Introduction to SMTP

RES, Lecture 3

Olivier Liechti
Juergen Ehrensberger

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Warning 1

The slides and the webcasts contain examples and demos with **real SMTP servers**.

The behaviour of these servers may change over time. It may also change depending on the network you are connected to (internal, ISP, other ISP).

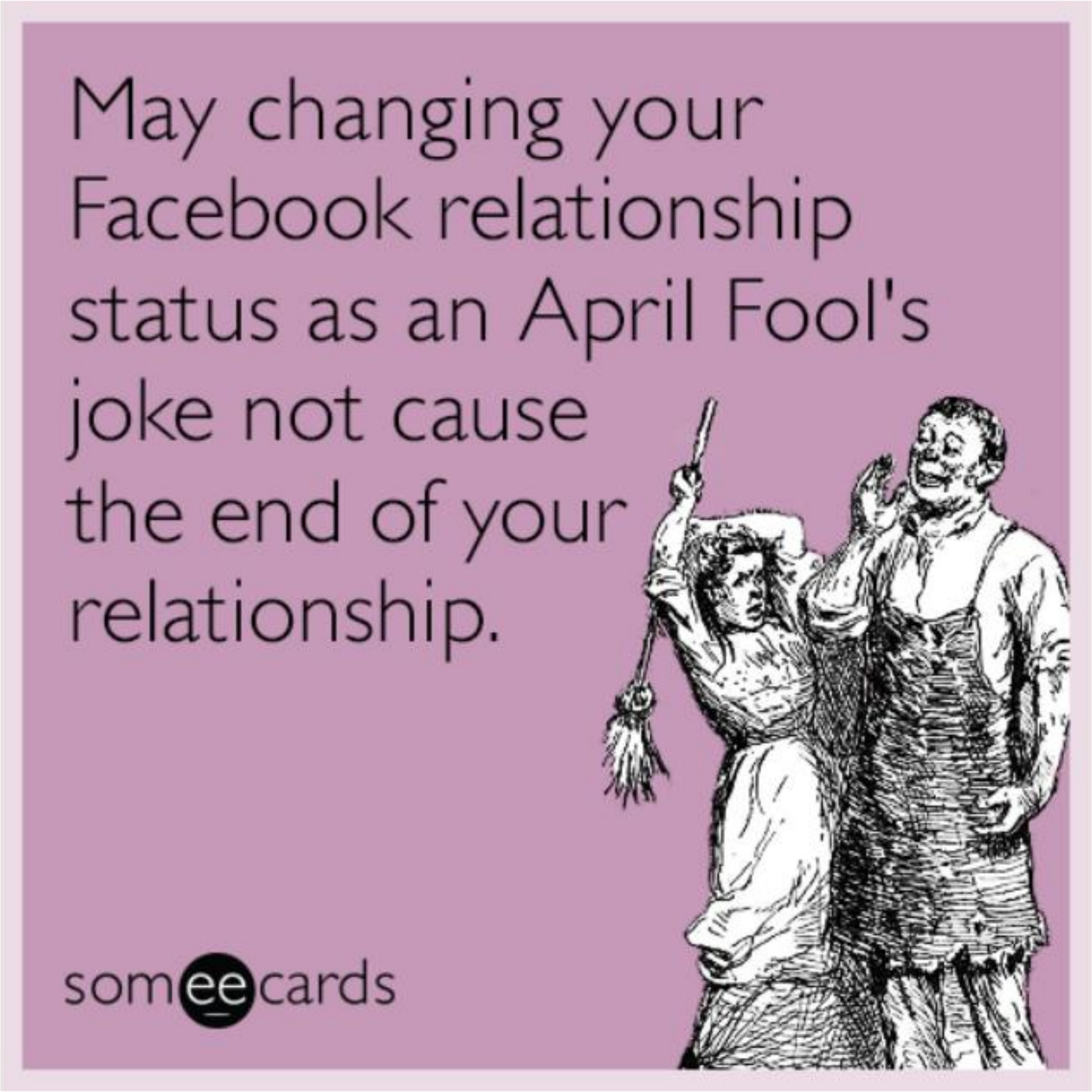
The main reason why a server might behave differently is the fight between mail administrators and **spammers**.

Warning 2

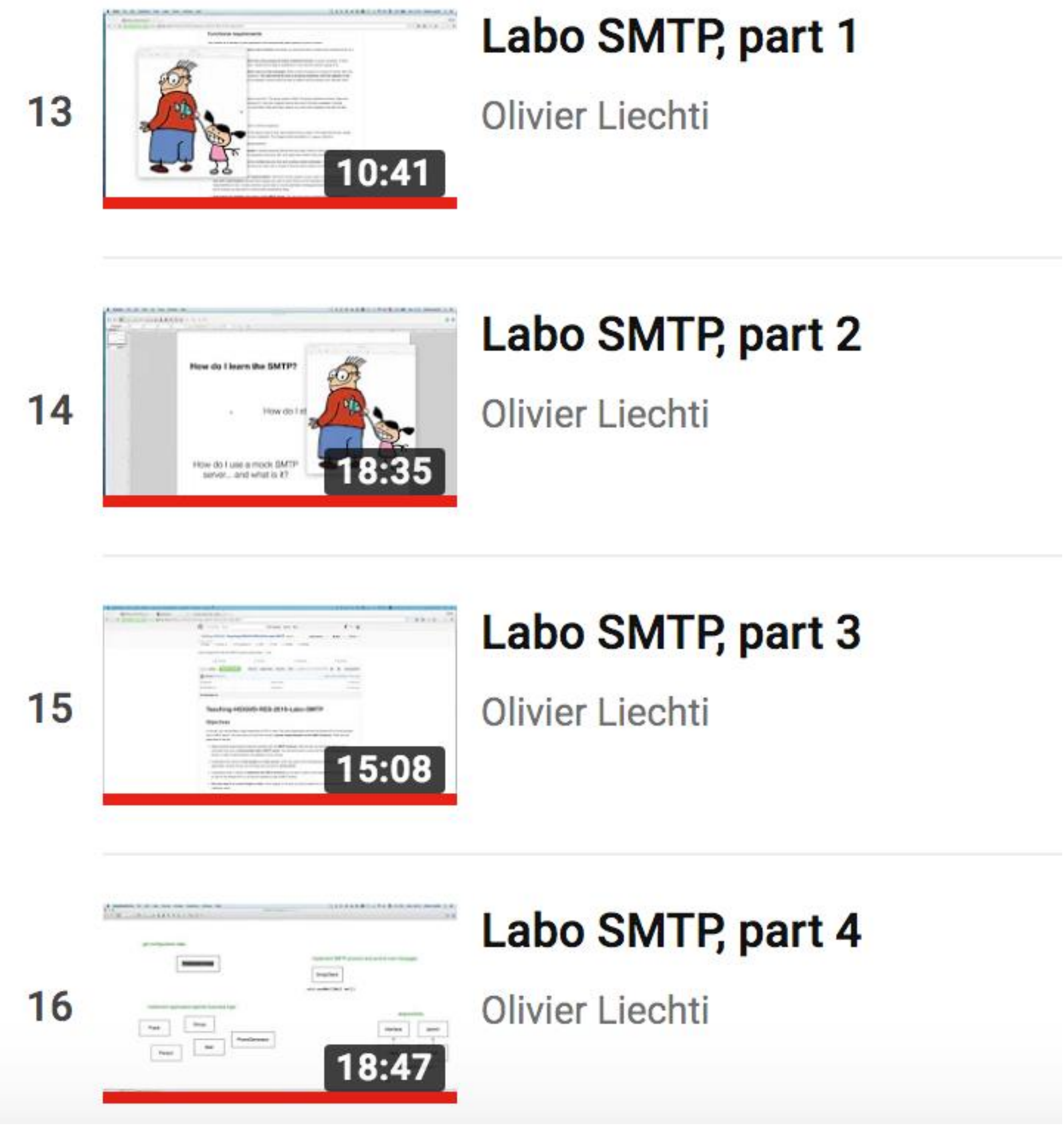
It is a good thing to experiment with real SMTP servers.

But remember that they are real servers and act responsibly.

Please avoid launching a **surprise denial of service attack** with your accidental infinite loop.



May changing your Facebook relationship status as an April Fool's joke not cause the end of your relationship.



13 Labo SMTP, part 1
Olivier Liechti
10:41

14 Labo SMTP, part 2
Olivier Liechti
18:35

15 Labo SMTP, part 3
Olivier Liechti
15:08

16 Labo SMTP, part 4
Olivier Liechti
18:47

- SMTP demo & hints
- SMTP protocol
- Mock server
- Implementation walk-through

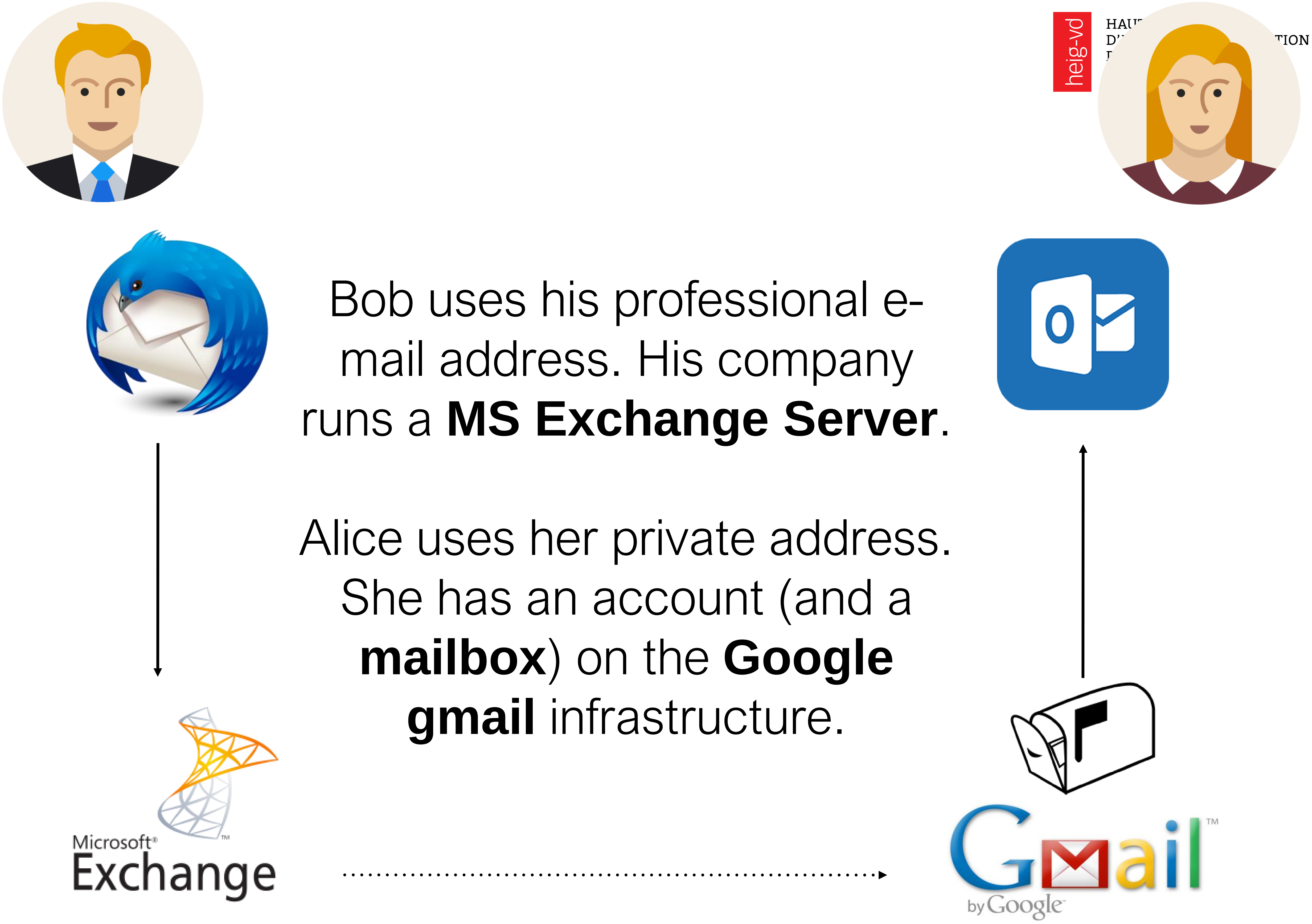
Démo (**5 minutes MAX**)	
Le labo est terminé et la démo est faite dans les délais.	
Le groupe arrive à démarrer un serveur mock dans un container Docker et à expliquer à quoi il sert. Le groupe a aussi configuré le service mailtrap.io	
Le groupe montre comment configurer la campagne de "pranks" et lance son programme dans un environnement de test (mock mock, mailtrap ou autre). Le groupe explique les résultats. La démo ne marche pas: 0 pt!	
Le groupe montre son repo GitHub. En regardant les commits, on voit que tout le monde a participé et qu'il n'y a pas seulement un gros commit à la fin.	
Une documentation de qualité et conforme aux exigences est fournie dans le repo GitHub.	

