Internet Electronic Mail

Antonio Carzaniga

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University of Lugano

October 10, 2014

Outline

- General concepts
- Transport protocol: SMTP
- Basic message format
- MIME format

A Postal Service for the Internet

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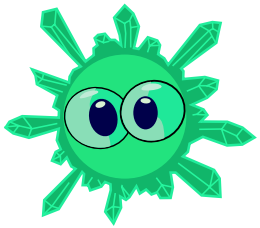

Alice

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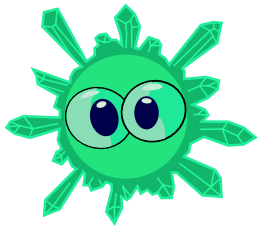

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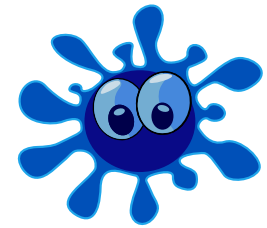

Bob

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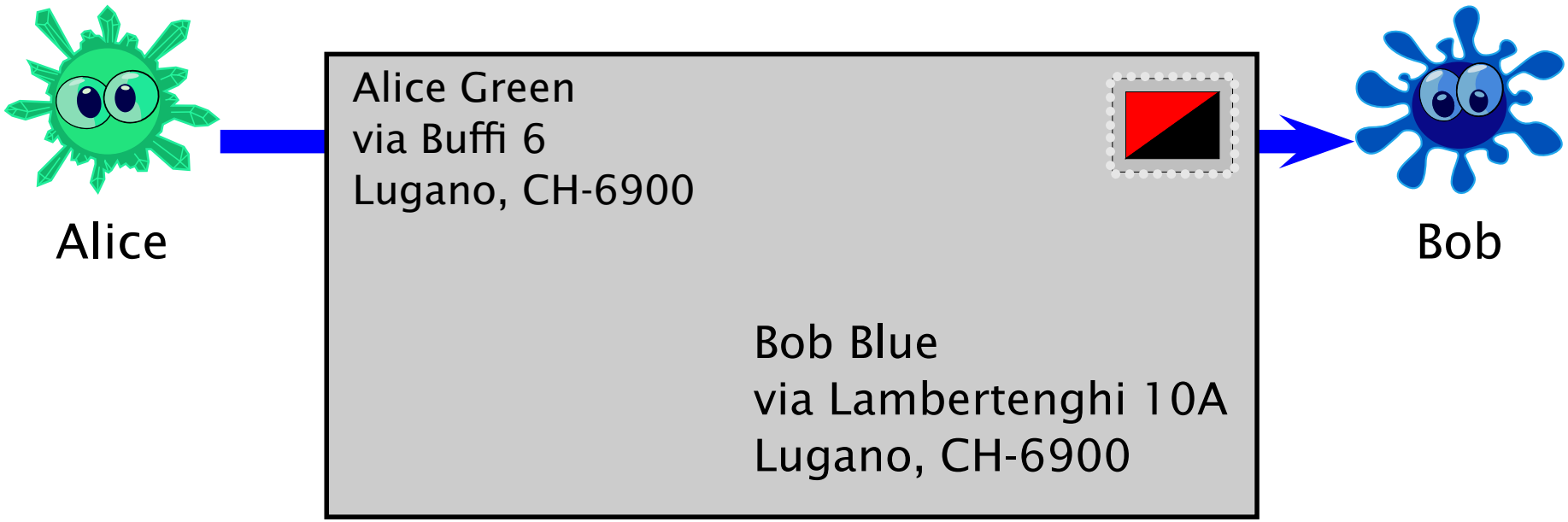

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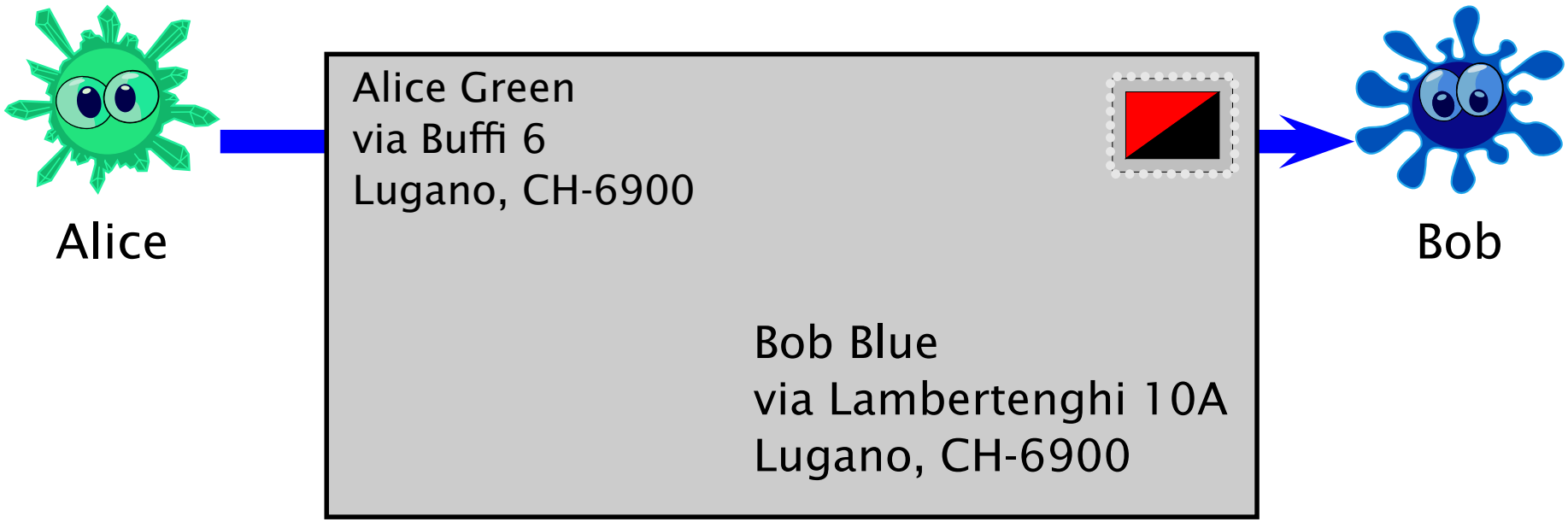

Alice Green

Lugano, April 15, 2005

Bob Blue

Re: Your lecture on DNS

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I wanted to tell you that last week's lecture on DNS. . .
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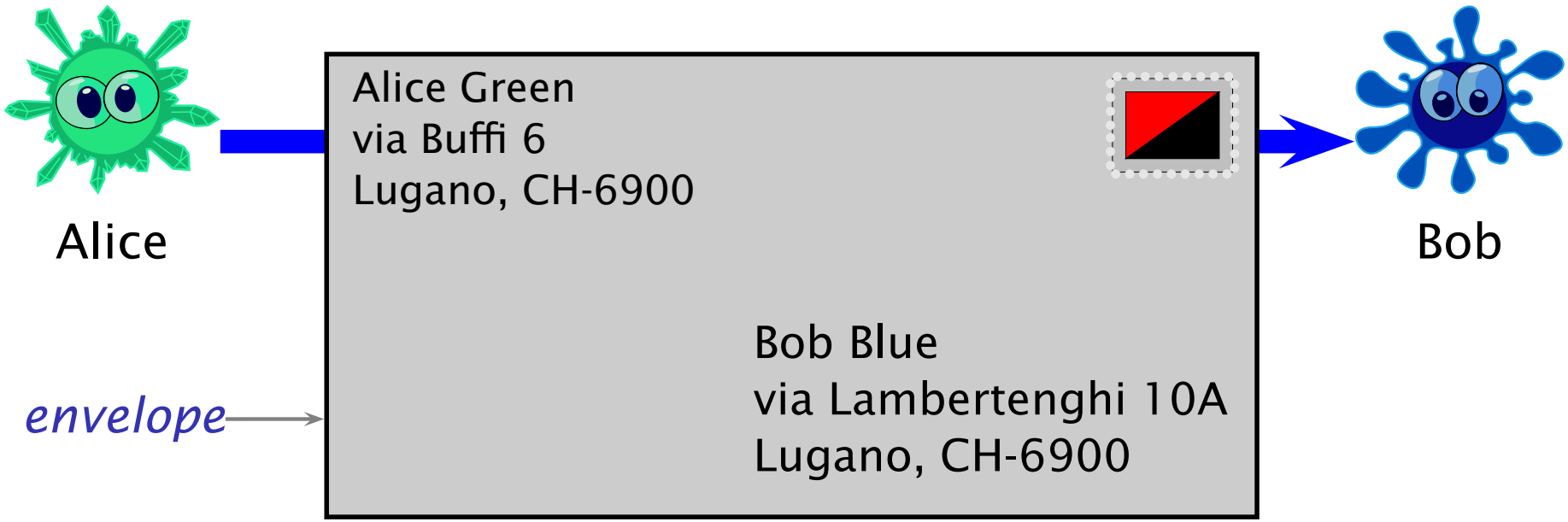

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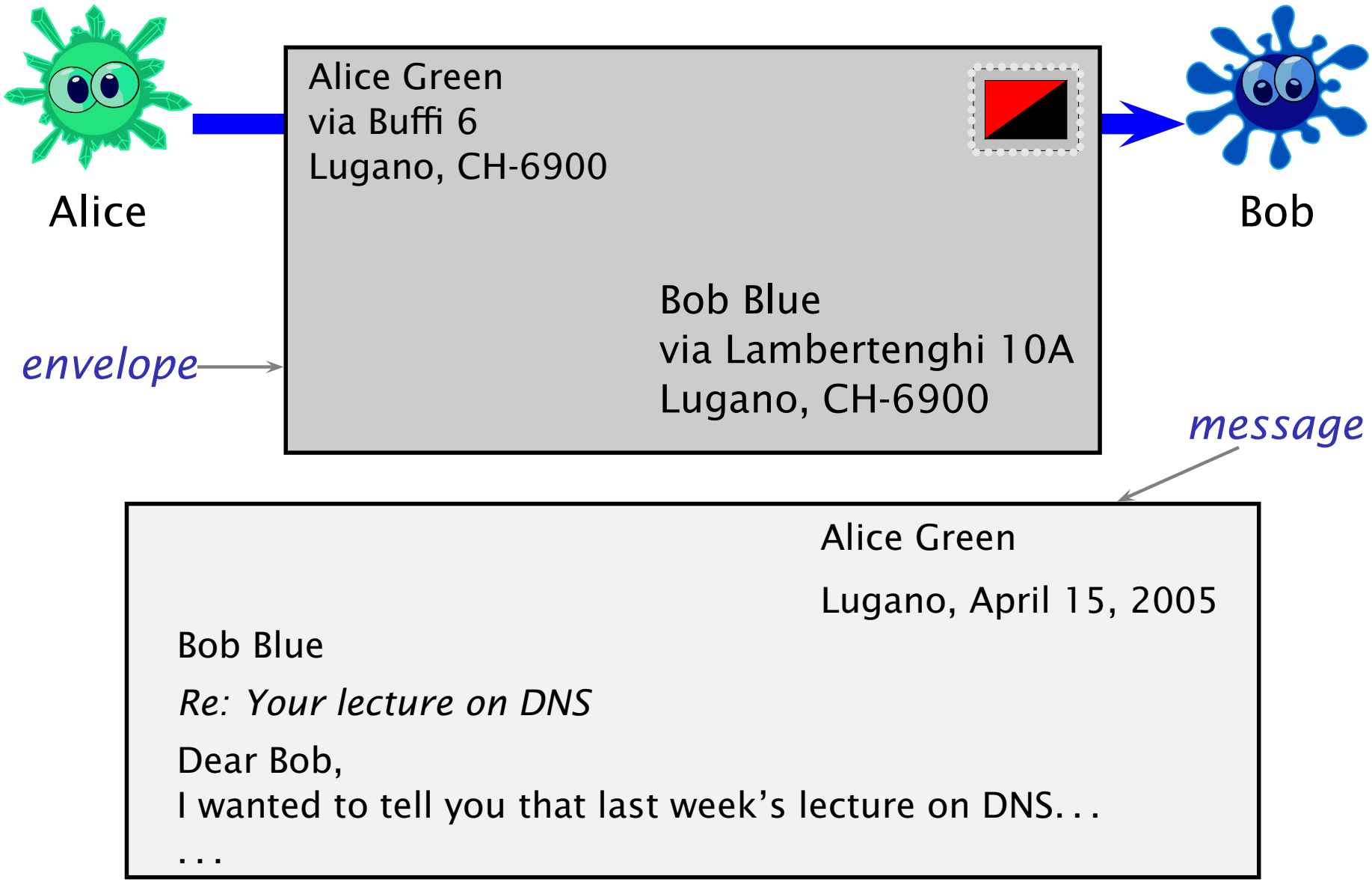

Features and Goals

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  - a mailing list sends messages to several receivers
- Multi-media content
  - images and all sorts of attachments as well as normal text

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- No confidentiality
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  - the message can be read by others
- Little or no delivery guarantees
  - Alice has no idea whether the messages was in fact receiver (much less read!) by Bob
  - messages can be accidentally lost or intentionally blocked
  - no reliable acknowledgement system

Architecture and Terminology

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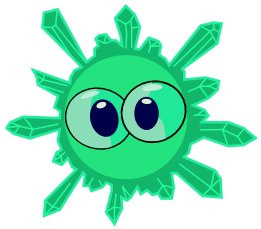

