OS 2016

Homework3:

Socket, Multithreading and Synchronization

(Due date: 2016/12/01 23:59:59)

Requirements

- A Simple DNS Database Server
  - Client-side code is provided to you
- Use internet socket to connect with clients
- Use threads to handle client requests
  - Pthreads or clone() a shared address space task
  - Three types of requests: SET, GET and INFO
- Use lock to address the concurrent issues
  - Mutex, Semaphore or Spin-lock

Simple DNS Database Server

- Use a simple protocol (not the real DNS protocol)
  - Handle three types of requests: SET, GET and INFO
- Use internet socket to connect with clients
  - Byte-streams, send/receive message byte-by-byte
- Support multithreading
  - Main thread will `listen` for any new connections
  - When the main thread `accept` a new connection, create a new worker thread to handle requests sent from the client

Requests

- Each request contains 1-3 component(s)
  - Format: **method [domain] [ipv4]**
  - Components are split with whitespace character
  - The first component – **method** is case-sensitive
- SET – `SET domain ipv4`
  - Associate the domain name with an IPv4 address
    - Example: `SET www.csie.ncku.edu.tw 140.116.264.4`
  - If the domain name (i.e., key) has already existed in the database, the server replaces the old IPv4 address with the new one.
- GET – `GET domain`
  - Get the `ipv4` address of the `domain`
    - Example: `GET mail.google.com`
- INFO – `INFO`
  - Show how many domain names are stored in the database

Responses

- Each response contains 2 or 3 components
  - Format: **status_code status_name [result]**
  - Components are split with whitespace character
  - The first and second components are borrowed from http status code
- 200 – `200 "OK" result`
  - Response for successful requests
- 400 – `400 "Bad Request"`
  - Invalid request (e.g., invalid ipv4 address)
- 404 – `404 "Not Found"`
  - The domain is not found
- 405 – `405 "Method Not Allowed"`
  - Method is not supported by the server

Example (1)

Client **Server**

```
SET google.com 192.168.0.1
```

```
200 "OK"
```

```
SET google.com abc
```

```
400 "Bad Request"
```

```
SET google.com
```

```
400 "Bad Request"
```

```
set google.com 192.168.1.1
```

```
405 "Method Not Allowed"
```

```
SET abc 234.123.12.234
```

```
400 "Bad Request"
```

Example (2)

Client **Server**

```
GET google.com
```

```
200 "OK" 192.168.0.1
```

```
GET google.com 192.168.0.1
```

```
400 "Bad Request"
```

```
GET ncku.com
```

```
404 "Not Found"
```

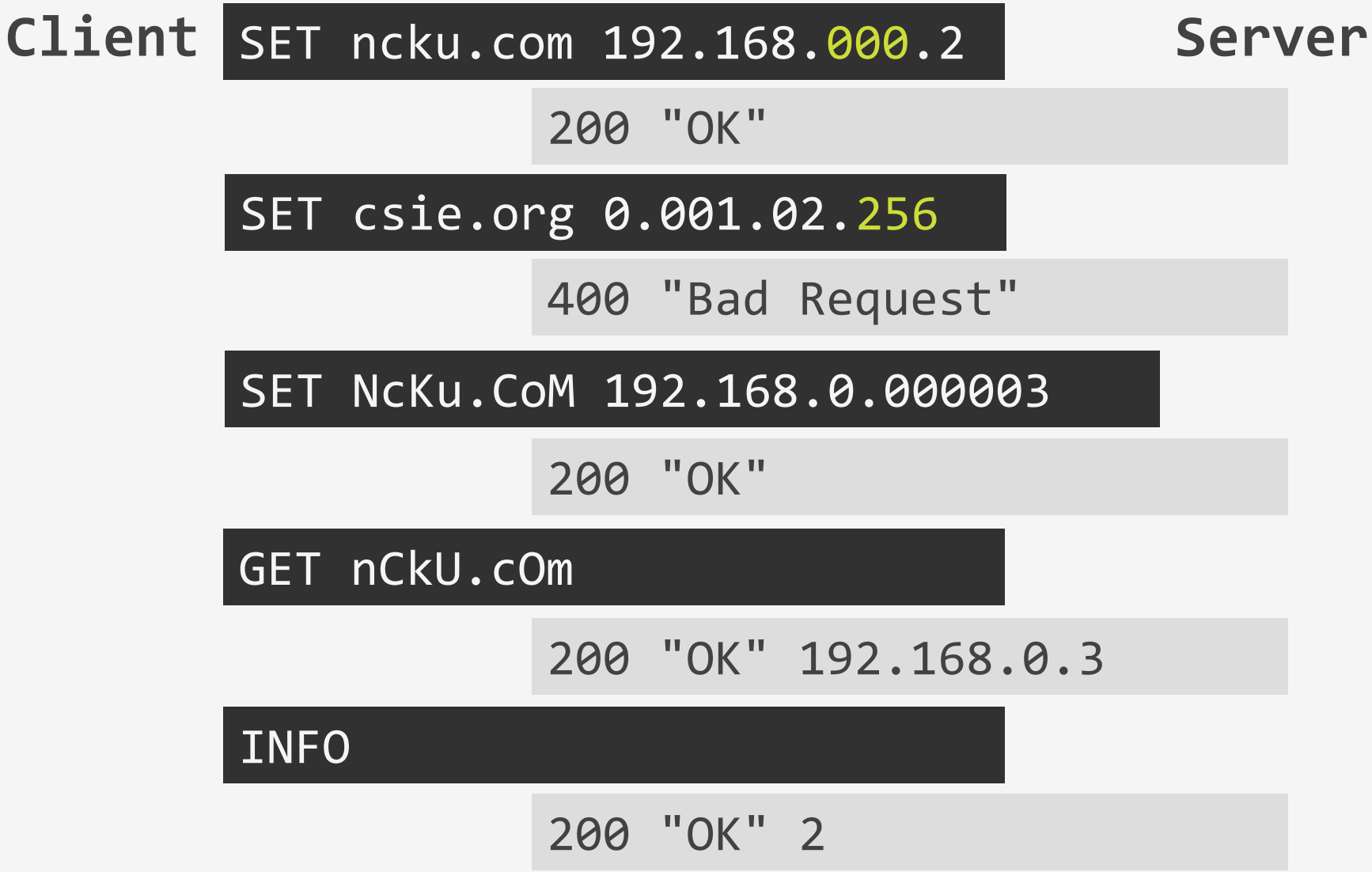
```
INFO
```

```
200 "OK" 1
```

```
INF0
```

```
405 "Method Not Allowed"
```

Example (3)


Client
Server
SET ncku.com 192.168.000.2
200 "OK"
SET csie.org 0.001.02.256
400 "Bad Request"
SET NcKu.CoM 192.168.0.000003
200 "OK"
GET nCkU.cOm
200 "OK" 192.168.0.3
INFO
200 "OK" 2

Reference

- Manual Page
  - pthreads
  - pthread_mutex_init, pthread_mutex_lock
  - pthread_spin_init, pthread_spin_lock
  - clone
  - sem_overview
  - socket, getaddrinfo
- Beej's Guide to Network Programming