What happens when Bob wants to **send an e-mail** to Alice?

Bob uses **Thunderbird** to write his mail.

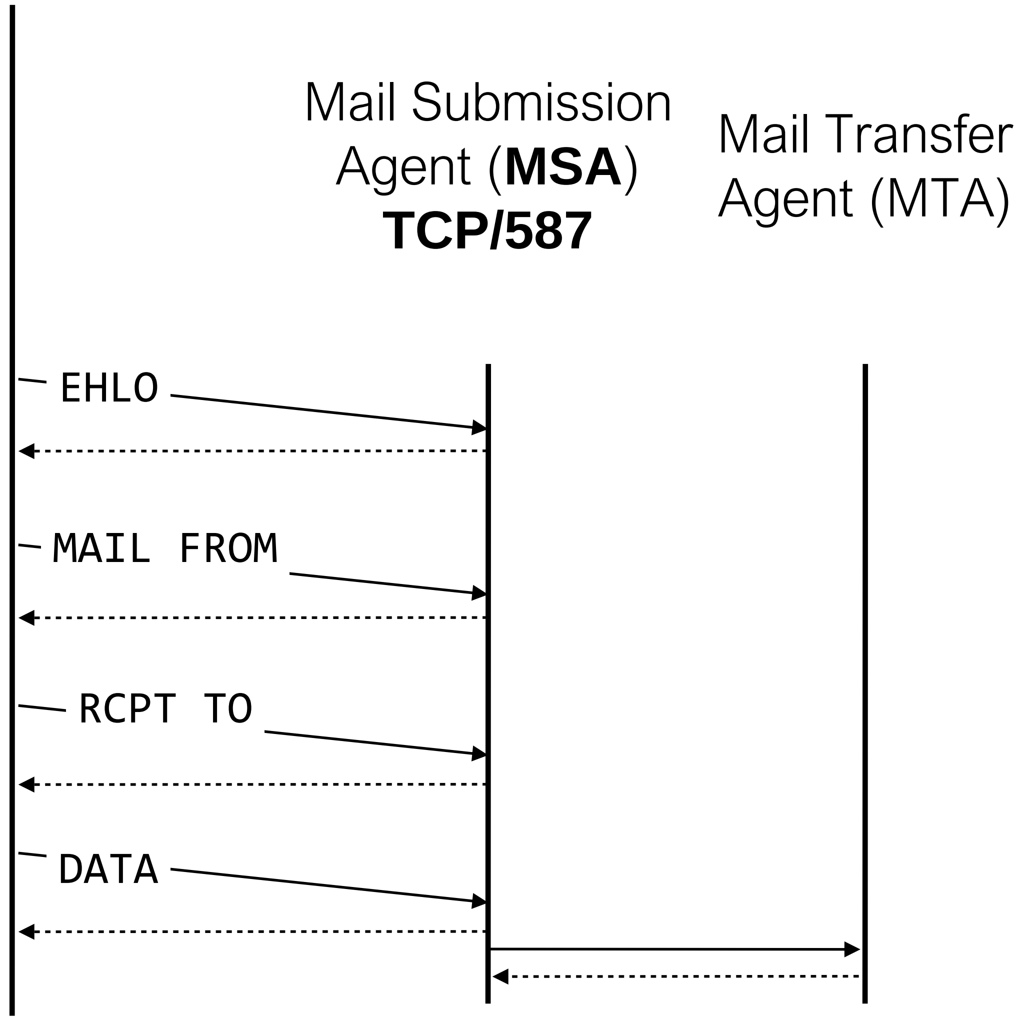
Alice uses **MS Outlook** to check and read her mails.

In the technical specs (RFCs), these programs are called **Mail User Agents (MUA)**



Bob uses his professional e-mail address. His company runs a **MS Exchange Server**.

Alice uses her private address. She has an account (and a **mailbox**) on the **Google gmail** infrastructure.

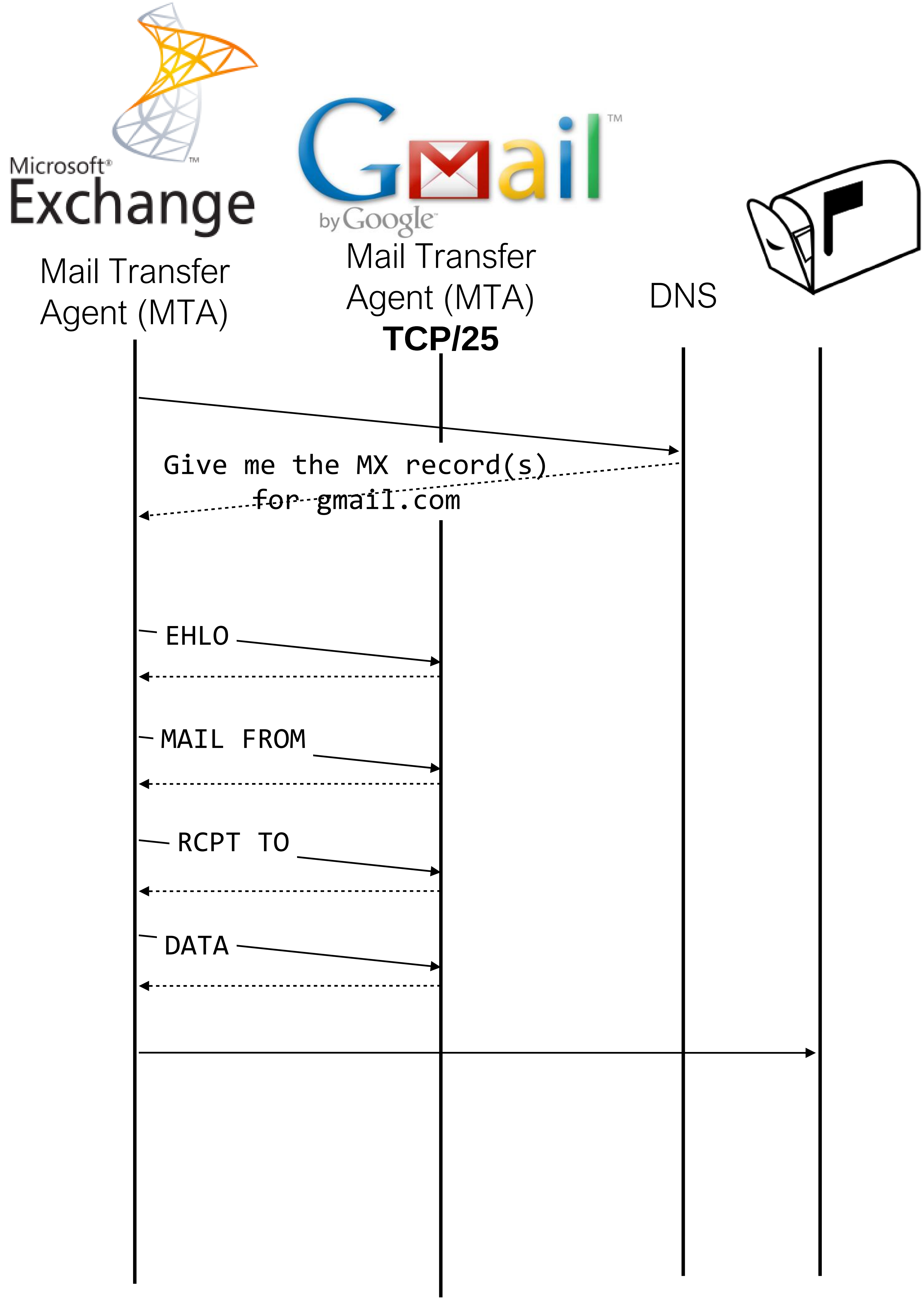

Mail Submission Agent (**MSA**) **TCP/587**
Mail Transfer Agent (MTA)
EHLO
MAIL FROM
RCPT TO
DATA

Bob writes a message to "**alice.res@gmail.com**". He pushes on the "Send" button.

The Exchange Server is made of **2 logical components:** the **MSA** and the **MTA**.

Bob's MUA asks Bob's MSA to deliver the mail. It uses the **SMTP** protocol for that purpose and (should) use TCP port 587.

After enforcing **usage policies**, the MSA delegates the work to the MTA. We don't know how.