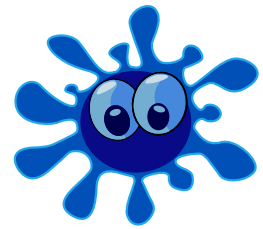

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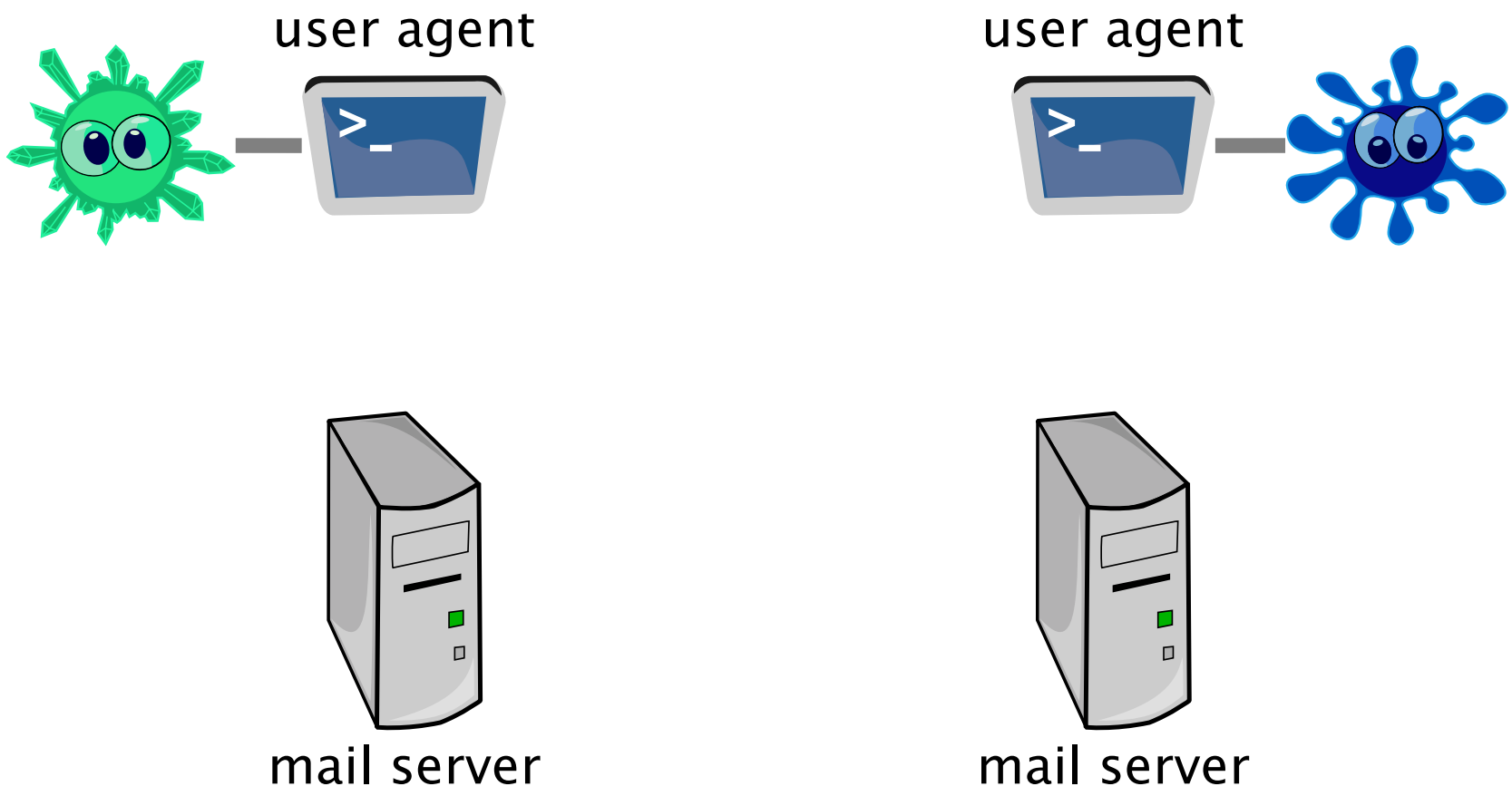

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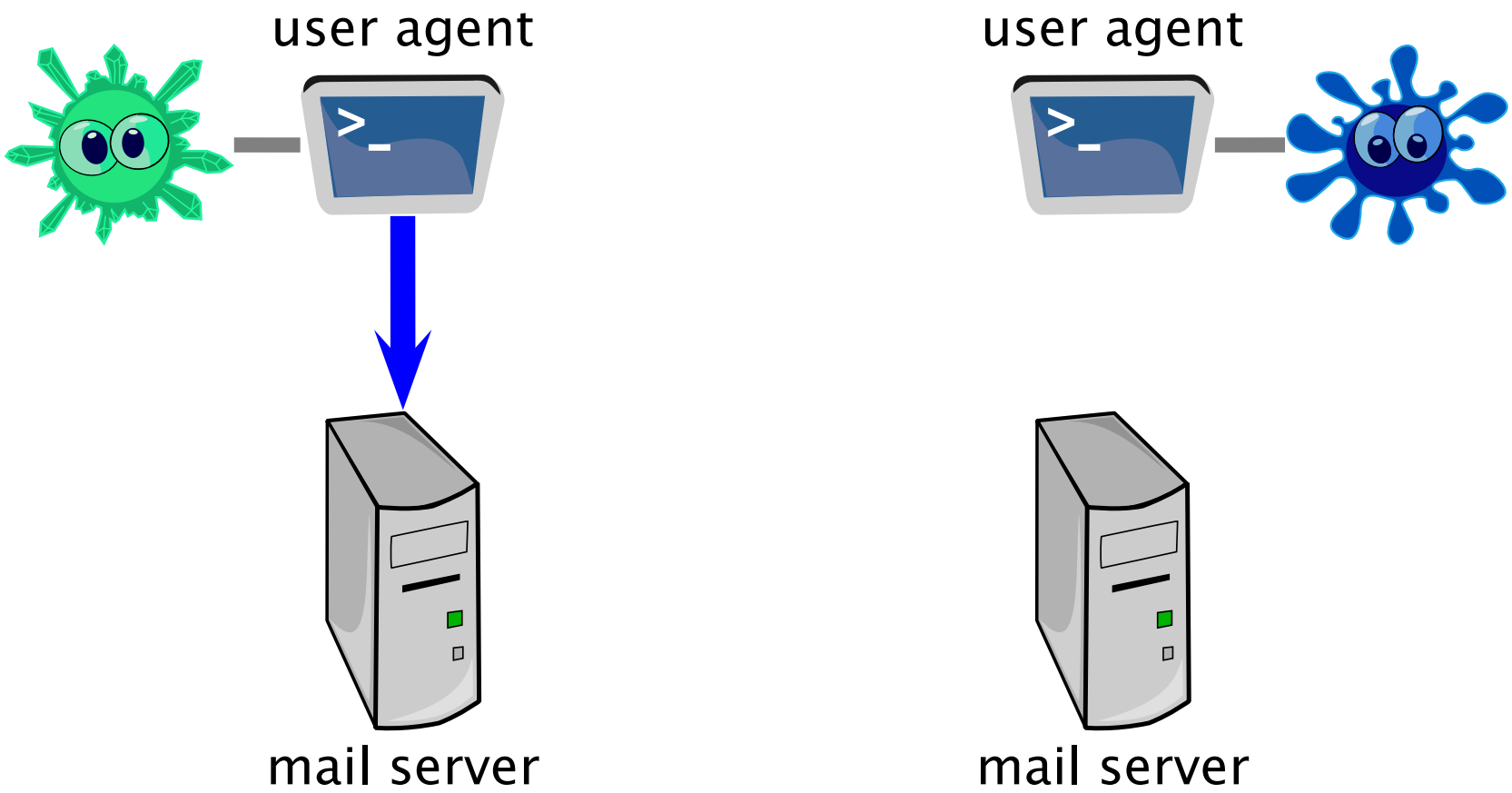

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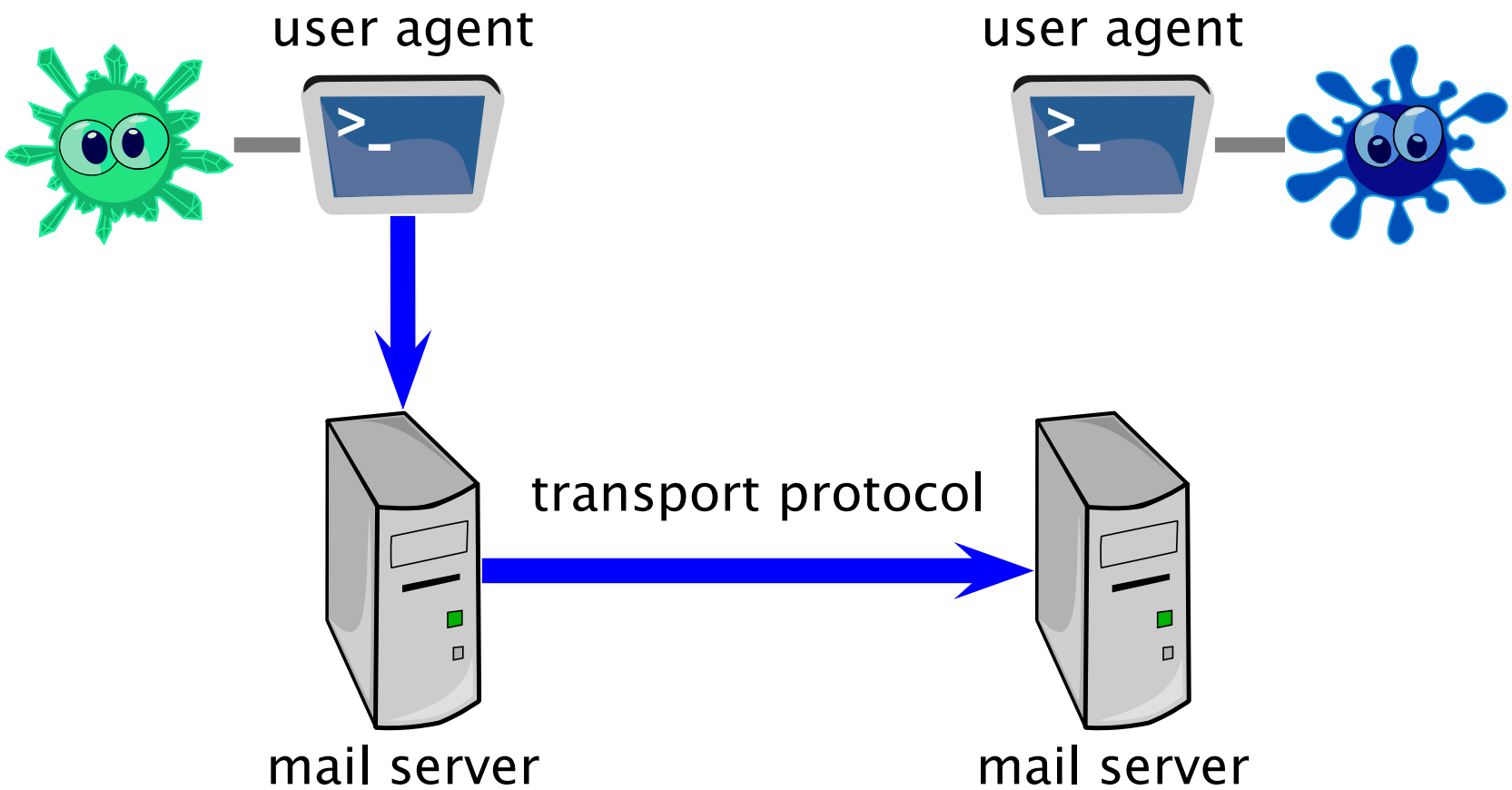

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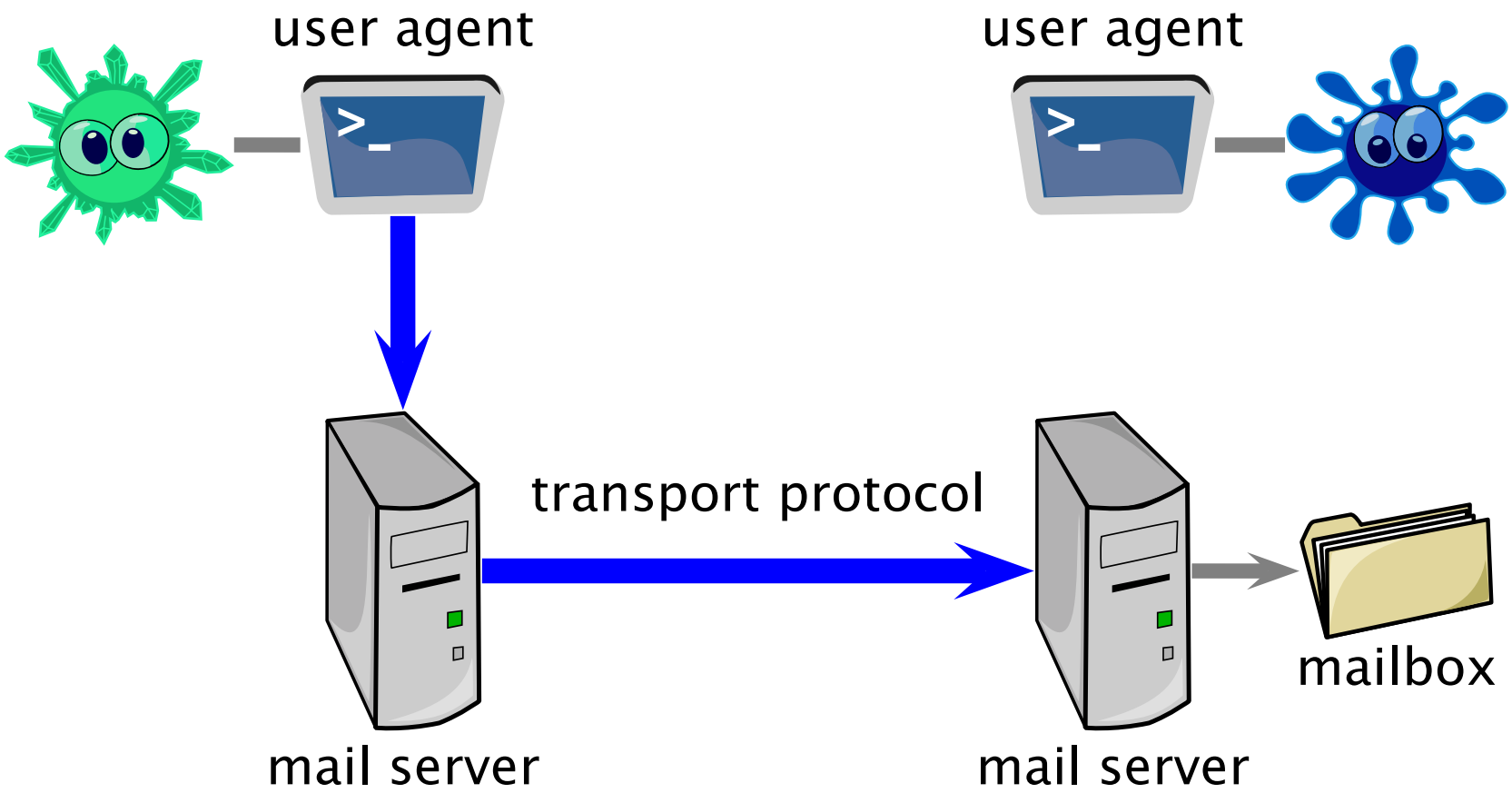

