/slack-request

```
$ curl http://127.0.0.1:8080/function/slack-request -d "{\"name\": \"Rocky\"}"
```

Here port 8080 is the routing port number from VM to Host

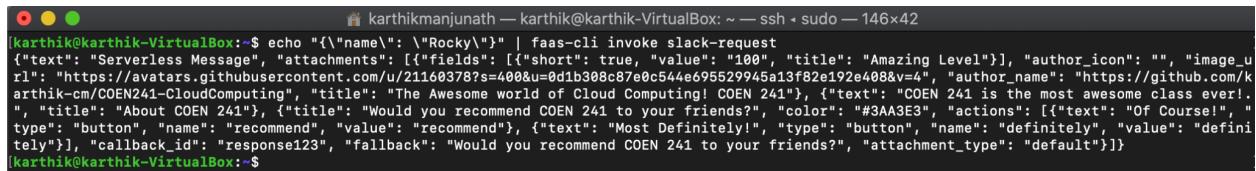
b. Via faas-cli

Ans. faas-cli invoke slack-request

```
$ echo "{\"name\": \"Rocky\"}" | faas-cli invoke slack-request
```

2. What is the output you see when you invoke the slack-request function ?

Ans. We see the JSON response as returned by the slack-request/handler.py python file



```
[karthik@karthik-VirtualBox:~]$ echo "{\"name\": \"Rocky\"}" | faas-cli invoke slack-request
{
  "text": "Serverless Message",
  "attachments": [
    {
      "fields": [
        {
          "short": true,
          "value": "100",
          "title": "Amazing Level"
        }
      ],
      "author_icon": "",
      "image_url": "https://avatars.githubusercontent.com/u/21168378?s=40&v=4",
      "author_name": "https://github.com/karthik-cm/COEN241-CloudComputing",
      "title": "The Awesome world of Cloud Computing! COEN 241",
      "text": "COEN 241 is the most awesome class ever!",
      "type": "button",
      "name": "recommend",
      "value": "recommend",
      "text": "Most Definitely!",
      "color": "#3AA3E3",
      "actions": [
        {
          "text": "Of Course!",
          "type": "button",
          "name": "definitely",
          "value": "definitely"
        }
      ],
      "callback_id": "response123",
      "fallback": "Would you recommend COEN 241 to your friends?",
      "attachment_type": "default"
    }
  ]
}
[karthik@karthik-VirtualBox:~]$
```

3. What is the command to invoke the slack-interactive function ?

a. Via Curl

Ans. curl http://127.0.0.1:8080/function/slack-interactive

```
$ curl http://127.0.0.1:8080/function/slack-interactive -d "{\"name\": \"Rocky\"}"
```

Here port 8080 is the routing port number from VM to Host

b. Via faas-cli

Ans. faas-cli invoke slack-interactive

```
$ echo "{\"name\": \"Rocky\"}" | faas-cli invoke slack-interactive
```

4. What is the output you see when you invoke the slack-interactive function ?

Ans. We see the JSON response as returned by the slack-interactive/handler.py python file

```
[karthik@karthik-VirtualBox:~]$ echo "{\"name\": \"Rocky\"}" | faas-cli invoke slack-interactive
{
  "attachments": [
    {
      "footer": "Slack Apps built on OpenFaaS", "author_link": "https://github.com/karthik-cm/COEN241-CloudComputing", "color": "#36a64f", "text": "Head over to COEN 241", "title": "COEN 241", "ts": 123456789, "author_name": "", "title_link": "https://www.scu.edu/engineering/academic-programs/department-of-computer-engineering/graduate/course-descriptions/", "image_url": "https://www.scu.edu/media/offices/umc/scu-brand-guidelines/visual-identity-amp-photography/visual-identity-toolkit/logos-amp-seals/Mission-Dont3.png", "response_type": "ephemeral", "replace_original": true, "footer_icon": "https://a.slack-edge.com/45901/marketing/img/_rebrand/meta/slack_hash_256.png", "pretext": "Ahh yeah! Great choice, COEN 241 is absolutely amazing!", "fallback": "Required plain-text summary of the attachment.", "thumb_url": "https://www.scu.edu/engineering/academic-programs/department-of-computer-engineering/graduate/course-descriptions/", "author_icon": "https://avatars.githubusercontent.com/u/21160378?s=40&u=0d1b308c87e0c544e695529945a13f82e192e408&v=4"}]
}
[karthik@karthik-VirtualBox:~]$
```

5. How would you pass different arguments to the functions ?

Ans. We can invoke the functions by passing different arguments by 2 methods.

a) Via STDIN using -d:

```
$ curl http://127.0.0.1:8080/function/some_function -d <data string>
```

It is also shown in 2a / 3a for example of slack invocation.

b) Via echo:

```
$ echo <data string> | faas-cli invoke some_function
```

It is also shown in 2b / 3b for example of slack invocation.