Microsoft Exchange
Mail Transfer Agent (MTA)
Gmail by Google
Mail Transfer Agent (MTA)
TCP/25
DNS
Give me the MX record(s) for gmail.com
EHLO
MAIL FROM
RCPT TO
DATA

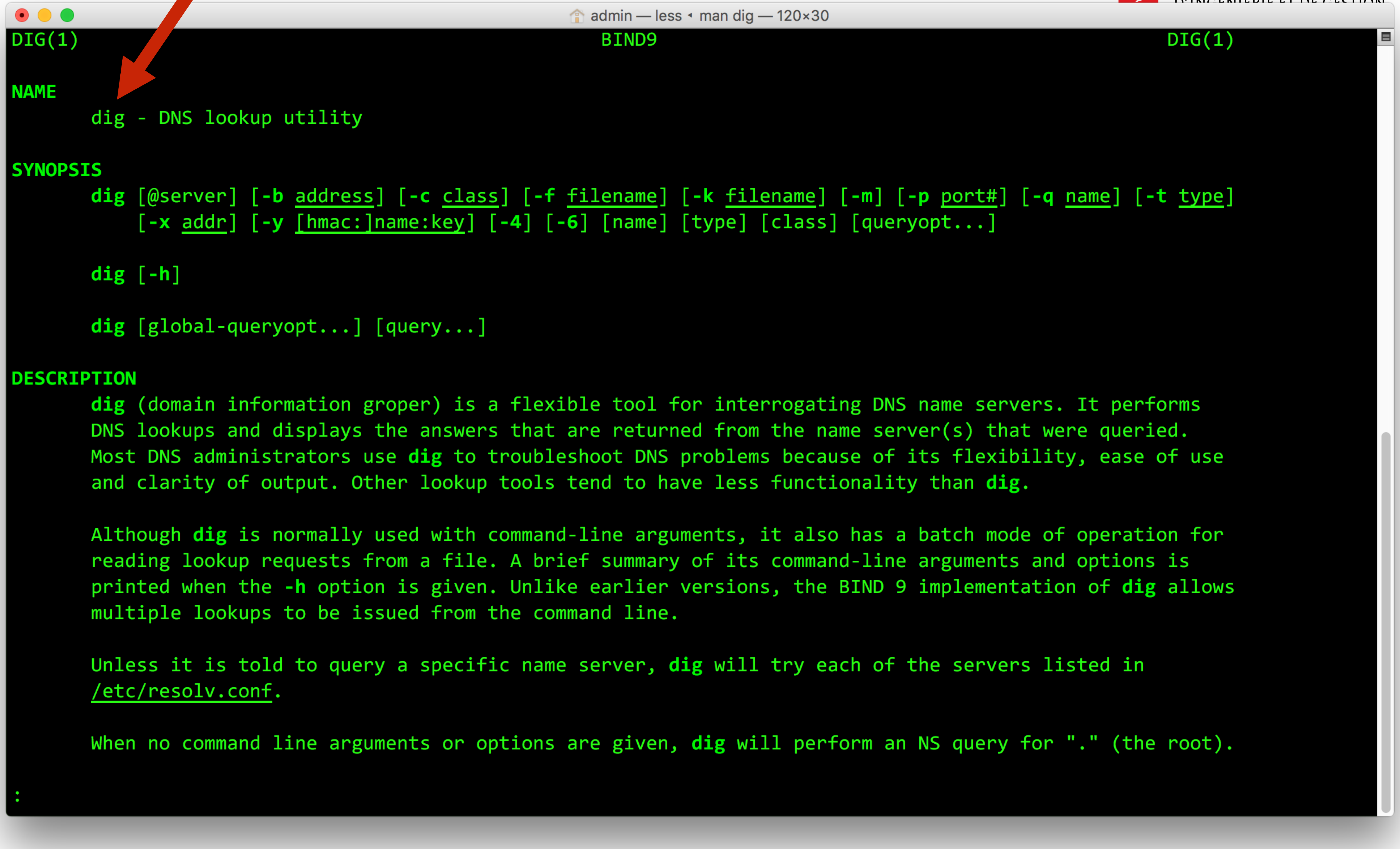
Bob's MTA initially does not know where to forward the mail...

It issues a **DNS** query to get a list of **MX records** for Alice's domain (gmail.com).

When Bob's MTA knows the IP address of Alice's MTA, it uses the **SMTP** protocol once more to forward the message. TCP **port 25** is used in this case.

When Alice's MTA receives the mail, it stores it in Alice's **mailbox** (for later retrieval).

dig



```
DIG(1)                                          BIND9                                          DIG(1)

NAME
       dig - DNS lookup utility

SYNOPSIS
       dig [@server] [-b address] [-c class] [-f filename] [-k filename] [-m] [-p port#] [-q name] [-t type]
           [-x addr] [-y [hmac:]name:key] [-4] [-6] [name] [type] [class] [queryopt...]

       dig [-h]

       dig [global-queryopt...] [query...]

DESCRIPTION
       dig (domain information groper) is a flexible tool for interrogating DNS name servers. It performs
       DNS lookups and displays the answers that are returned from the name server(s) that were queried.
       Most DNS administrators use dig to troubleshoot DNS problems because of its flexibility, ease of use
       and clarity of output. Other lookup tools tend to have less functionality than dig.

       Although dig is normally used with command-line arguments, it also has a batch mode of operation for
       reading lookup requests from a file. A brief summary of its command-line arguments and options is
       printed when the -h option is given. Unlike earlier versions, the BIND 9 implementation of dig allows
       multiple lookups to be issued from the command line.

       Unless it is told to query a specific name server, dig will try each of the servers listed in
       /etc/resolv.conf.

       When no command line arguments or options are given, dig will perform an NS query for "." (the root).

:
```

`nslookup` is another command for querying DNS

Demo dig and telnet

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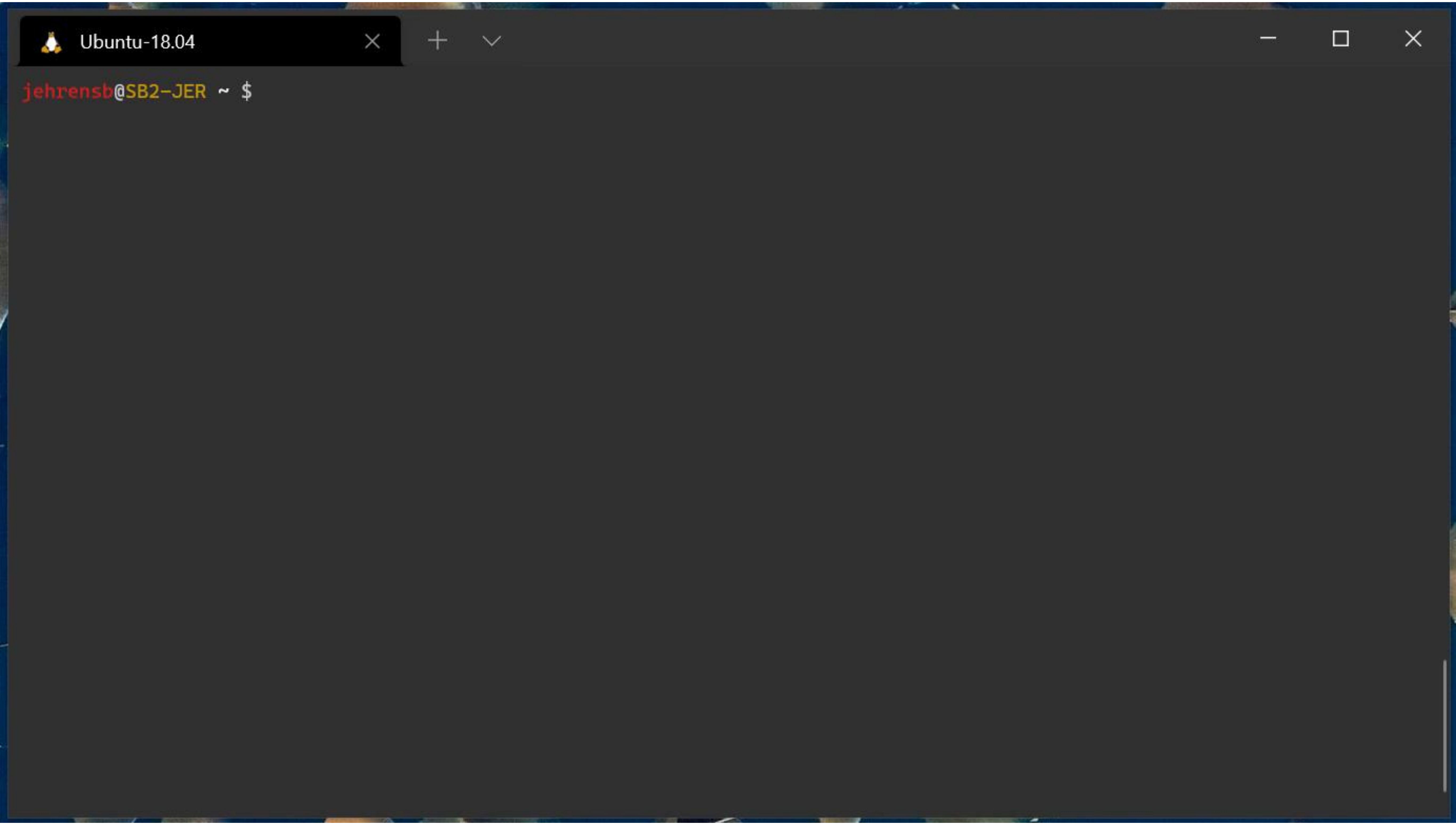
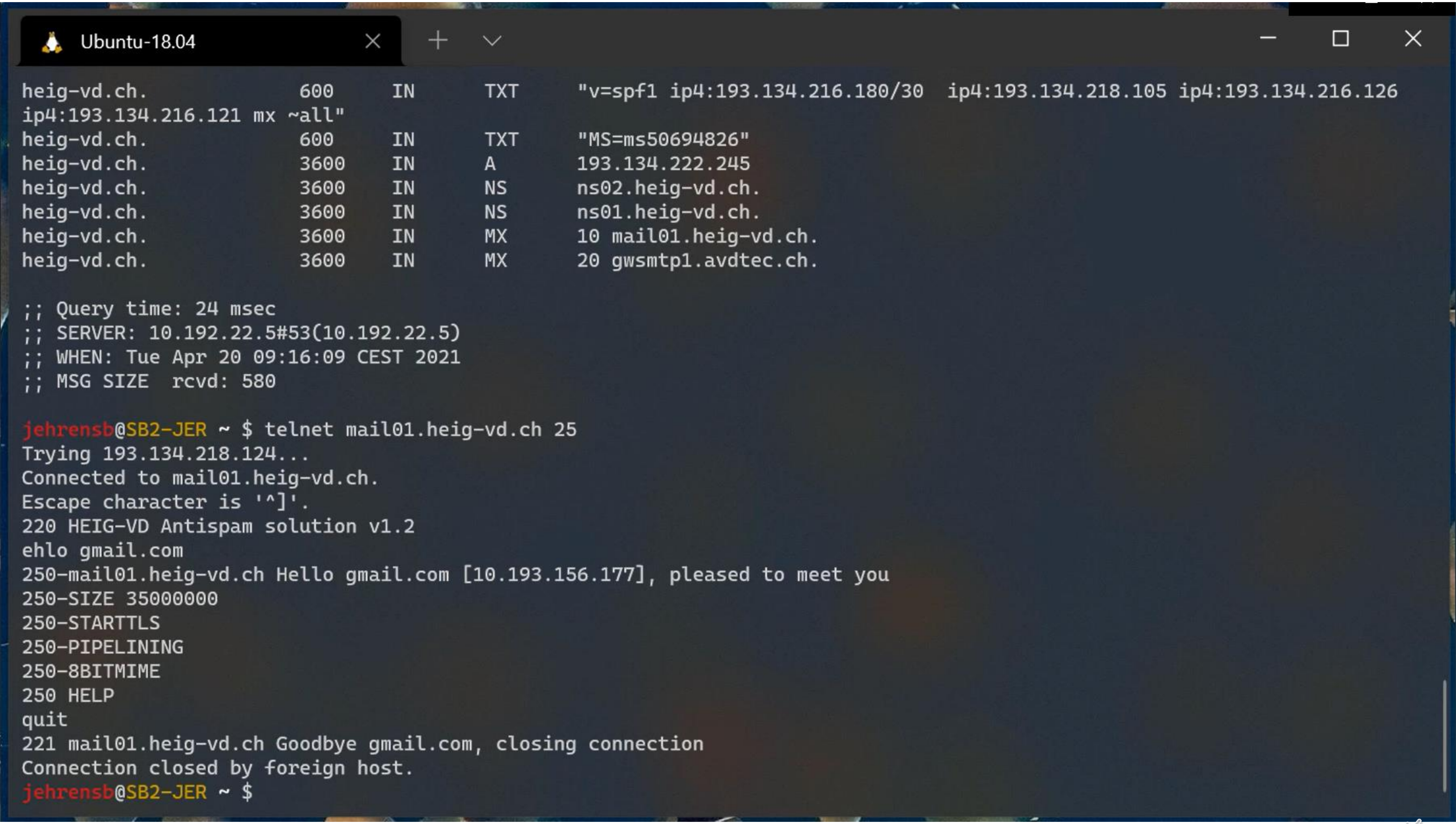


```
jehrensb@SB2-JER ~ $
```