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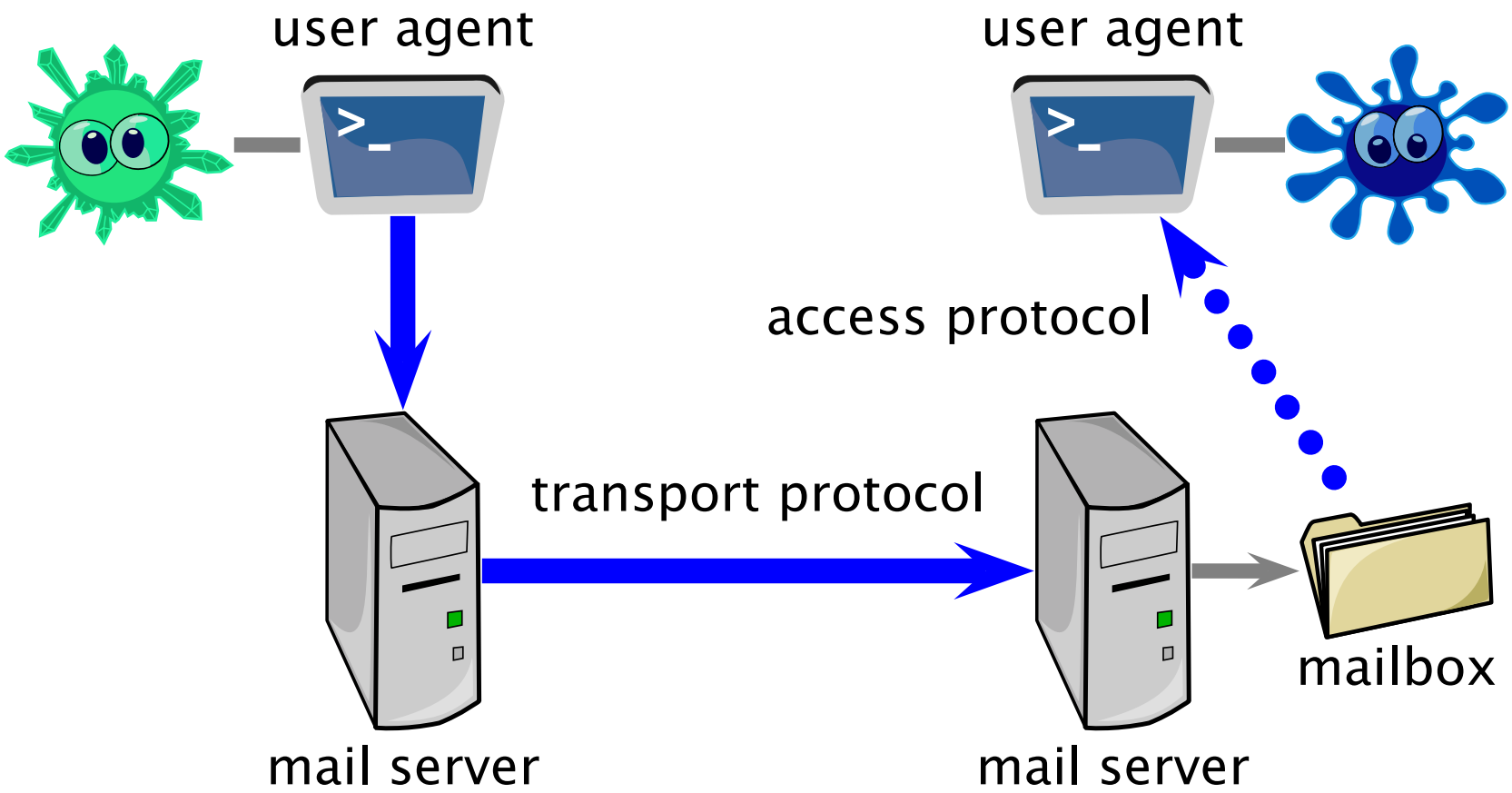

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- *User agent*
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  - allows a user to read, compose, reply to, send, and forward messages
  - and also to save, classify, sort, search, . . .
- *Mail servers*
  - accept messages for *remote delivery*
    - store messages in a local persistent queue
    - deliver messages to a remote (destination) server using the *transport protocol*
  - accept messages for *local delivery*
    - save messages in some local persistent mailbox
  - allow user agents to *access local mailboxes*
    - user agents can retrieve and/or delete messages
    - this is done through an *access protocol*

SMTP

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- Connection-oriented protocol
- It is “simple”
  - indeed its simplicity is a reason for its success
- It is an old protocol, compared to HTTP; the first RFCs date back to the early 80s
  - it has some archaic charachteristics. E.g., it is restricted to 7-bit characters

SMTP Abstract Example

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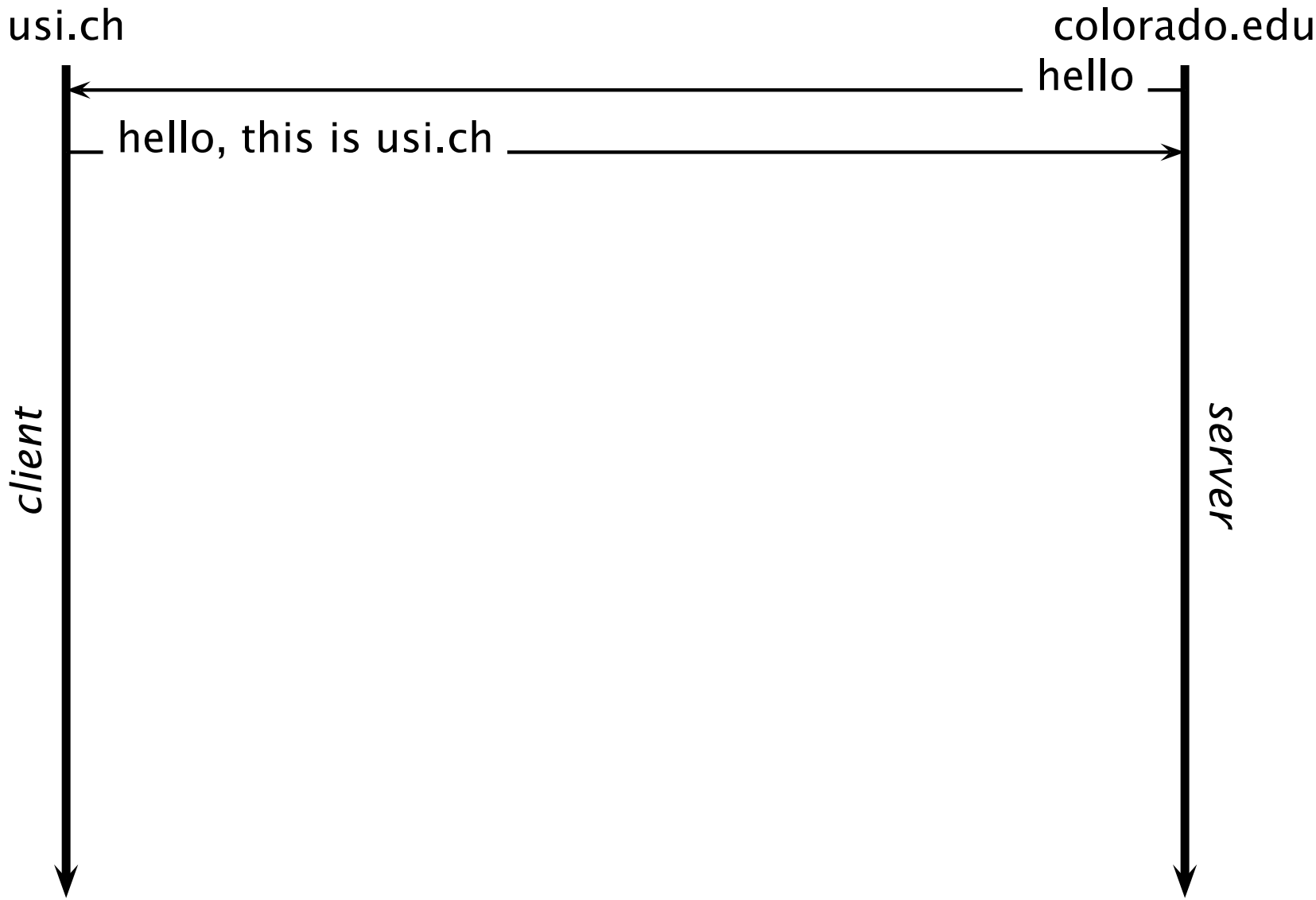

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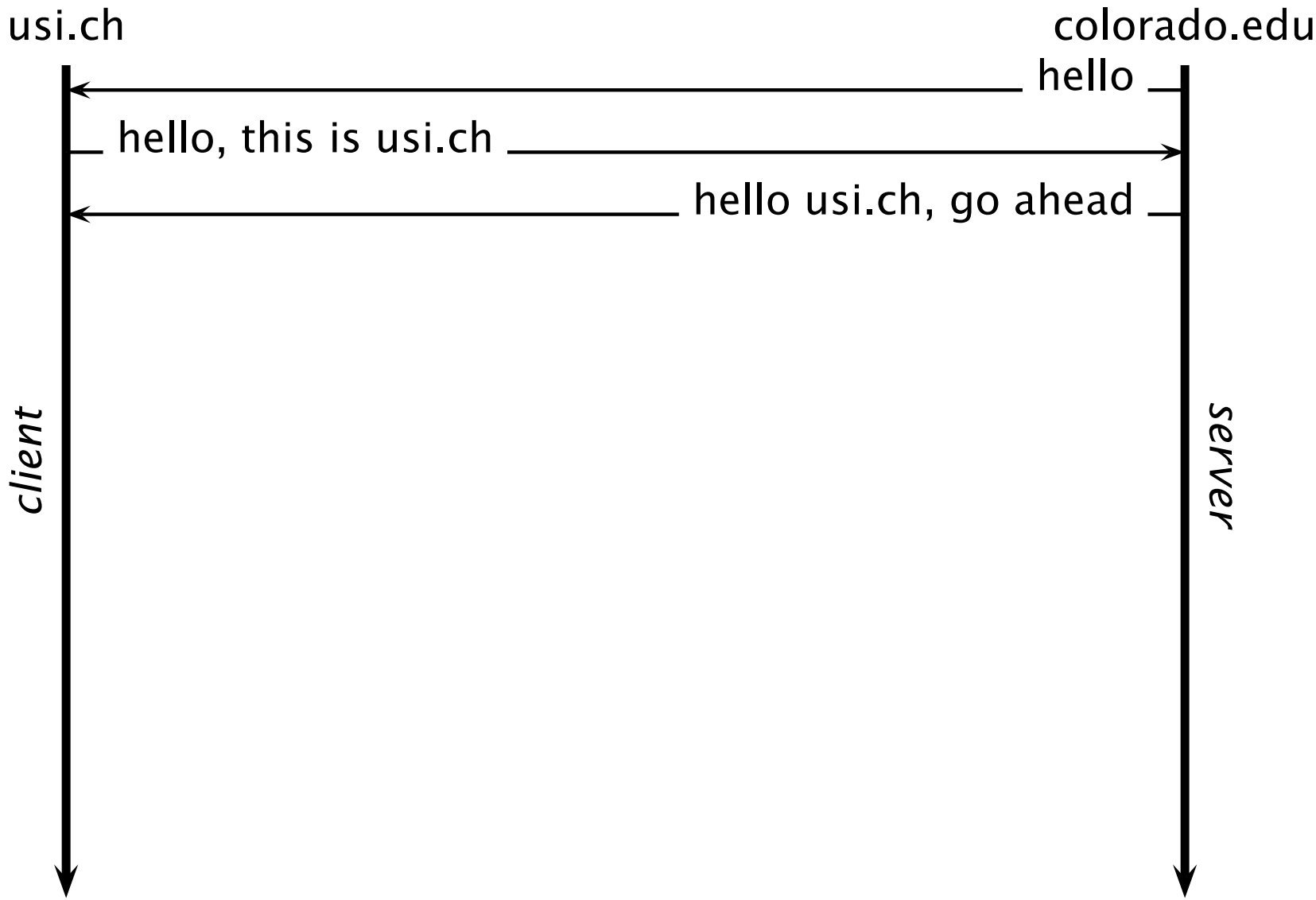

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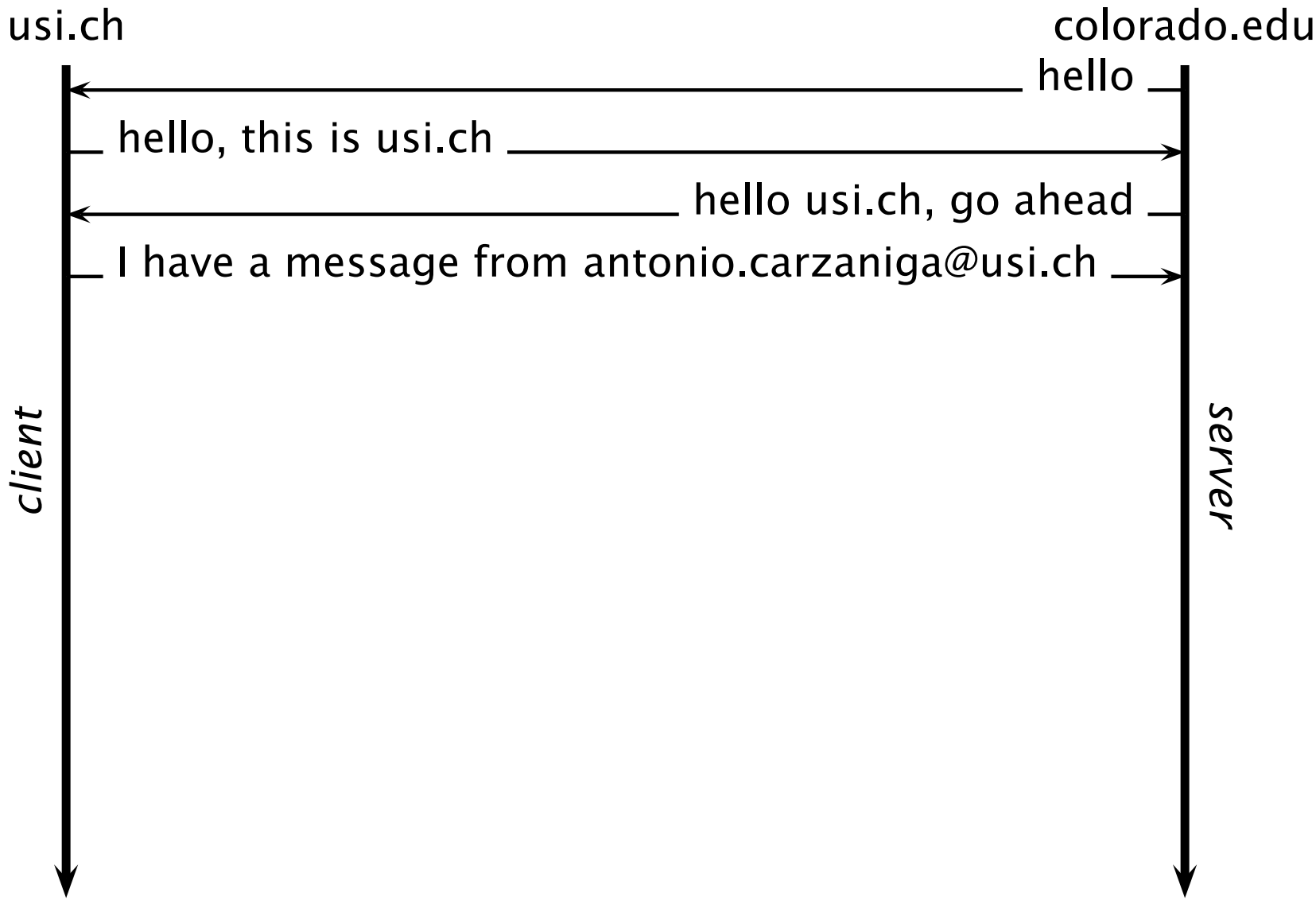