The <data string> can also be of type JSON.

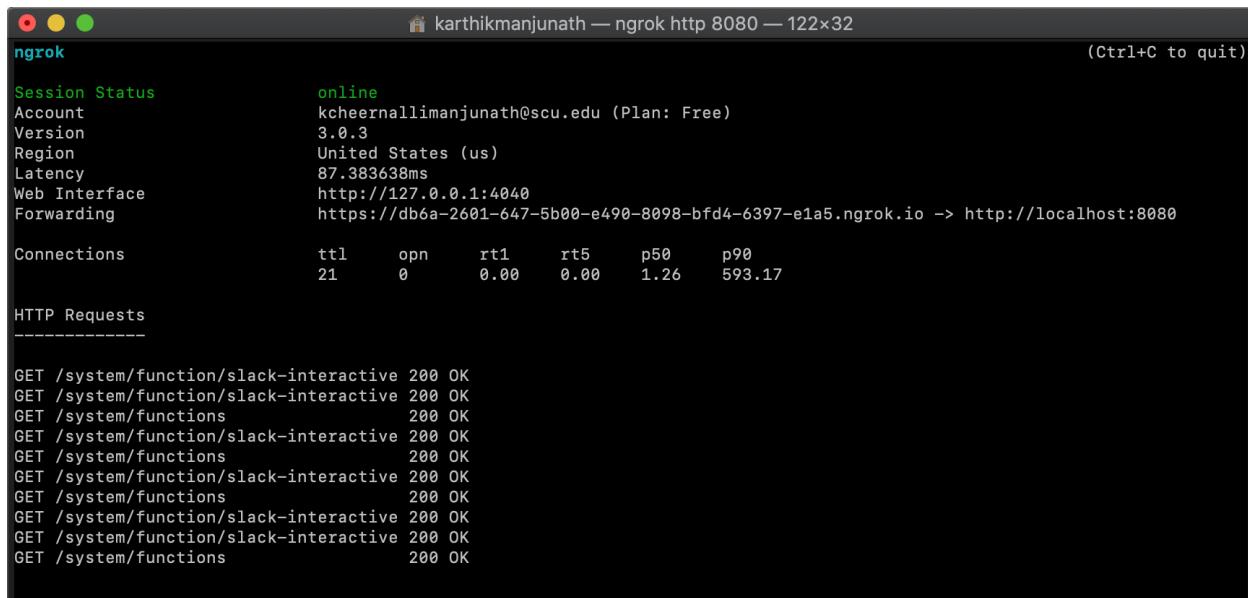
6. How would you change the slack-interactive function to react to different inputs ?

Ans. We can modify the slack-interactive function to take input as **kwargs which is equivalent to taking in the list of arguments similar to command-line arguments and handle it appropriately inside the function.

Other way is we can take in string input and parse it to JSON and process the information as required inside the function and return JSON as the response of the function.

3. Extra Credit

> Using ngrok I have got a public routable address as below.



The screenshot shows a terminal window titled "karthikmanjunath — ngrok http 8080 — 122x32". It displays the following information:

```
Session Status      online
Account            kcheernallimanjunath@scu.edu (Plan: Free)
Version            3.0.3
Region             United States (us)
Latency            87.383638ms
Web Interface     http://127.0.0.1:4040
Forwarding         https://db6a-2601-647-5b00-e490-8098-bfd4-6397-e1a5.ngrok.io -> http://localhost:8080

Connections        ttl     opn      rt1      rt5      p50      p90
                    21      0       0.00    0.00    1.26    593.17

HTTP Requests
-----
GET /system/function/slack-interactive 200 OK
GET /system/function/slack-interactive 200 OK
GET /system/functions                 200 OK
GET /system/function/slack-interactive 200 OK
GET /system/functions                 200 OK
GET /system/function/slack-interactive 200 OK
GET /system/functions                 200 OK
GET /system/function/slack-interactive 200 OK
GET /system/function/slack-interactive 200 OK
GET /system/functions                 200 OK
```

> Slack setup details:

Command:

/coen241hw2

Slash Command - Request URL:

<https://db6a-2601-647-5b00-e490-8098-bfd4-6397-e1a5.ngrok.io/function/slack-request>

Interactivity - Request URL:

<https://db6a-2601-647-5b00-e490-8098-bfd4-6397-e1a5.ngrok.io/function/slack-interactive>

> Slack App - working screenshots:

Slack App URL: <https://app.slack.com/client/T03EH13RCKZ/C03FA7TBCL9>