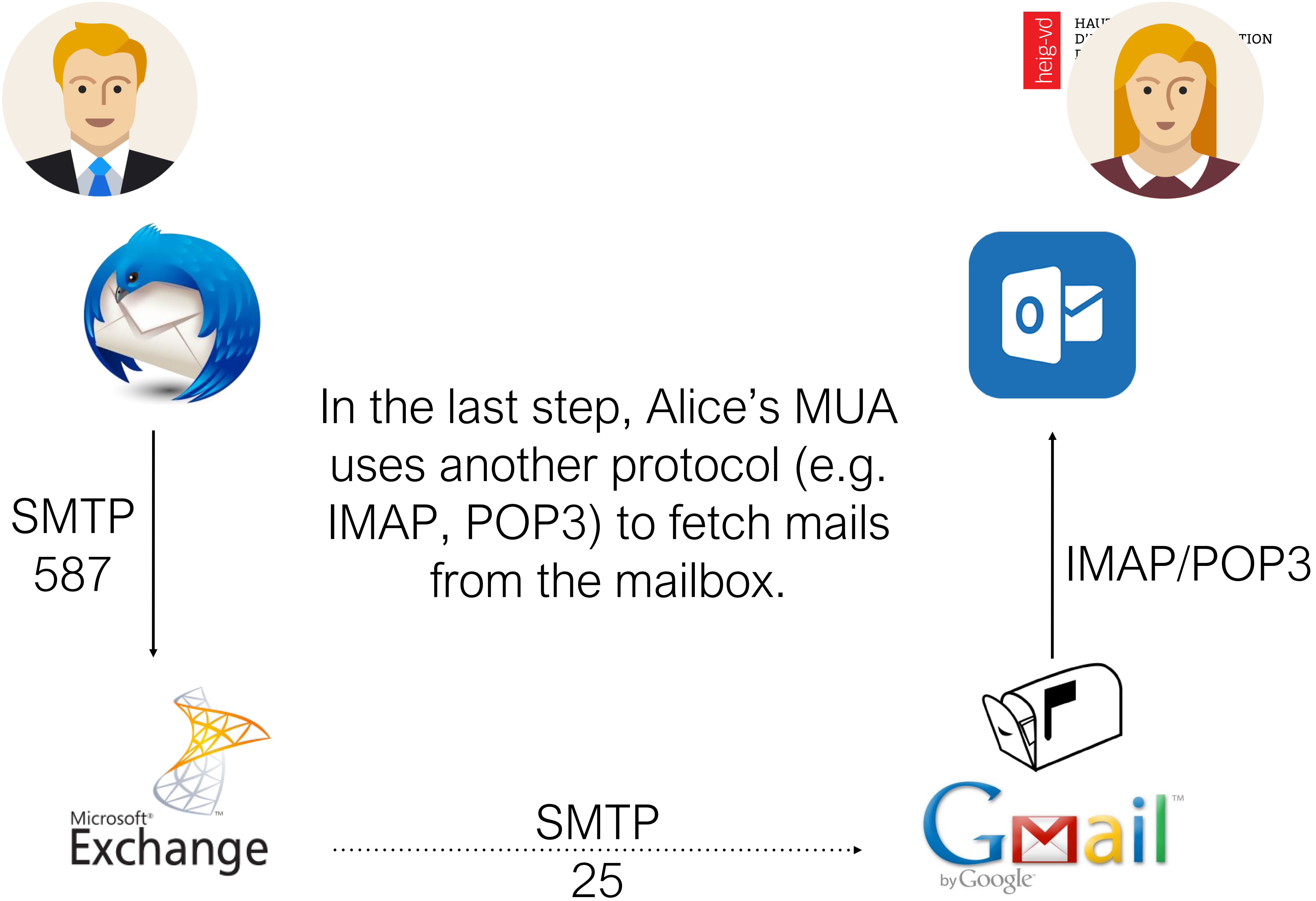
Demo dig and telnet



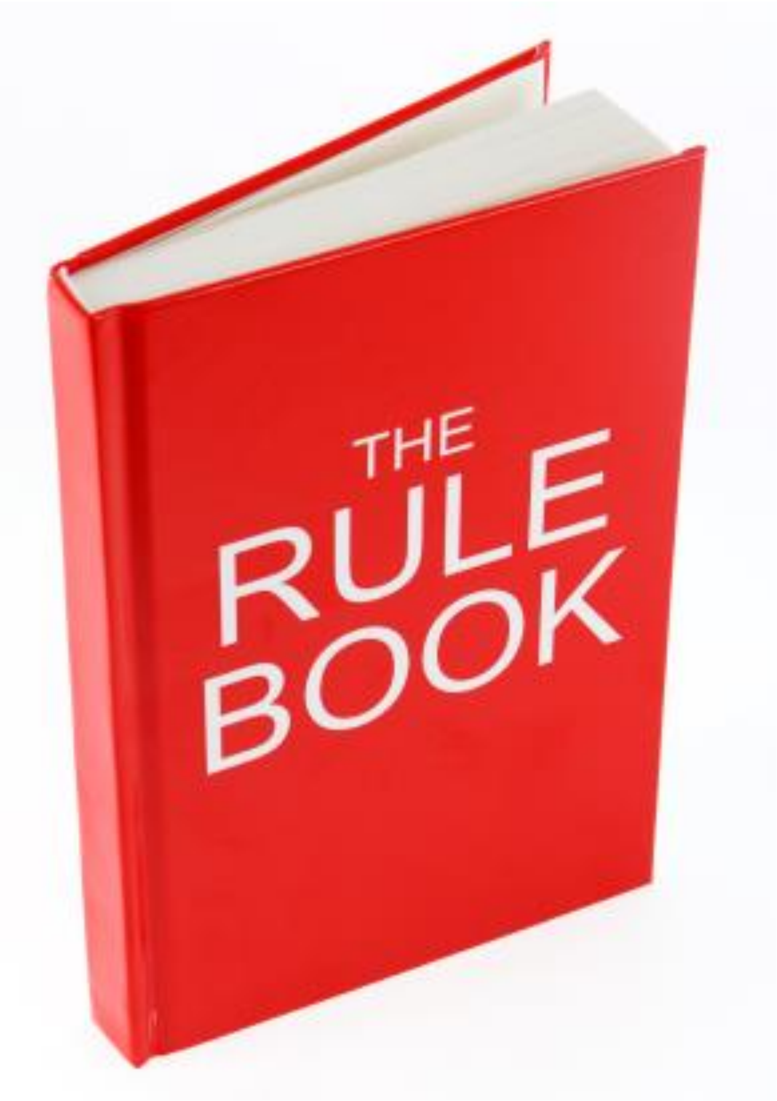
```
heig-vd.ch.             600     IN      TXT     "v=spf1 ip4:193.134.216.180/30  ip4:193.134.218.105 ip4:193.134.216.126
ip4:193.134.216.121 mx ~all"
heig-vd.ch.             600     IN      TXT     "MS=ms50694826"
heig-vd.ch.             3600    IN      A       193.134.222.245
heig-vd.ch.             3600    IN      NS      ns02.heig-vd.ch.
heig-vd.ch.             3600    IN      NS      ns01.heig-vd.ch.
heig-vd.ch.             3600    IN      MX      10 mail01.heig-vd.ch.
heig-vd.ch.             3600    IN      MX      20 gwsmtp1.avdtec.ch.

;; Query time: 24 msec
;; SERVER: 10.192.22.5#53(10.192.22.5)
;; WHEN: Tue Apr 20 09:16:09 CEST 2021
;; MSG SIZE  rcvd: 580

jehrensb@SB2-JER ~ $ telnet mail01.heig-vd.ch 25
Trying 193.134.218.124...
Connected to mail01.heig-vd.ch.
Escape character is '^]'.
220 HEIG-VD Antispam solution v1.2
ehlo gmail.com
250-mail01.heig-vd.ch Hello gmail.com [10.193.156.177], pleased to meet you
250-SIZE 35000000
250-STARTTLS
250-PIPELINING
250-8BITMIME
250 HELP
quit
221 mail01.heig-vd.ch Goodbye gmail.com, closing connection
Connection closed by foreign host.
jehrensb@SB2-JER ~ $
```