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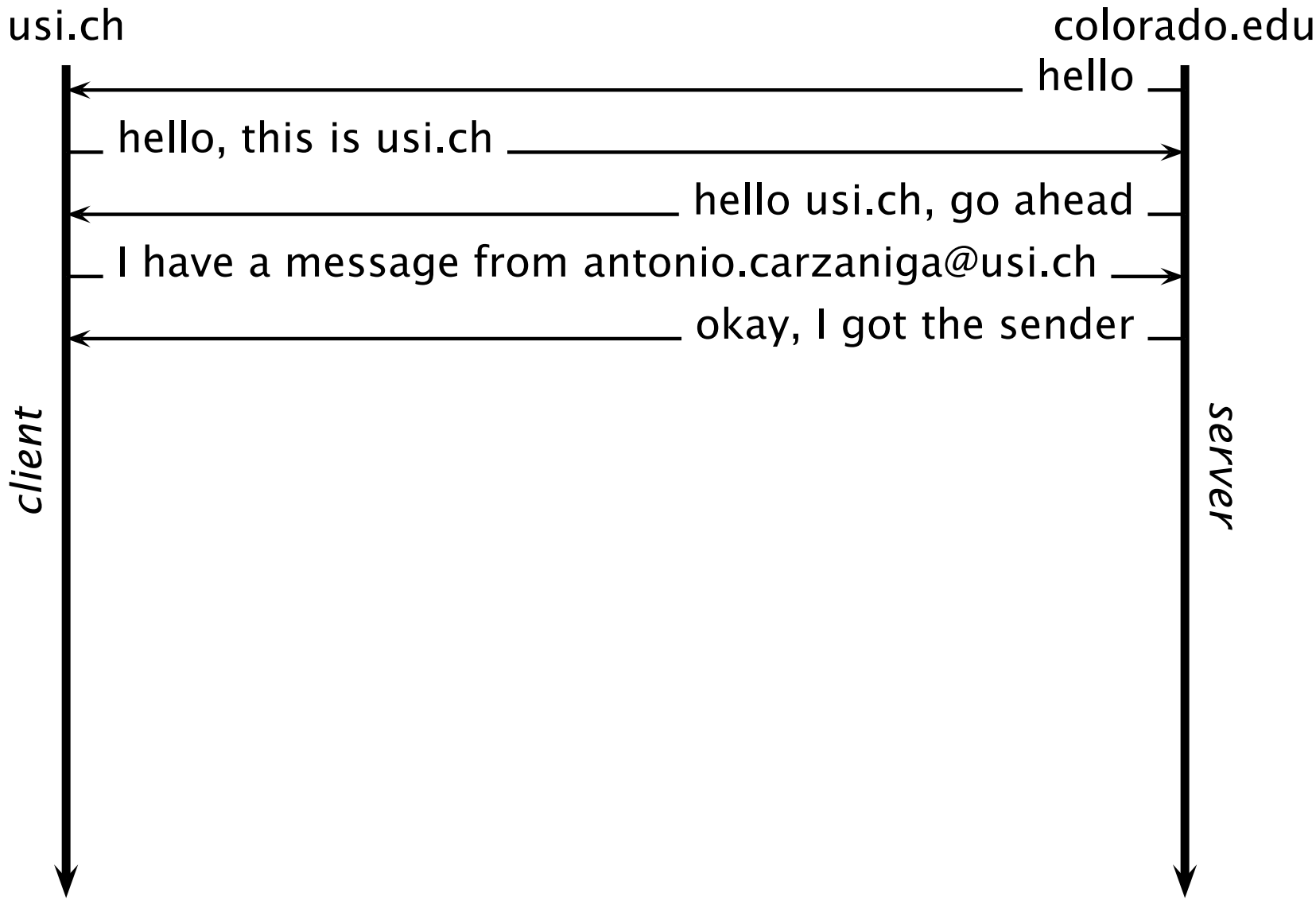

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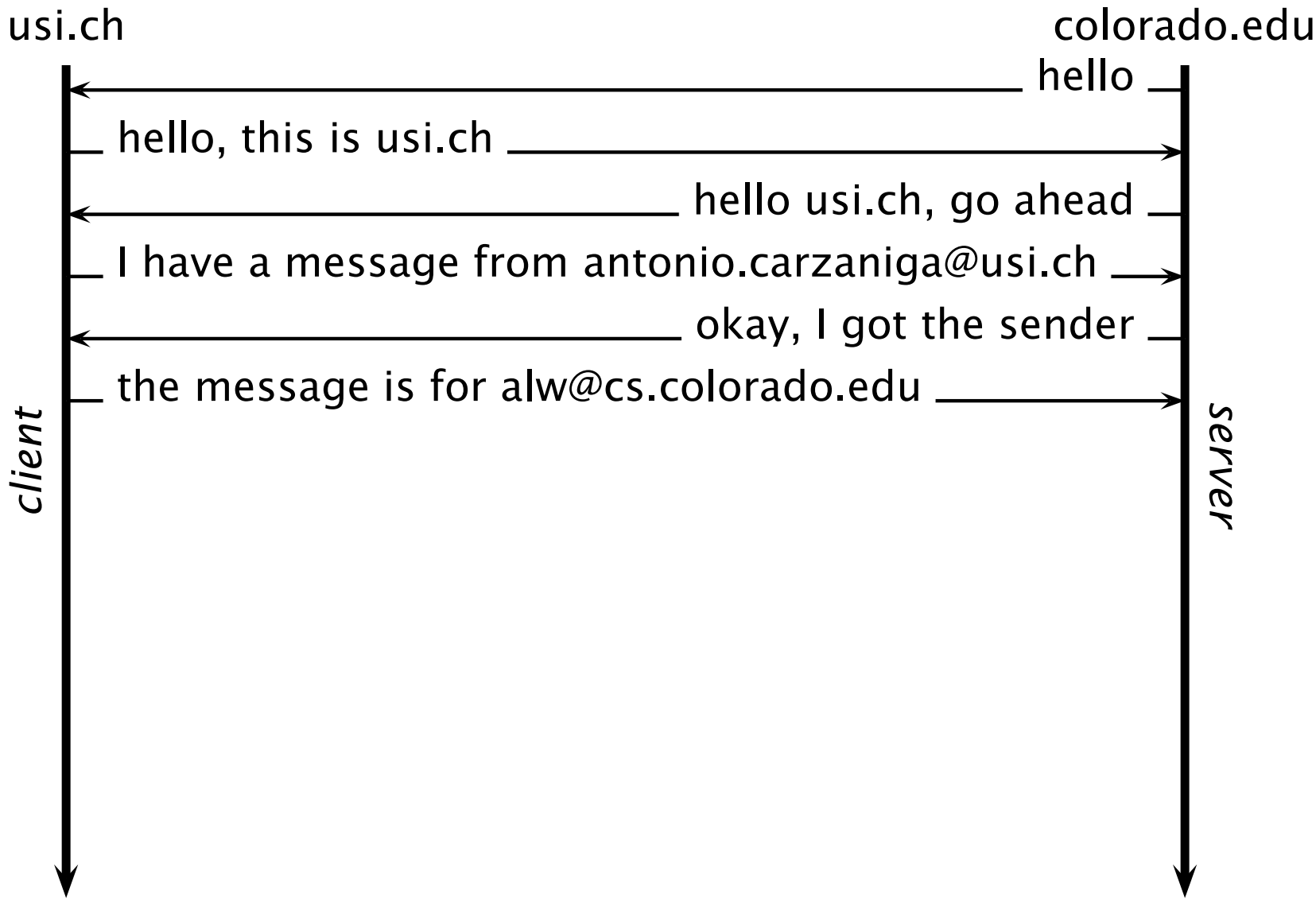

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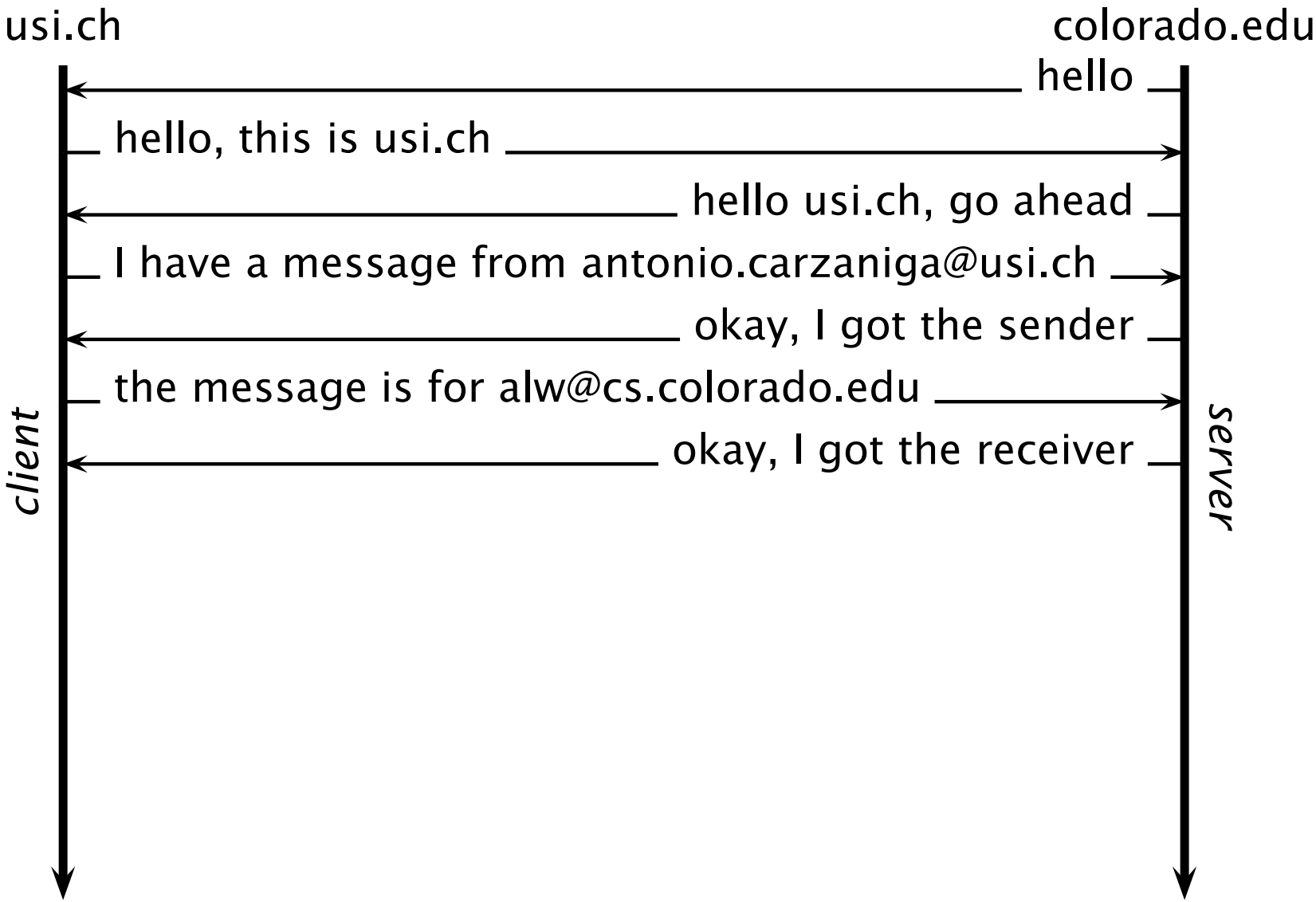

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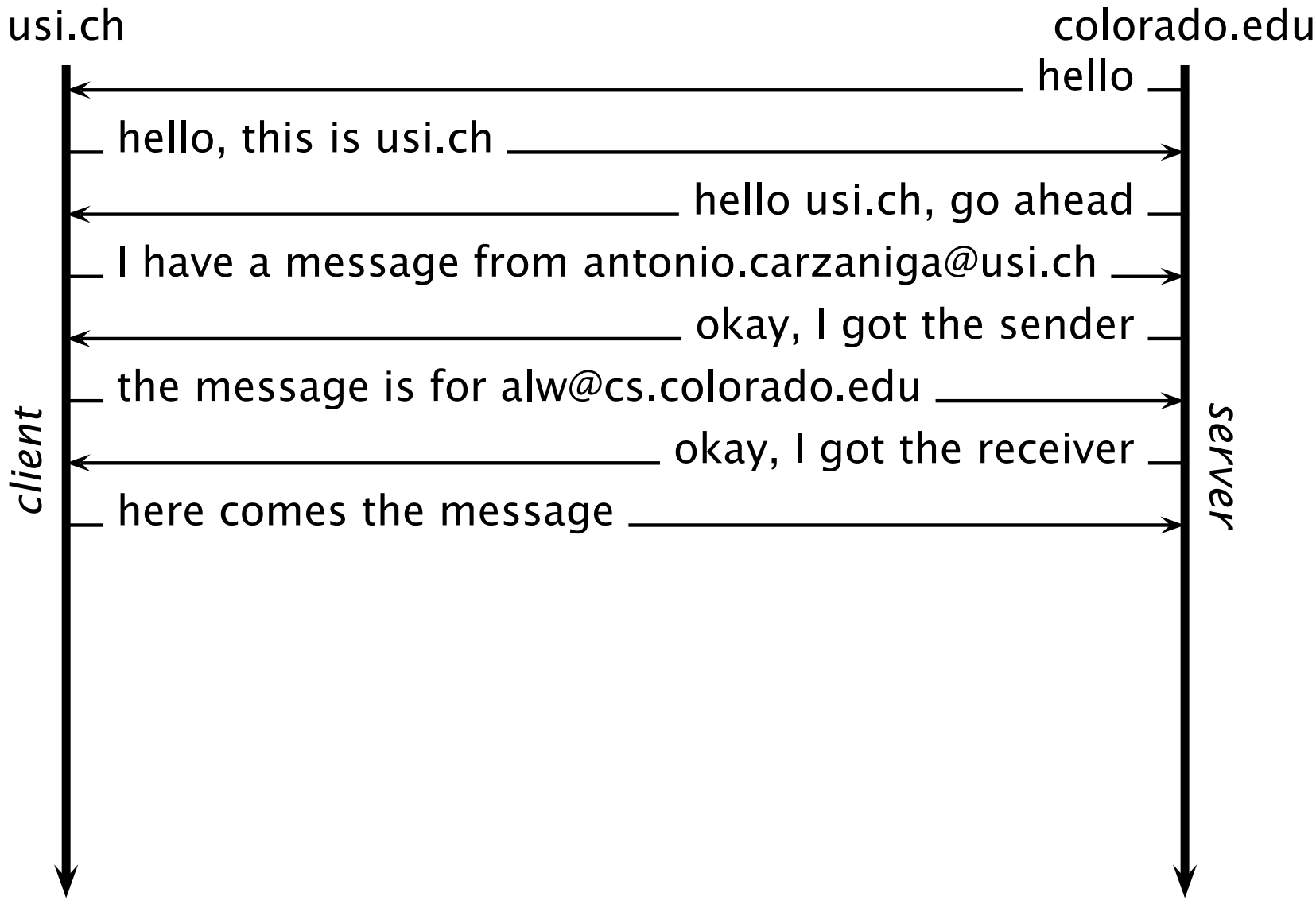