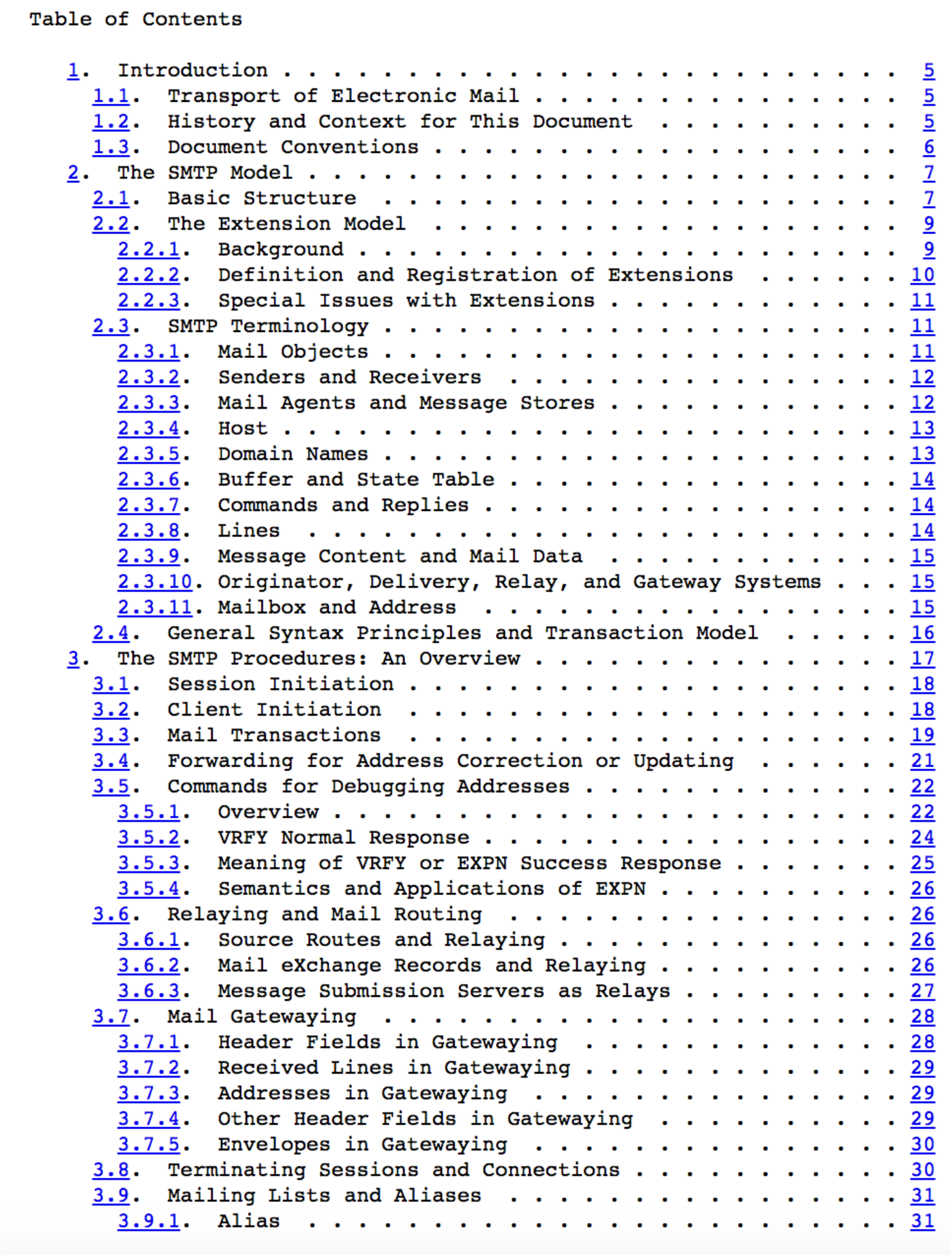


In the last step, Alice's MUA uses another protocol (e.g. IMAP, POP3) to fetch mails from the mailbox.



The Specs

https://tools.ietf.org/html/rfc5321



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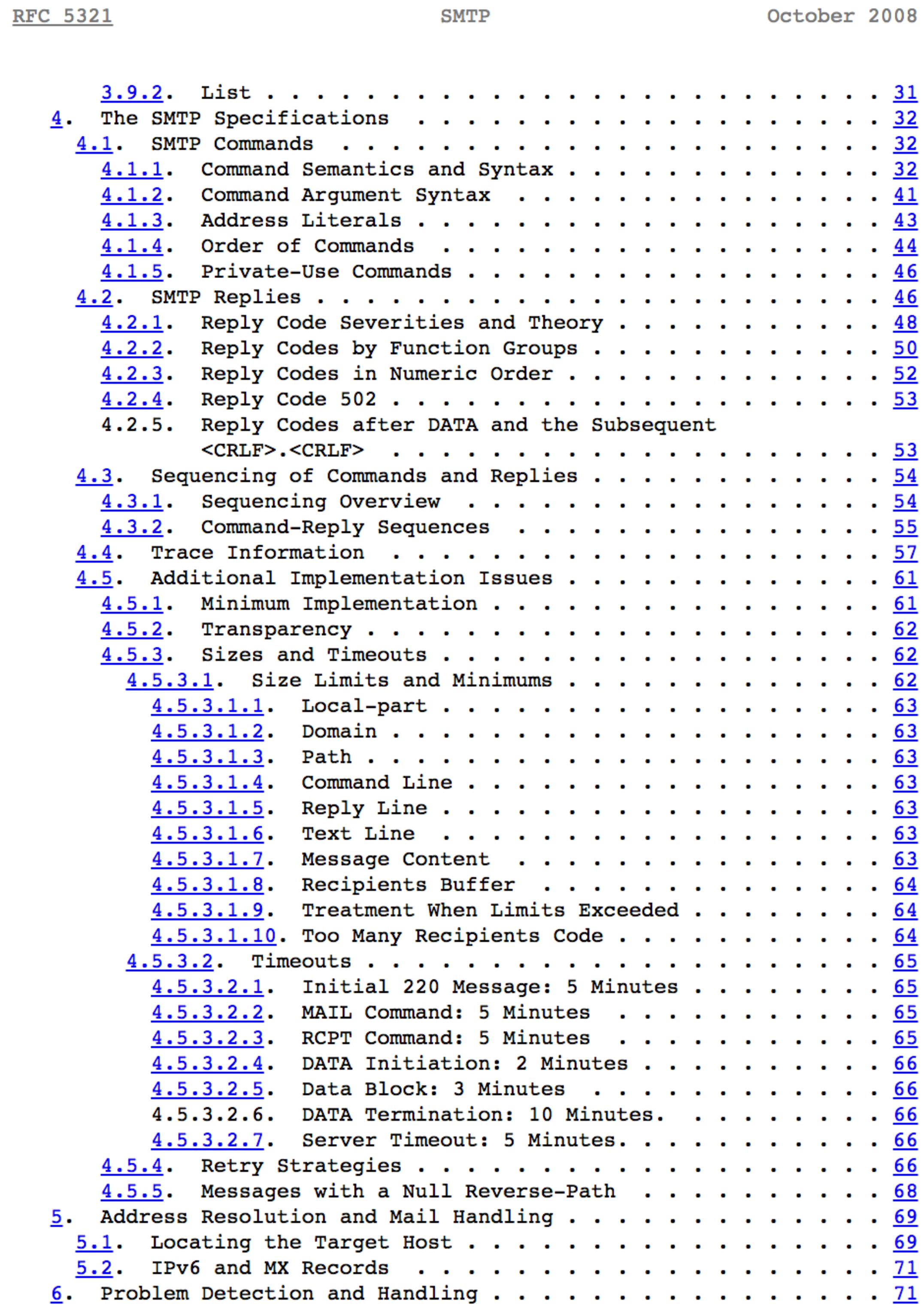
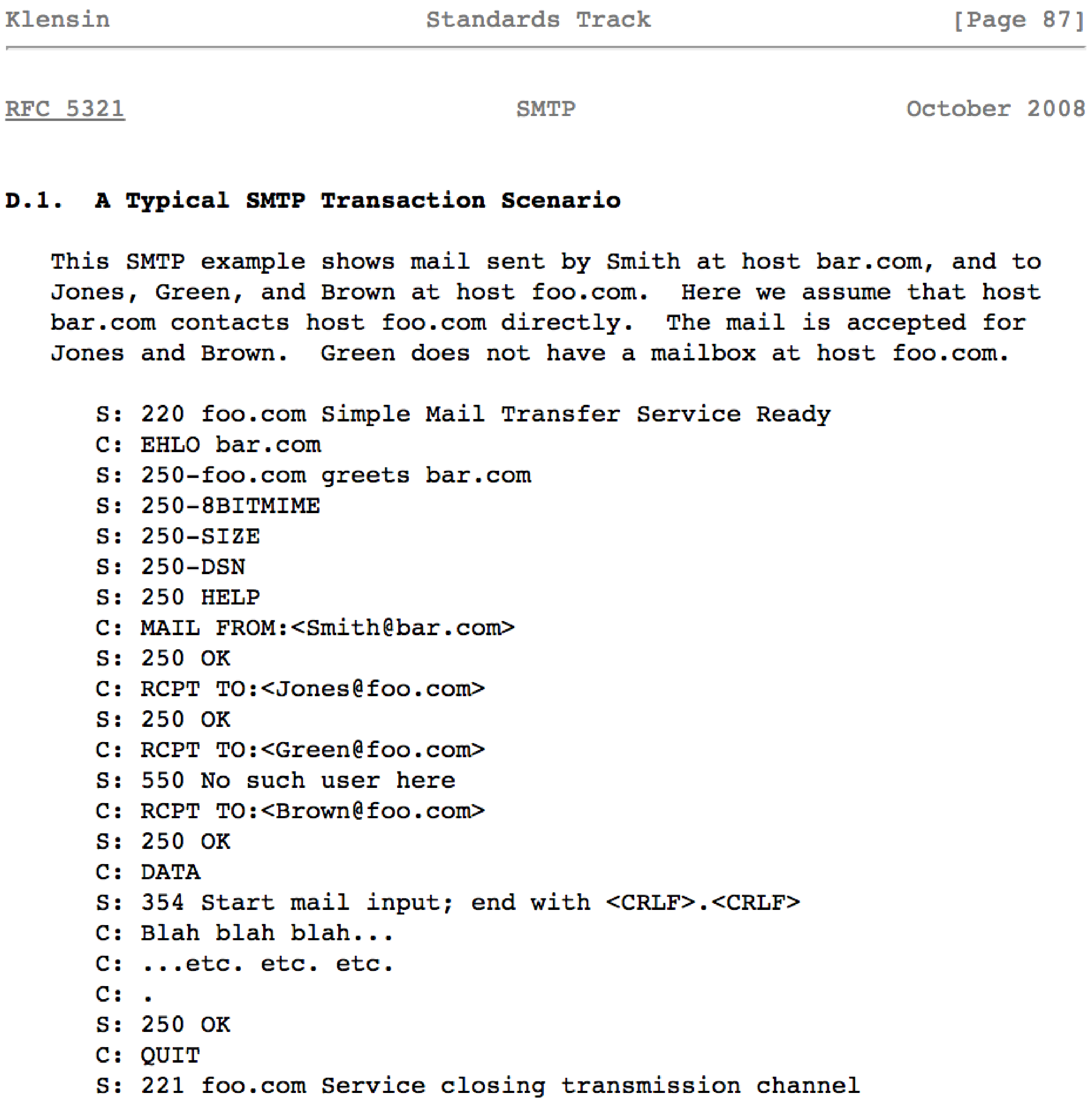