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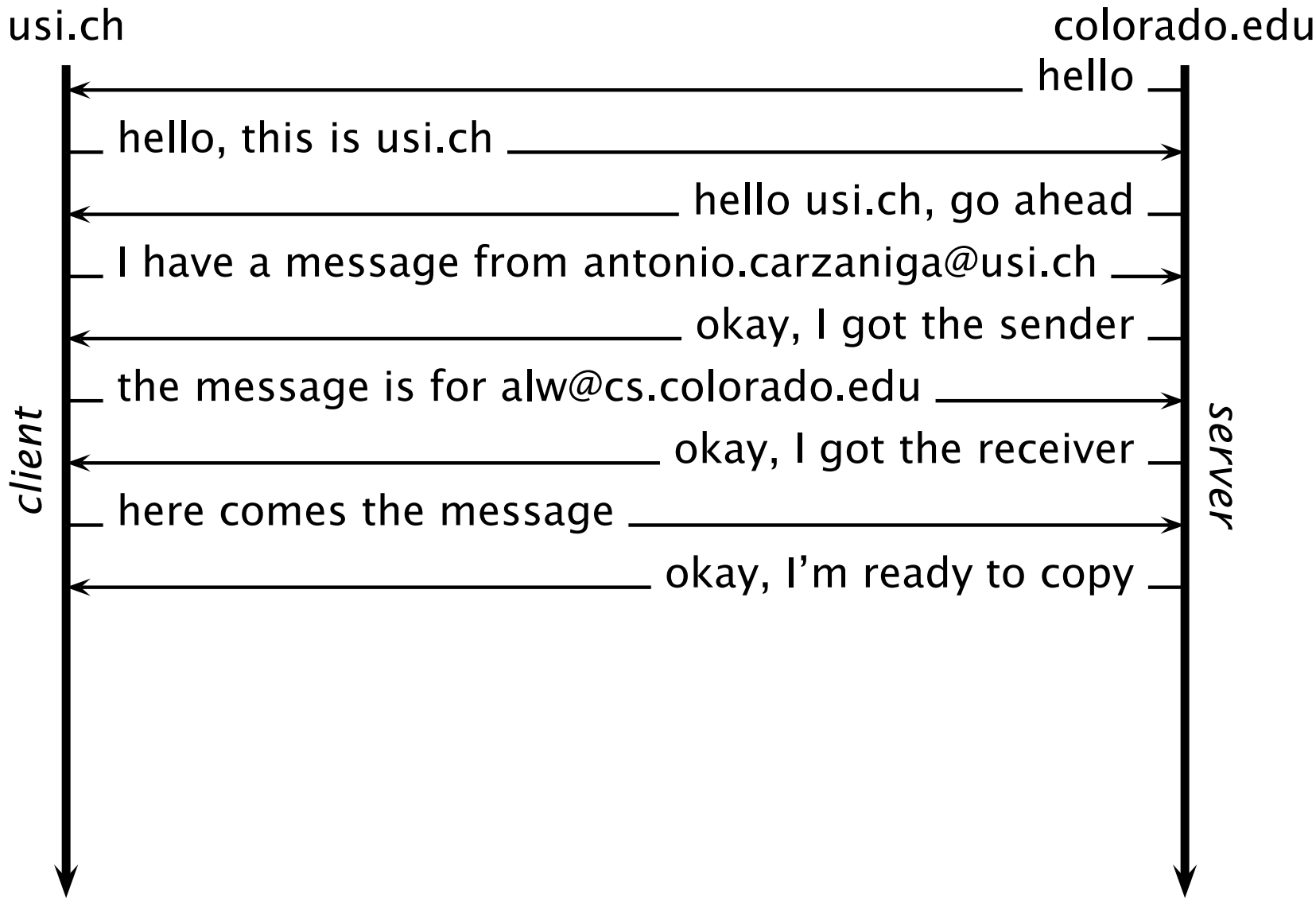

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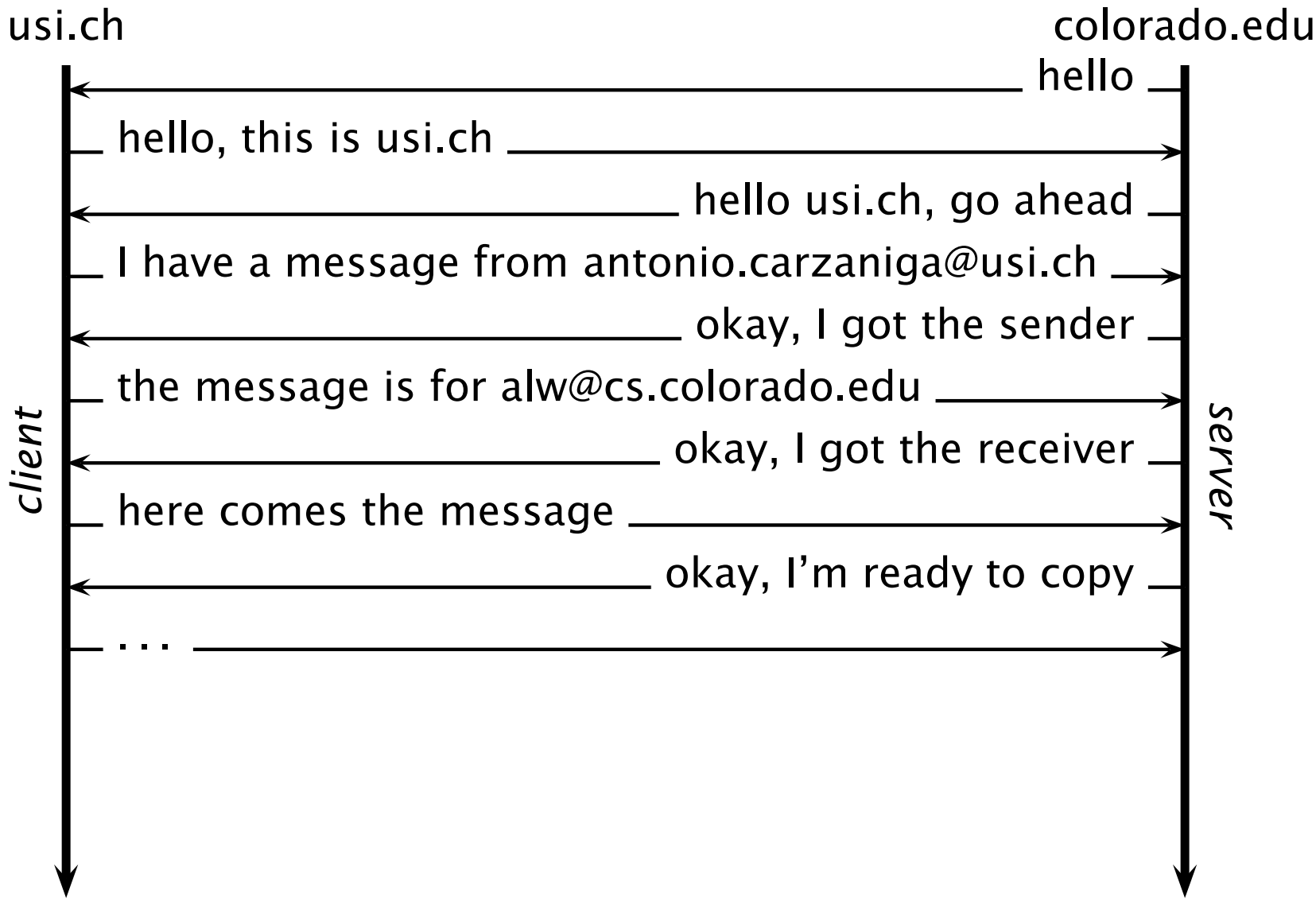

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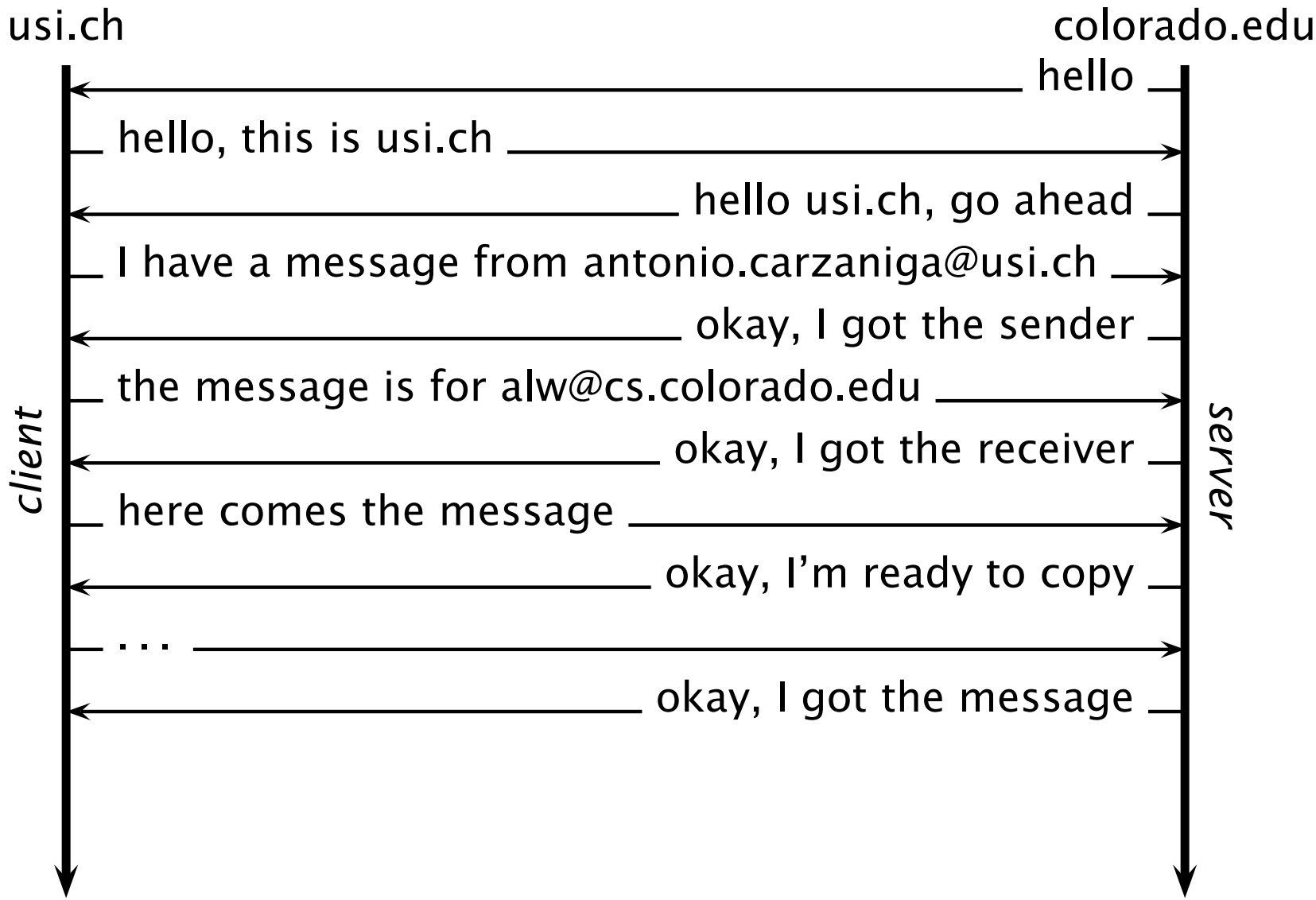

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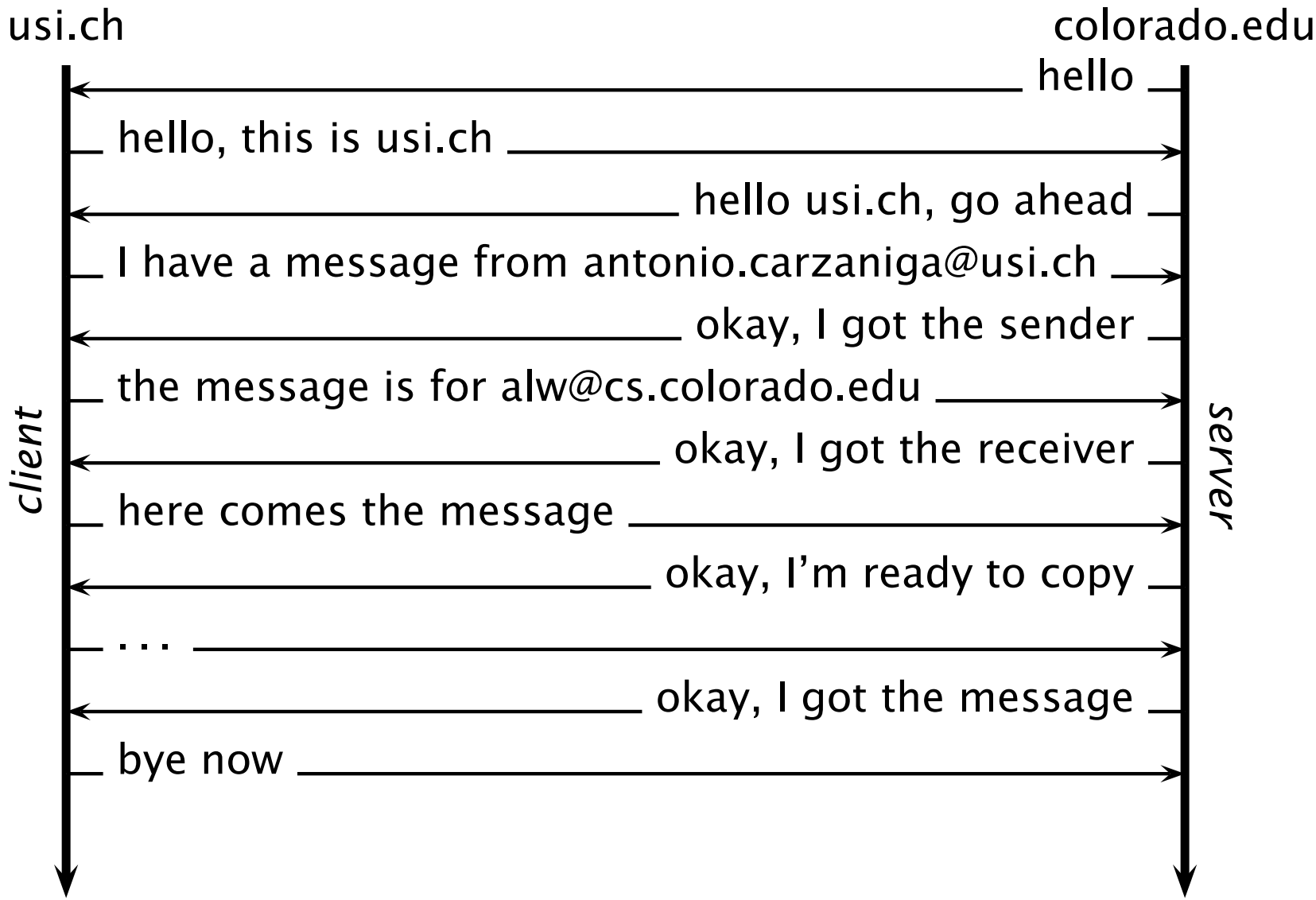

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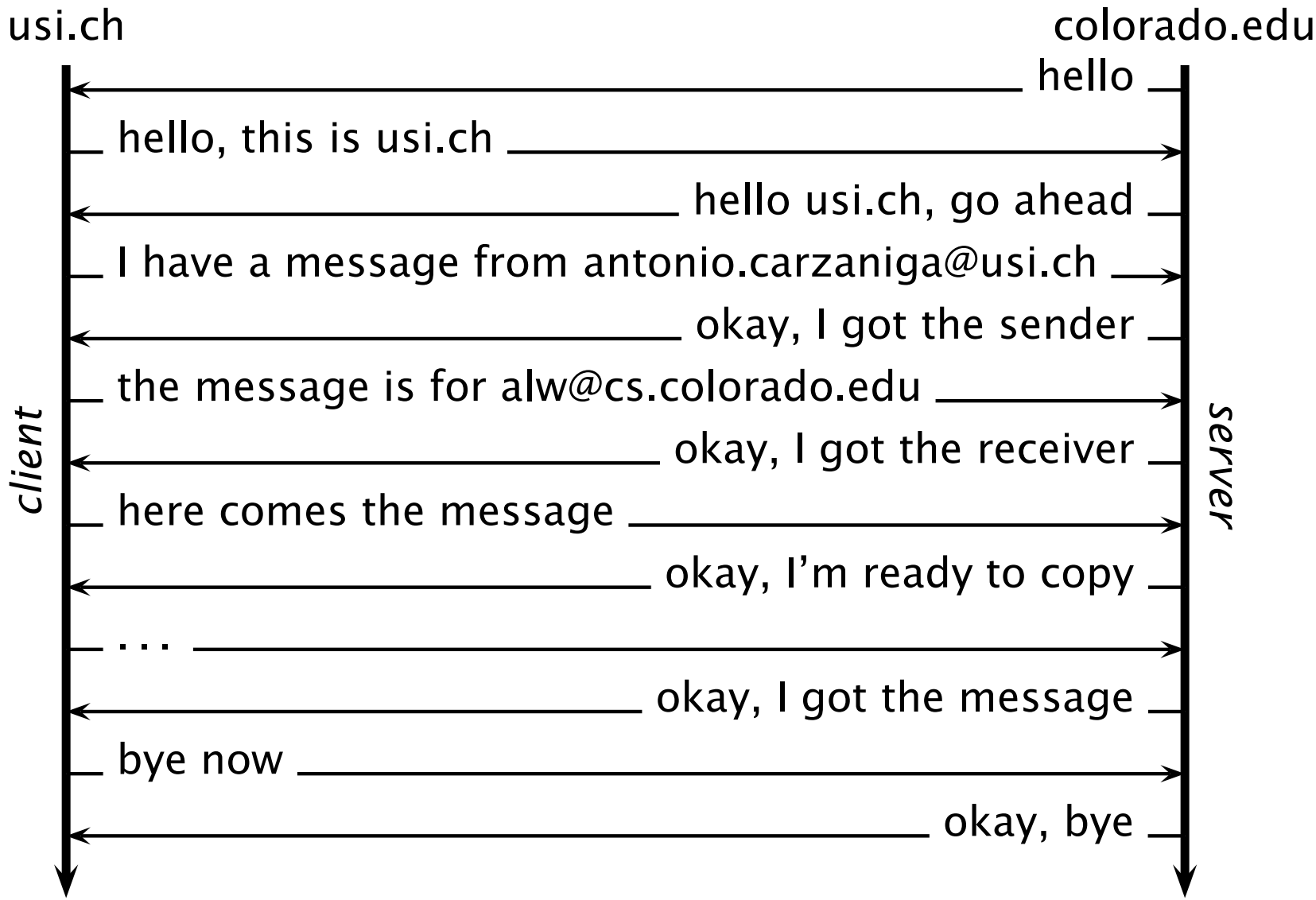

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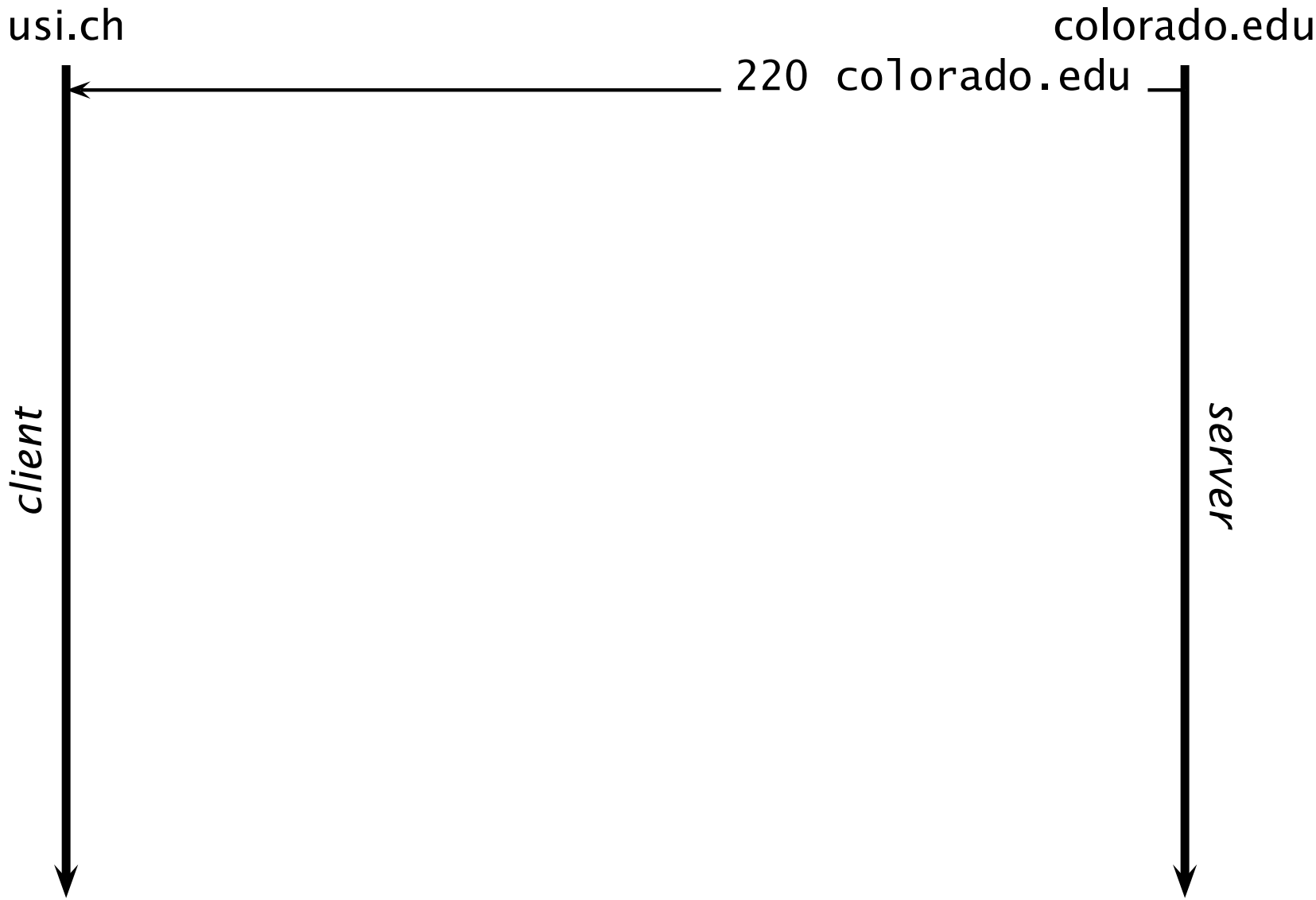

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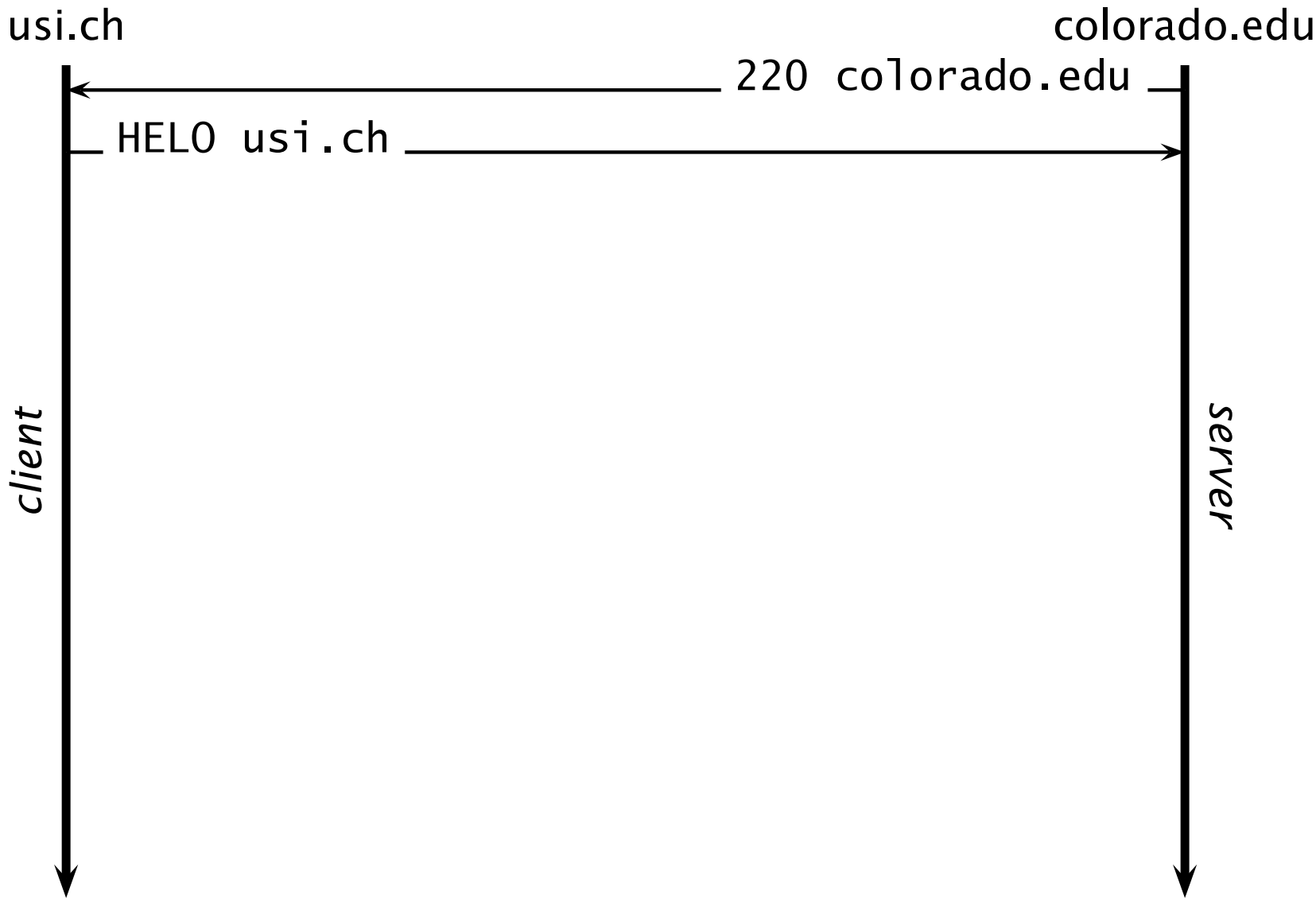

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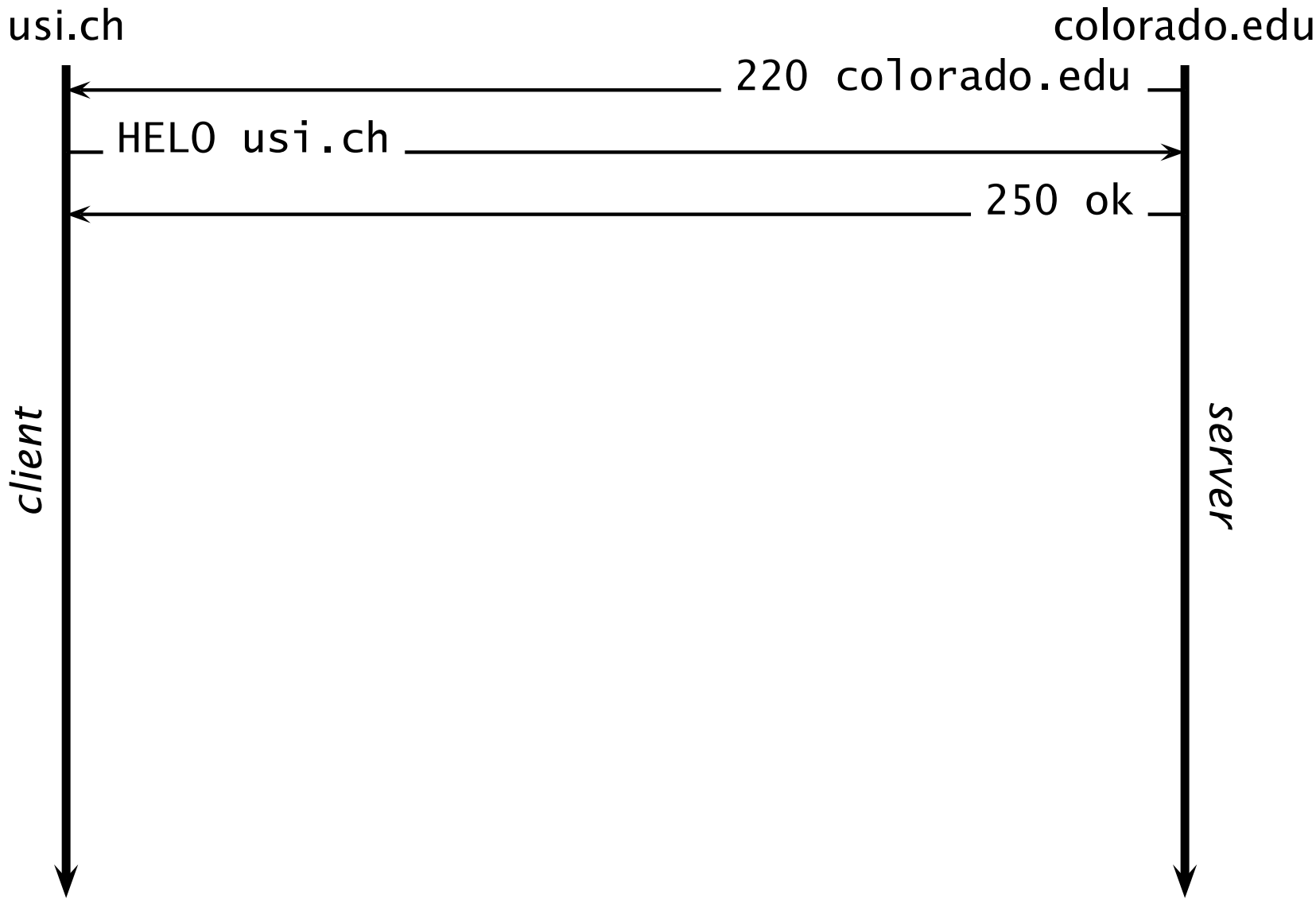