RFC 5321 SMTP October 2008

https://tools.ietf.org/html/rfc5321

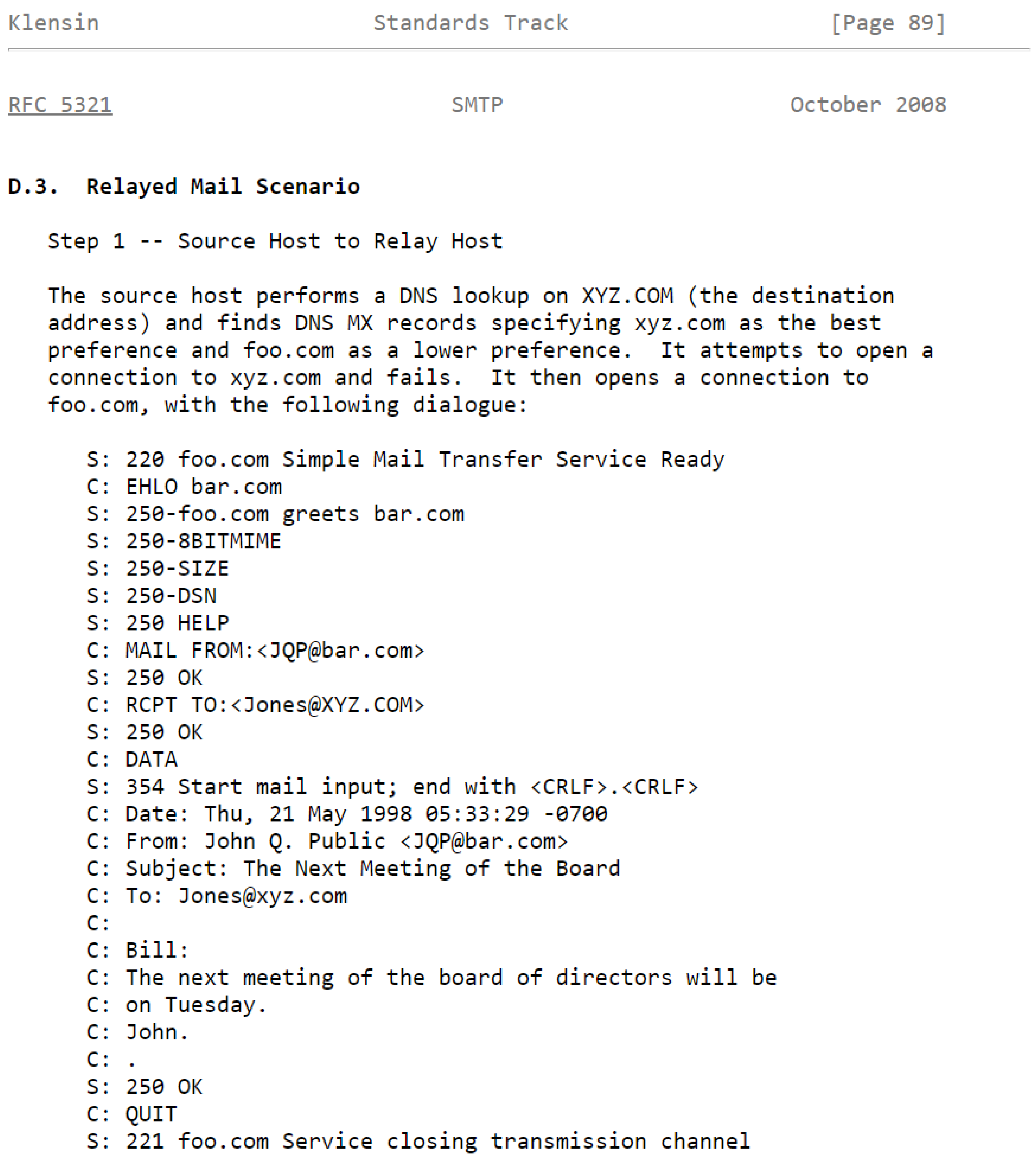


D.1. A Typical SMTP Transaction Scenario

This SMTP example shows mail sent by Smith at host bar.com, and to Jones, Green, and Brown at host foo.com. Here we assume that host bar.com contacts host foo.com directly. The mail is accepted for Jones and Brown. Green does not have a mailbox at host foo.com.

```
S: 220 foo.com Simple Mail Transfer Service Ready
C: EHLO bar.com
S: 250-foo.com greets bar.com
S: 250-8BITMIME
S: 250-SIZE
S: 250-DSN
S: 250 HELP
C: MAIL FROM:<Smith@bar.com>
S: 250 OK
C: RCPT TO:<Jones@foo.com>
S: 250 OK
C: RCPT TO:<Green@foo.com>
S: 550 No such user here
C: RCPT TO:<Brown@foo.com>
S: 250 OK
C: DATA
S: 354 Start mail input; end with <CRLF>.<CRLF>
C: Blah blah blah...
C: ...etc. etc. etc.
C: .
S: 250 OK
C: QUIT
S: 221 foo.com Service closing transmission channel
```

https://tools.ietf.org/html/rfc5321



```
Klensin                  Standards Track                  [Page 89]

RFC 5321                       SMTP                    October 2008
```

D.3. Relayed Mail Scenario

Step 1 -- Source Host to Relay Host

The source host performs a DNS lookup on XYZ.COM (the destination address) and finds DNS MX records specifying xyz.com as the best preference and foo.com as a lower preference. It attempts to open a connection to xyz.com and fails. It then opens a connection to foo.com, with the following dialogue:

```
S: 220 foo.com Simple Mail Transfer Service Ready
C: EHLO bar.com
S: 250-foo.com greets bar.com
S: 250-8BITMIME
S: 250-SIZE
S: 250-DSN
S: 250 HELP
C: MAIL FROM:<JQP@bar.com>
S: 250 OK
C: RCPT TO:<Jones@XYZ.COM>
S: 250 OK
C: DATA
S: 354 Start mail input; end with <CRLF>.<CRLF>
C: Date: Thu, 21 May 1998 05:33:29 -0700
C: From: John Q. Public <JQP@bar.com>
C: Subject: The Next Meeting of the Board
C: To: Jones@xyz.com
C:
C: Bill:
C: The next meeting of the board of directors will be
C: on Tuesday.
C: John.
C: .
S: 250 OK
C: QUIT
S: 221 foo.com Service closing transmission channel
```

Demo send email

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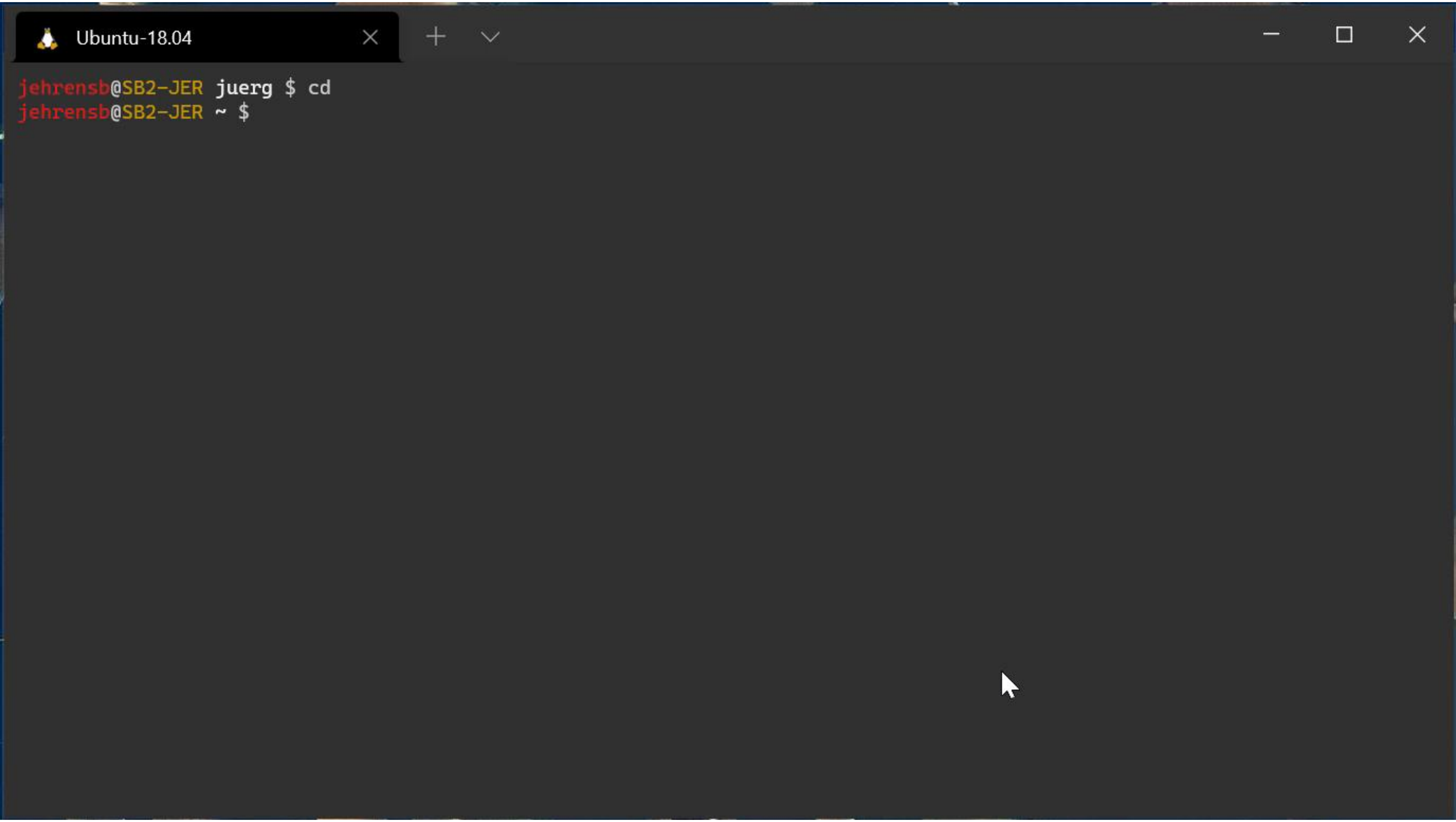
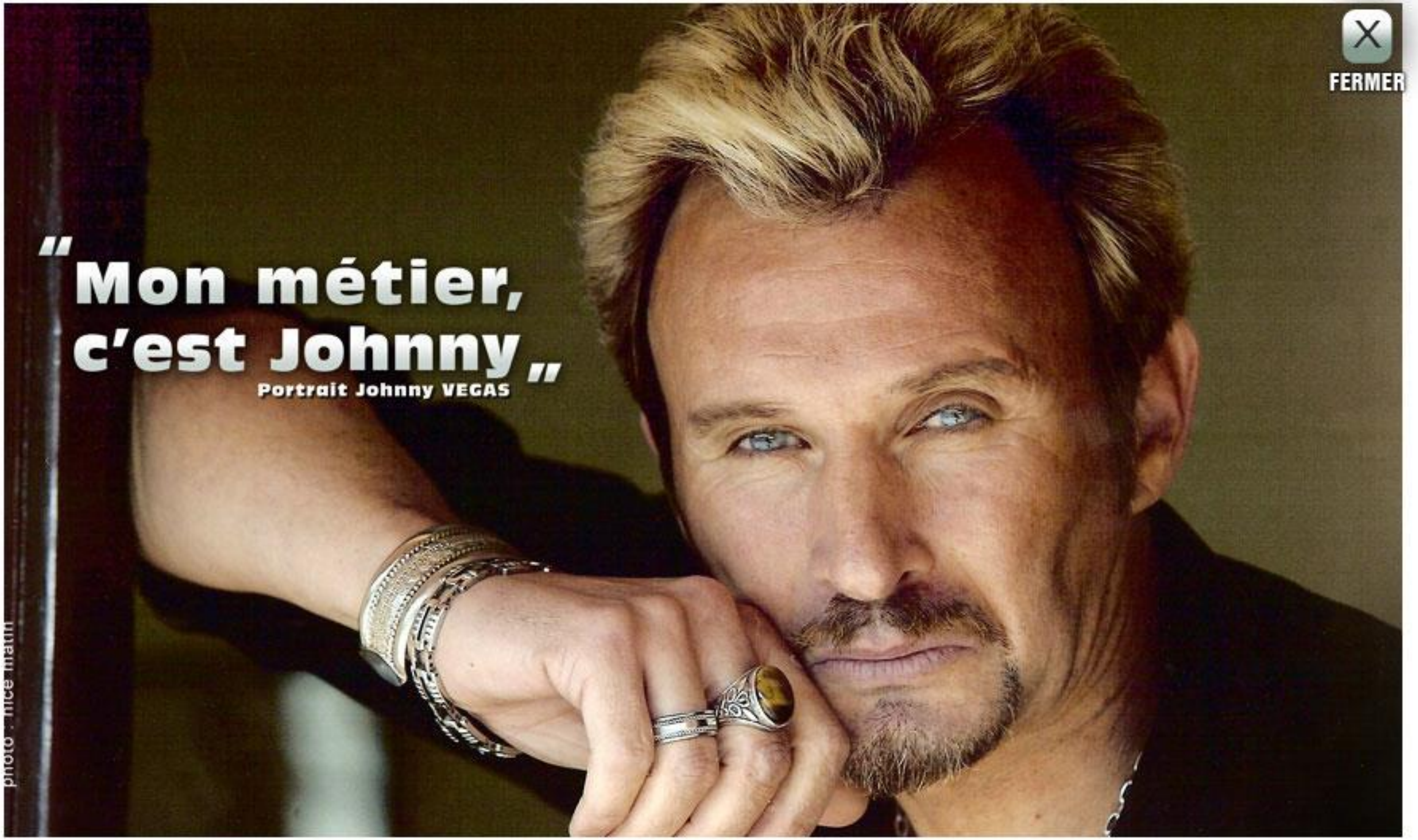