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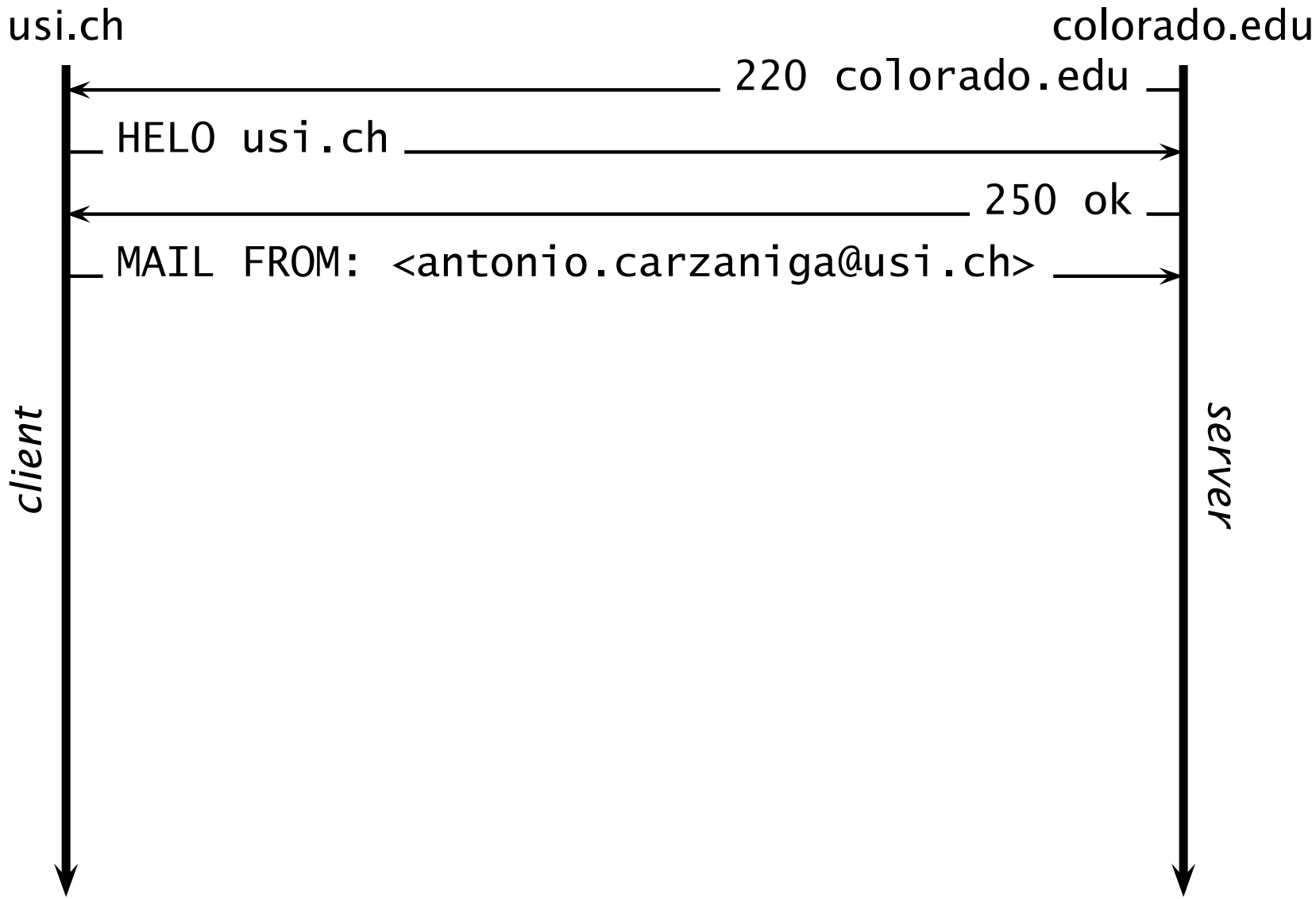

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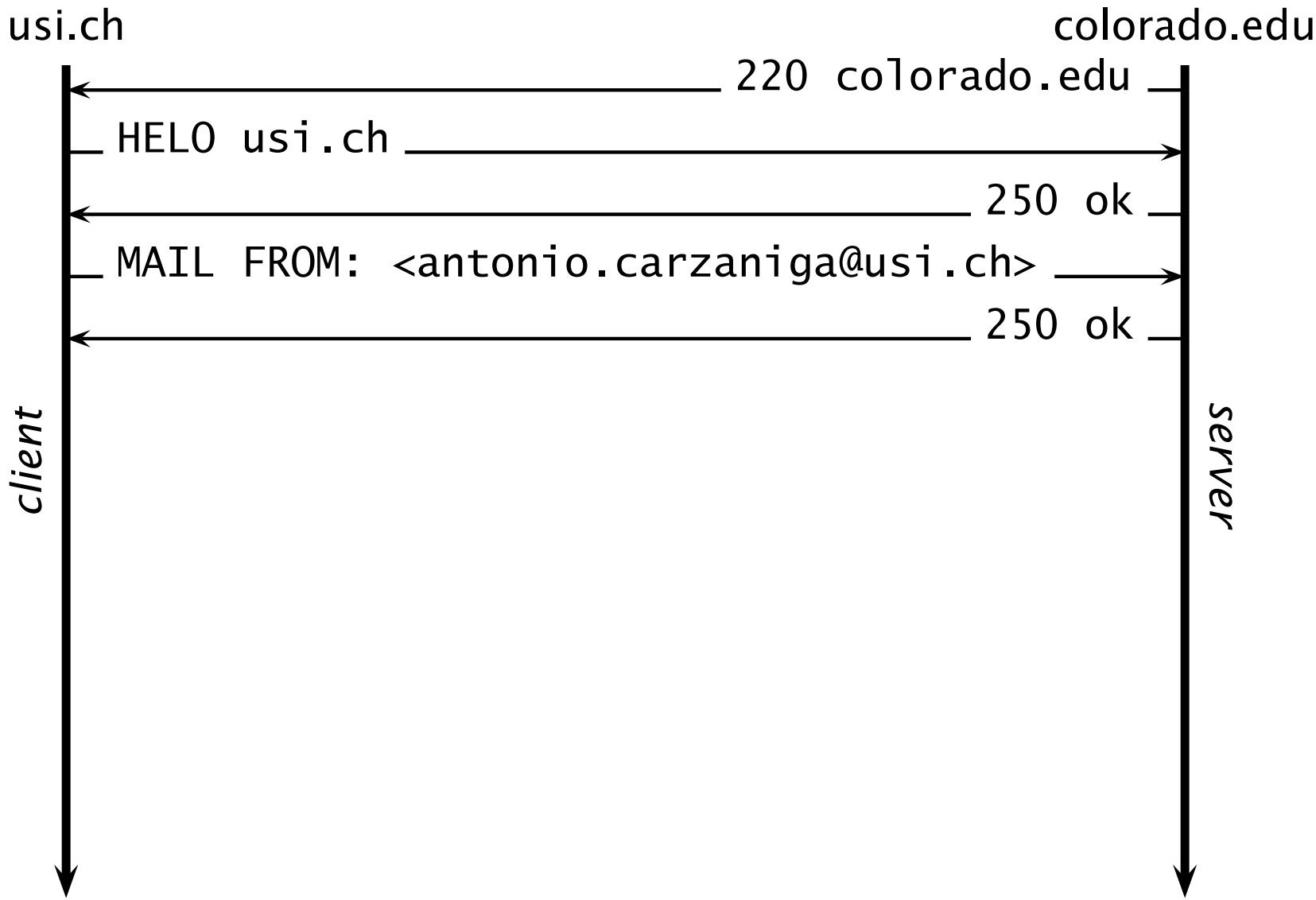

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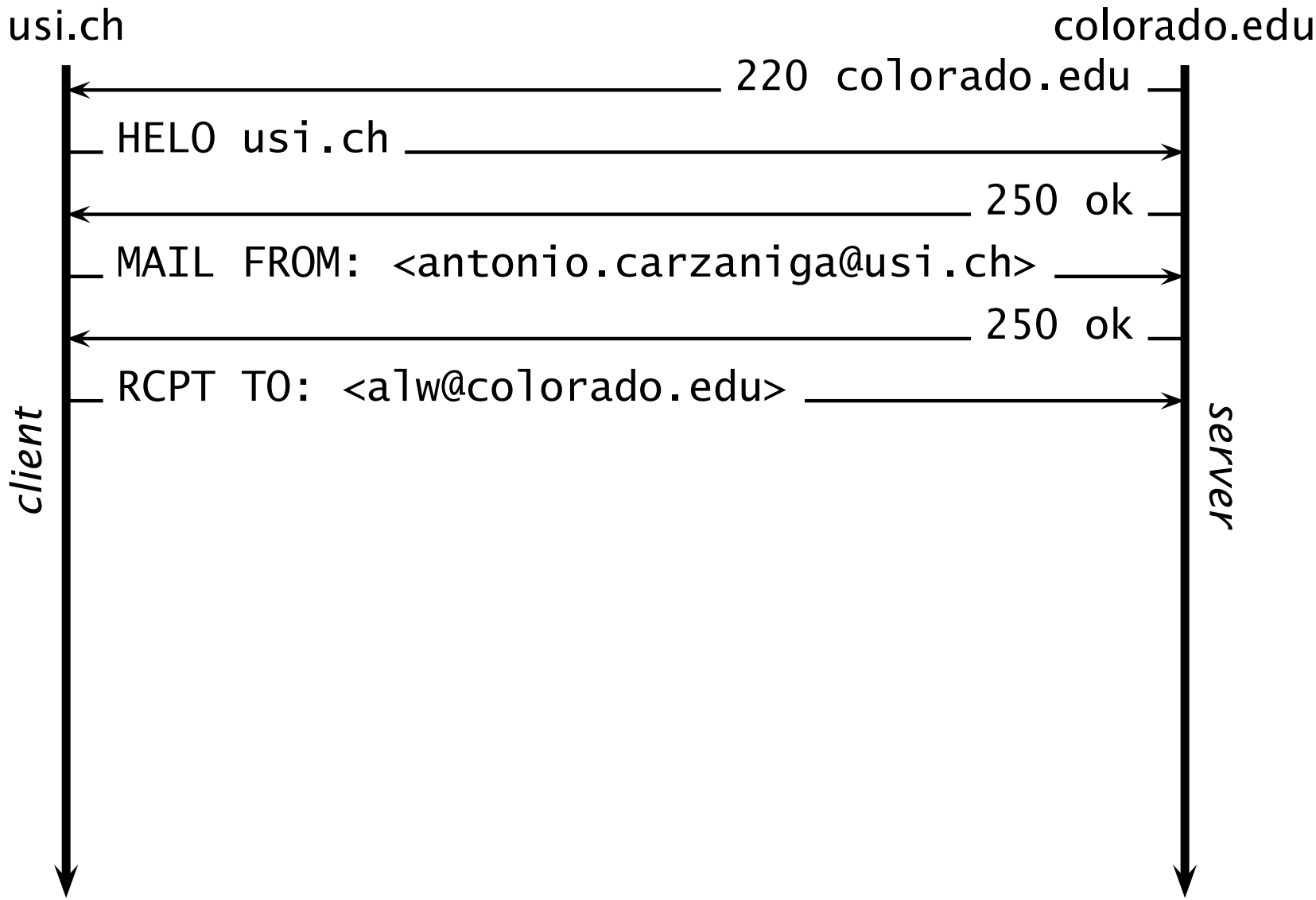

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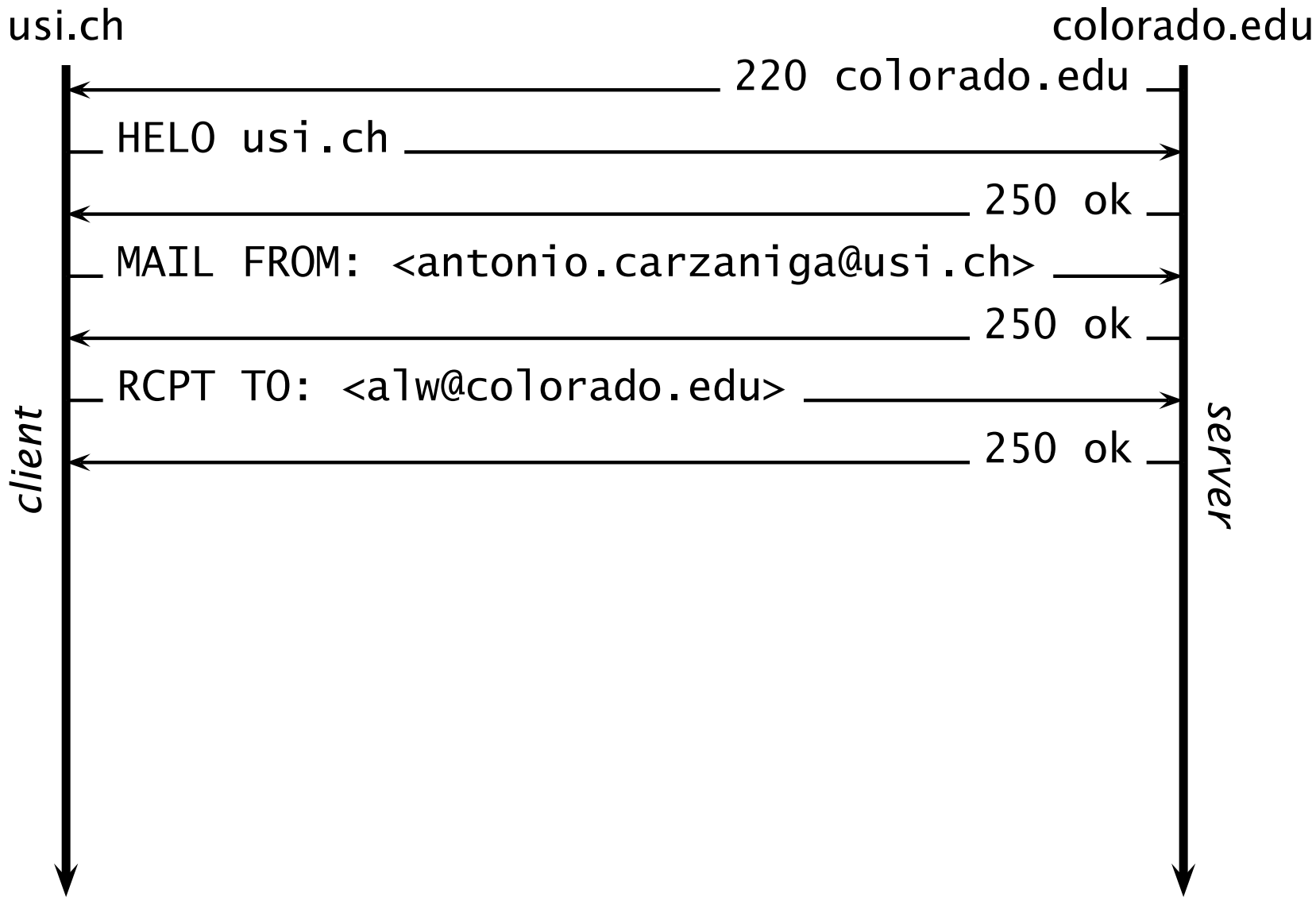