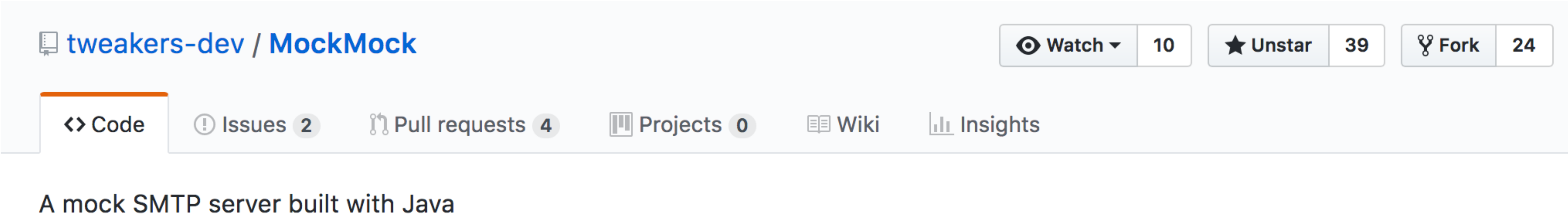
```
jehrensb@SB2-JER juerg $ cd
jehrensb@SB2-JER ~ $
```

SMTP Servers for experiments

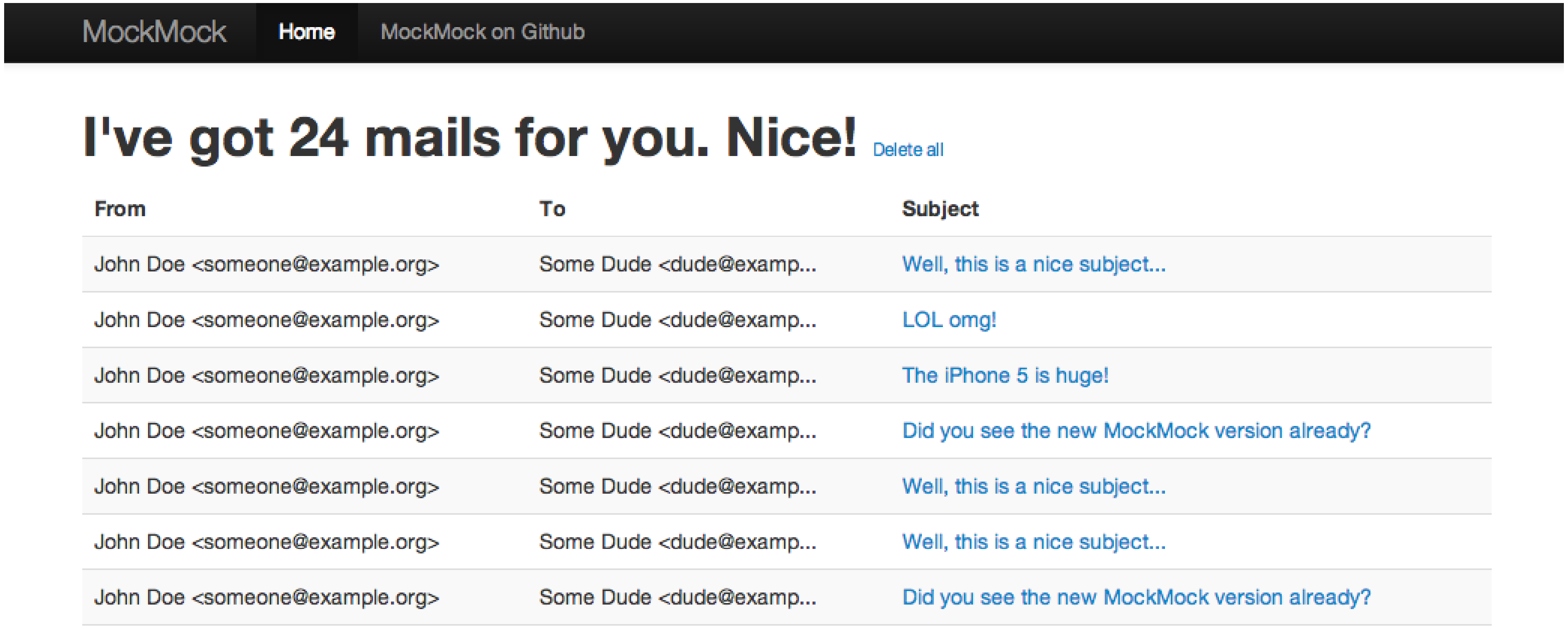


Mock Servers

https://github.com/tweakers/MockMock



A mock SMTP server built with Java



I've got 24 mails for you. Nice!

From	To	Subject
John Doe <someone@example.org>	Some Dude <dude@examp...	Well, this is a nice subject...
John Doe <someone@example.org>	Some Dude <dude@examp...	LOL omg!
John Doe <someone@example.org>	Some Dude <dude@examp...	The iPhone 5 is huge!
John Doe <someone@example.org>	Some Dude <dude@examp...	Did you see the new MockMock version already?
John Doe <someone@example.org>	Some Dude <dude@examp...	Well, this is a nice subject...
John Doe <someone@example.org>	Some Dude <dude@examp...	Well, this is a nice subject...
John Doe <someone@example.org>	Some Dude <dude@examp...	Did you see the new MockMock version already?

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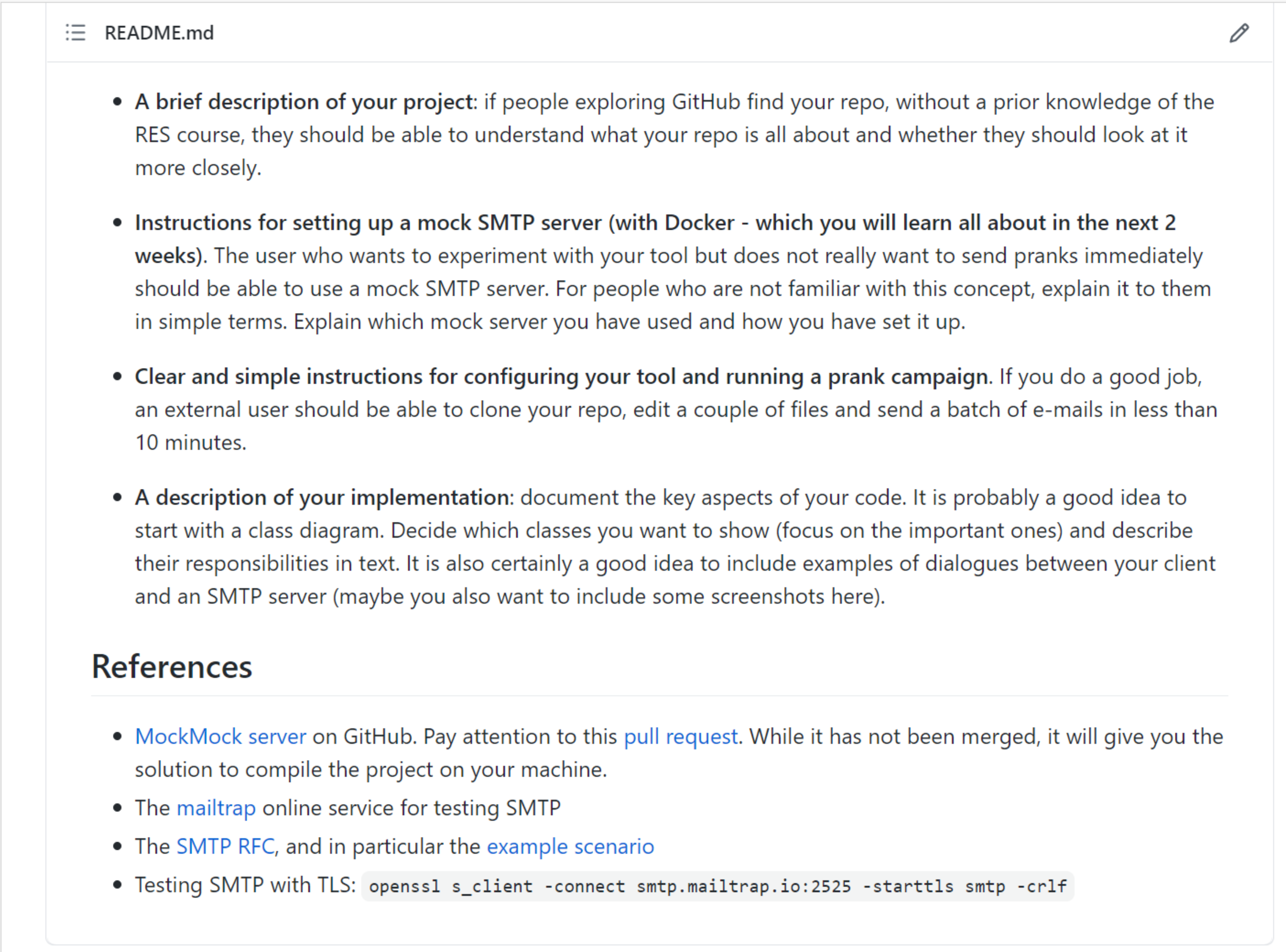
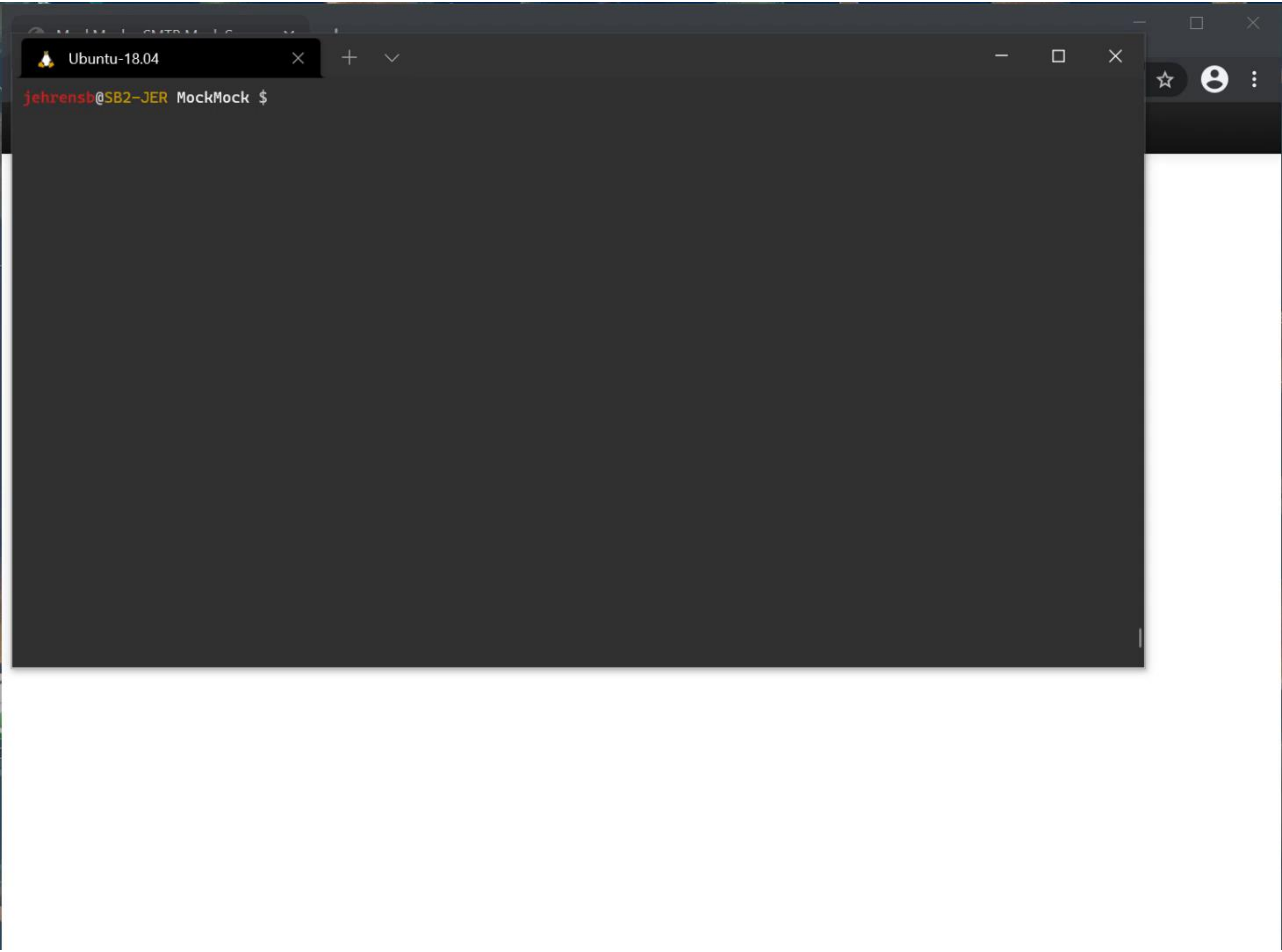


README.md

- **A brief description of your project**: if people exploring GitHub find your repo, without a prior knowledge of the RES course, they should be able to understand what your repo is all about and whether they should look at it more closely.
- **Instructions for setting up a mock SMTP server (with Docker - which you will learn all about in the next 2 weeks)**. The user who wants to experiment with your tool but does not really want to send pranks immediately should be able to use a mock SMTP server. For people who are not familiar with this concept, explain it to them in simple terms. Explain which mock server you have used and how you have set it up.
- **Clear and simple instructions for configuring your tool and running a prank campaign**. If you do a good job, an external user should be able to clone your repo, edit a couple of files and send a batch of e-mails in less than 10 minutes.
- **A description of your implementation**: document the key aspects of your code. It is probably a good idea to start with a class diagram. Decide which classes you want to show (focus on the important ones) and describe their responsibilities in text. It is also certainly a good idea to include examples of dialogues between your client and an SMTP server (maybe you also want to include some screenshots here).

References

- MockMock server on GitHub. Pay attention to this pull request. While it has not been merged, it will give you the solution to compile the project on your machine.
- The mailtrap online service for testing SMTP
- The SMTP RFC, and in particular the example scenario
- Testing SMTP with TLS: `openssl s_client -connect smtp.mailtrap.io:2525 -starttls smtp -crlf`

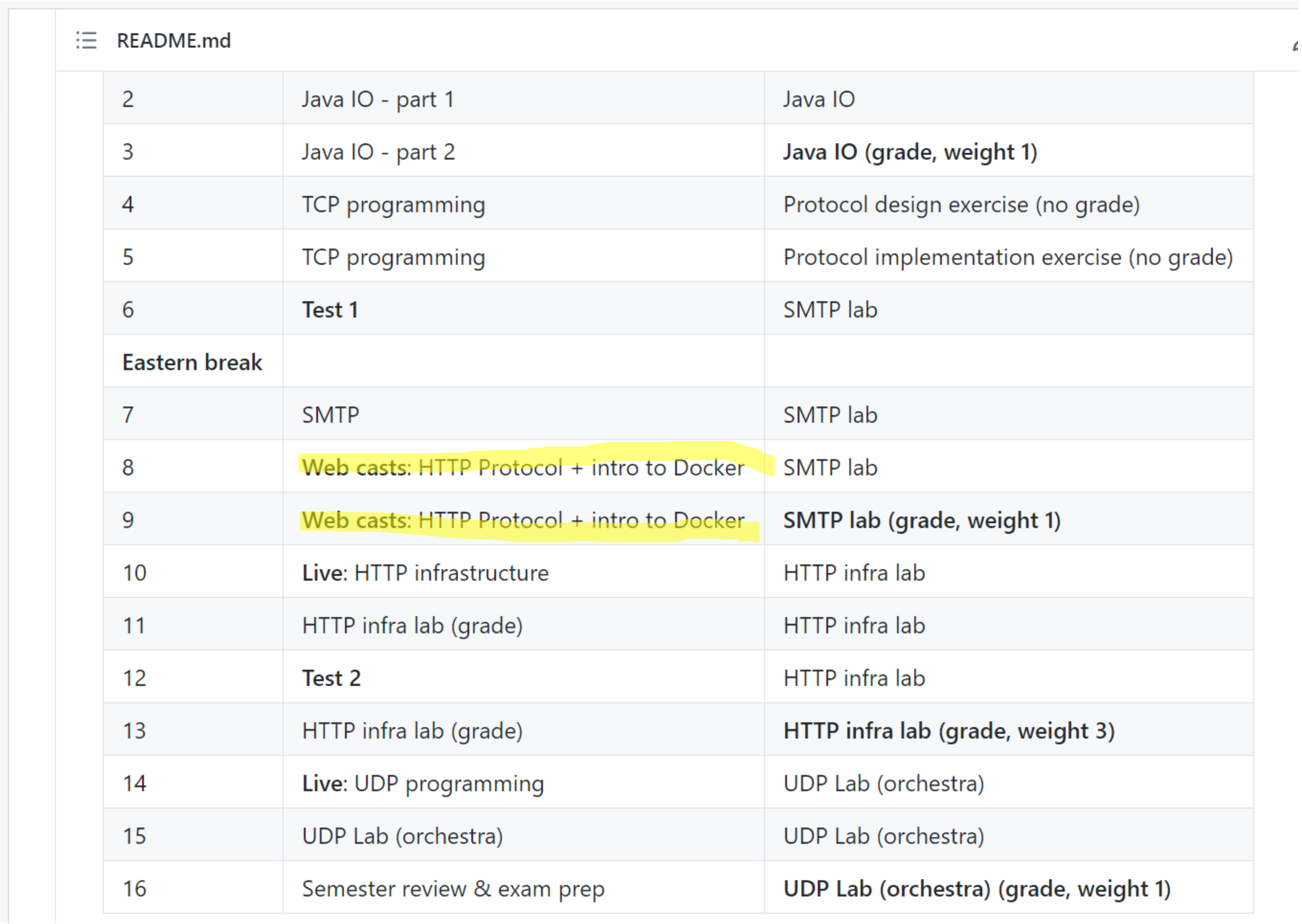


```
jehrensb@SB2-JER MockMock $
```

SAFE

email testing for dev teams

End of chapter



README.md

2	Java IO - part 1	Java IO
3	Java IO - part 2	**Java IO (grade, weight 1)**
4	TCP programming	Protocol design exercise (no grade)
5	TCP programming	Protocol implementation exercise (no grade)
6	**Test 1**	SMTP lab
Eastern break		
7	SMTP	SMTP lab
8	**Web casts:** HTTP Protocol + intro to Docker	SMTP lab
9	**Web casts:** HTTP Protocol + intro to Docker	**SMTP lab (grade, weight 1)**
10	**Live:** HTTP infrastructure	HTTP infra lab
11	HTTP infra lab (grade)	HTTP infra lab
12	**Test 2**	HTTP infra lab
13	HTTP infra lab (grade)	**HTTP infra lab (grade, weight 3)**
14	**Live:** UDP programming	UDP Lab (orchestra)
15	UDP Lab (orchestra)	UDP Lab (orchestra)
16	Semester review & exam prep	**UDP Lab (orchestra) (grade, weight 1)**