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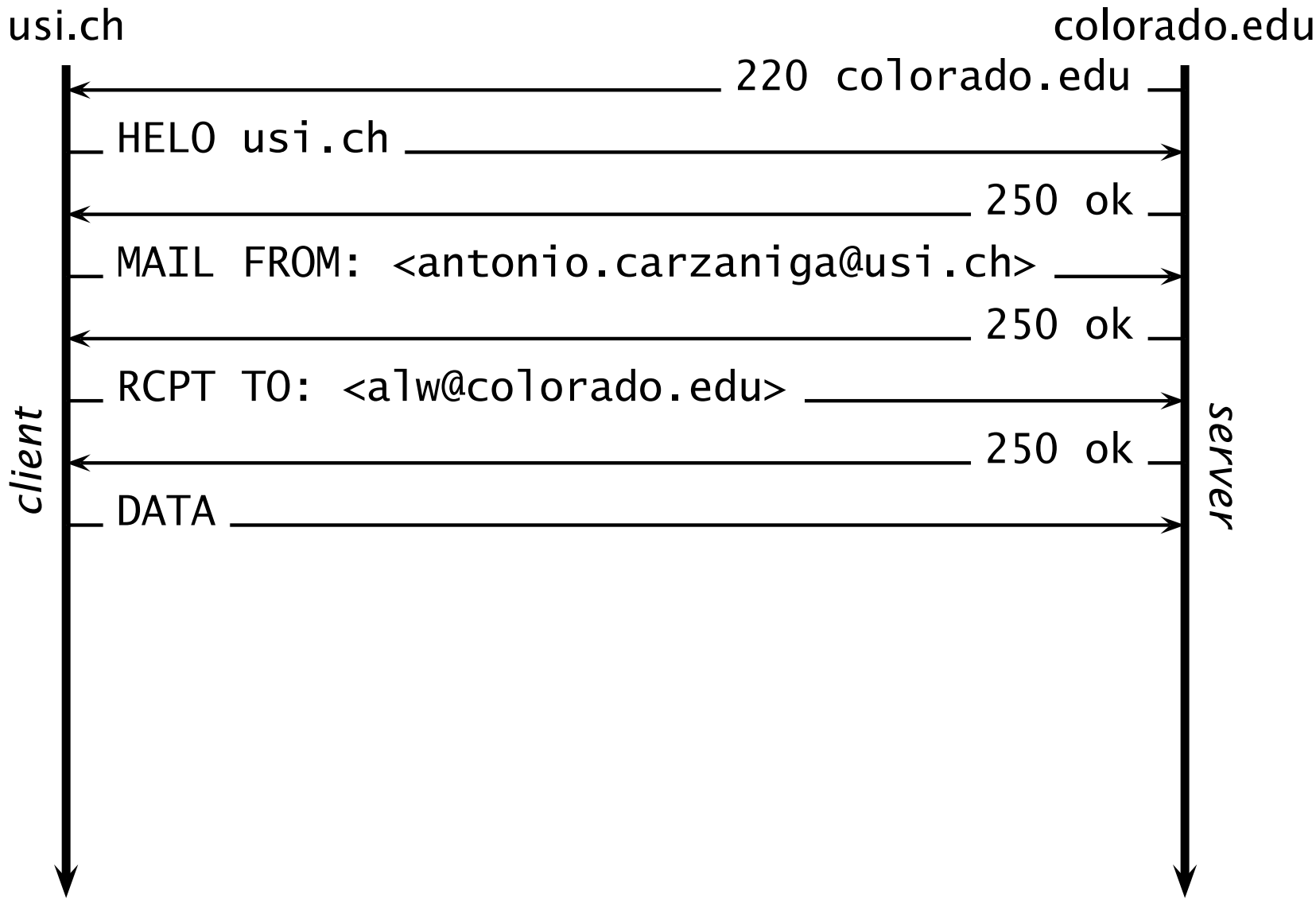

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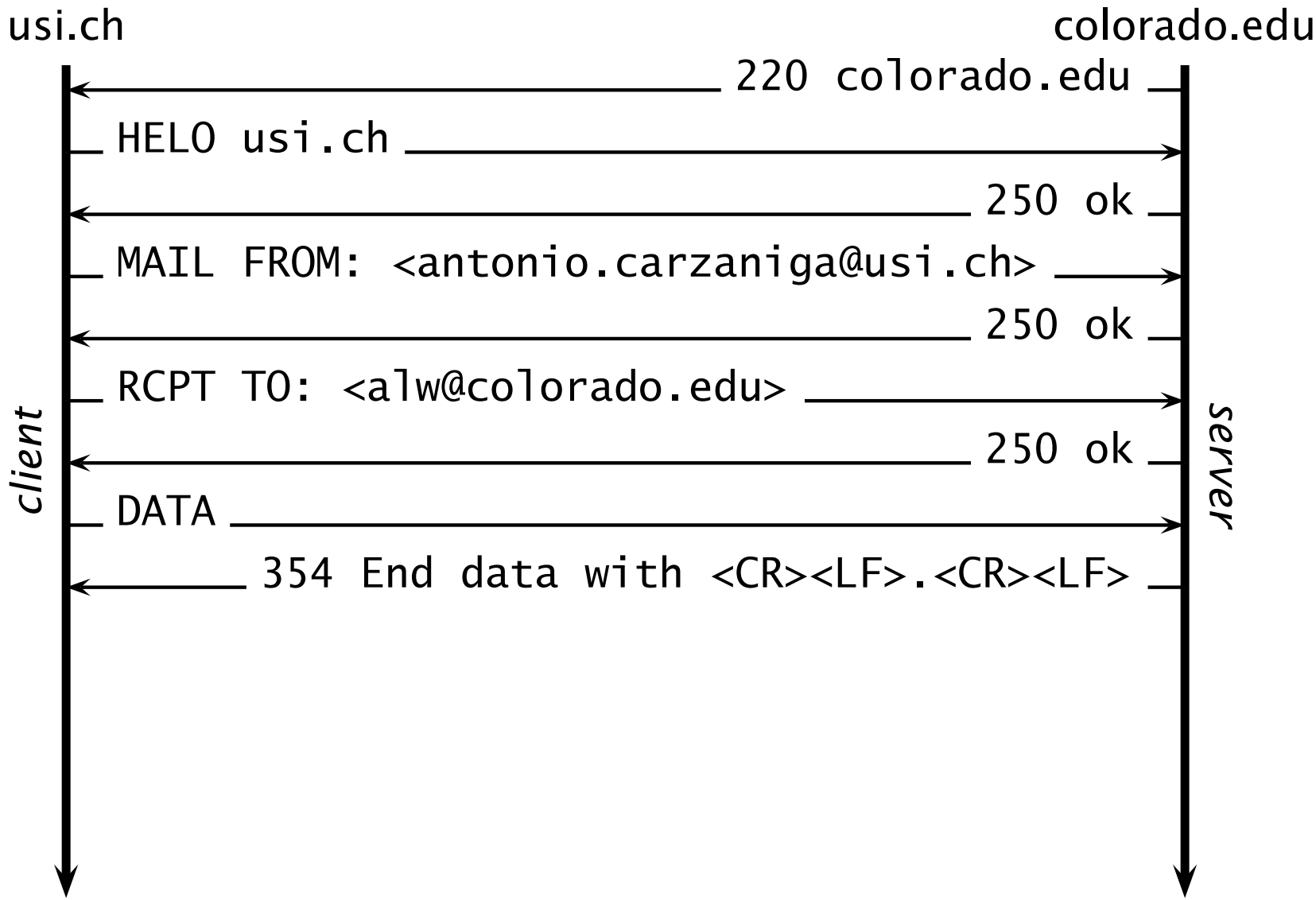

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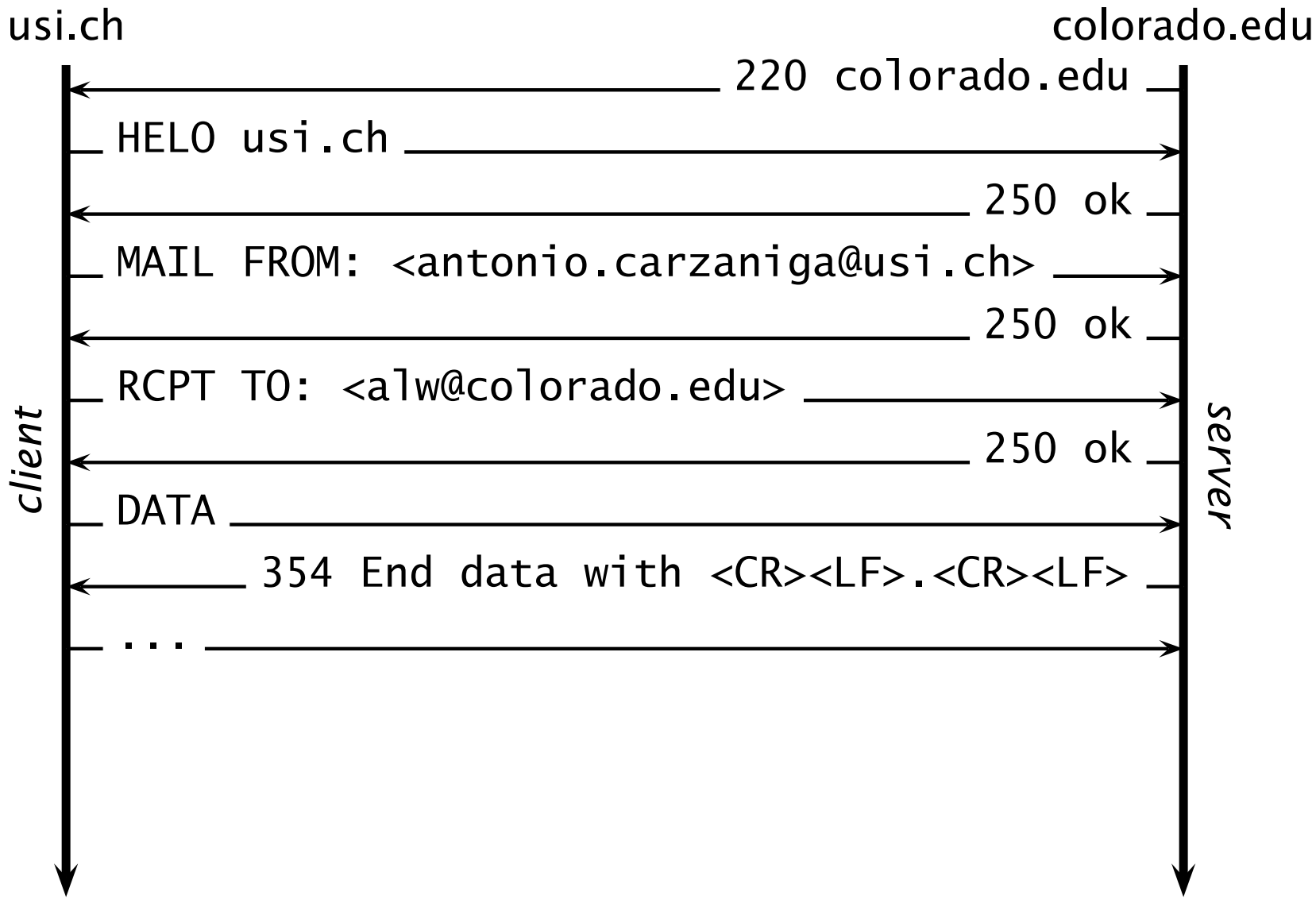

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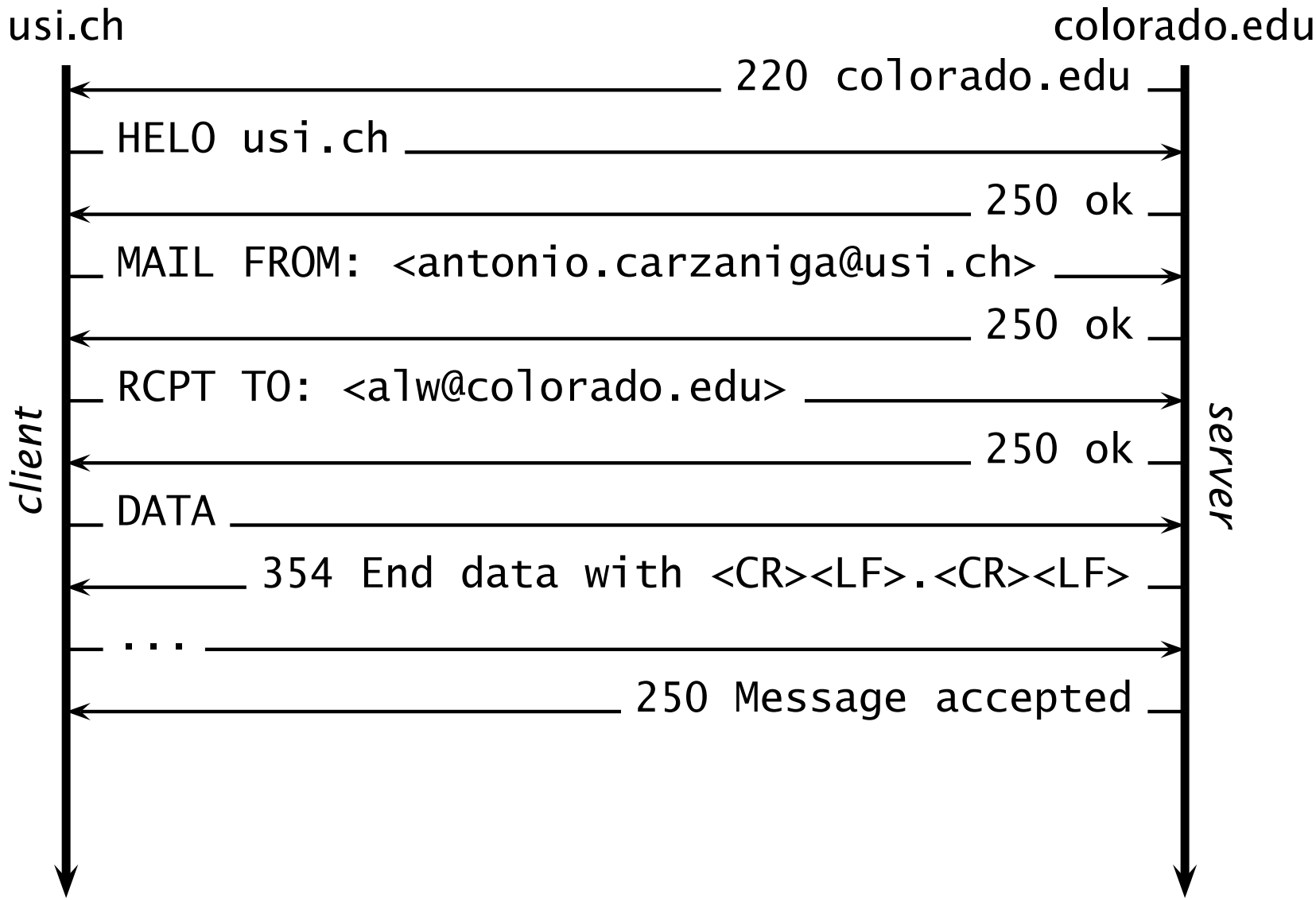

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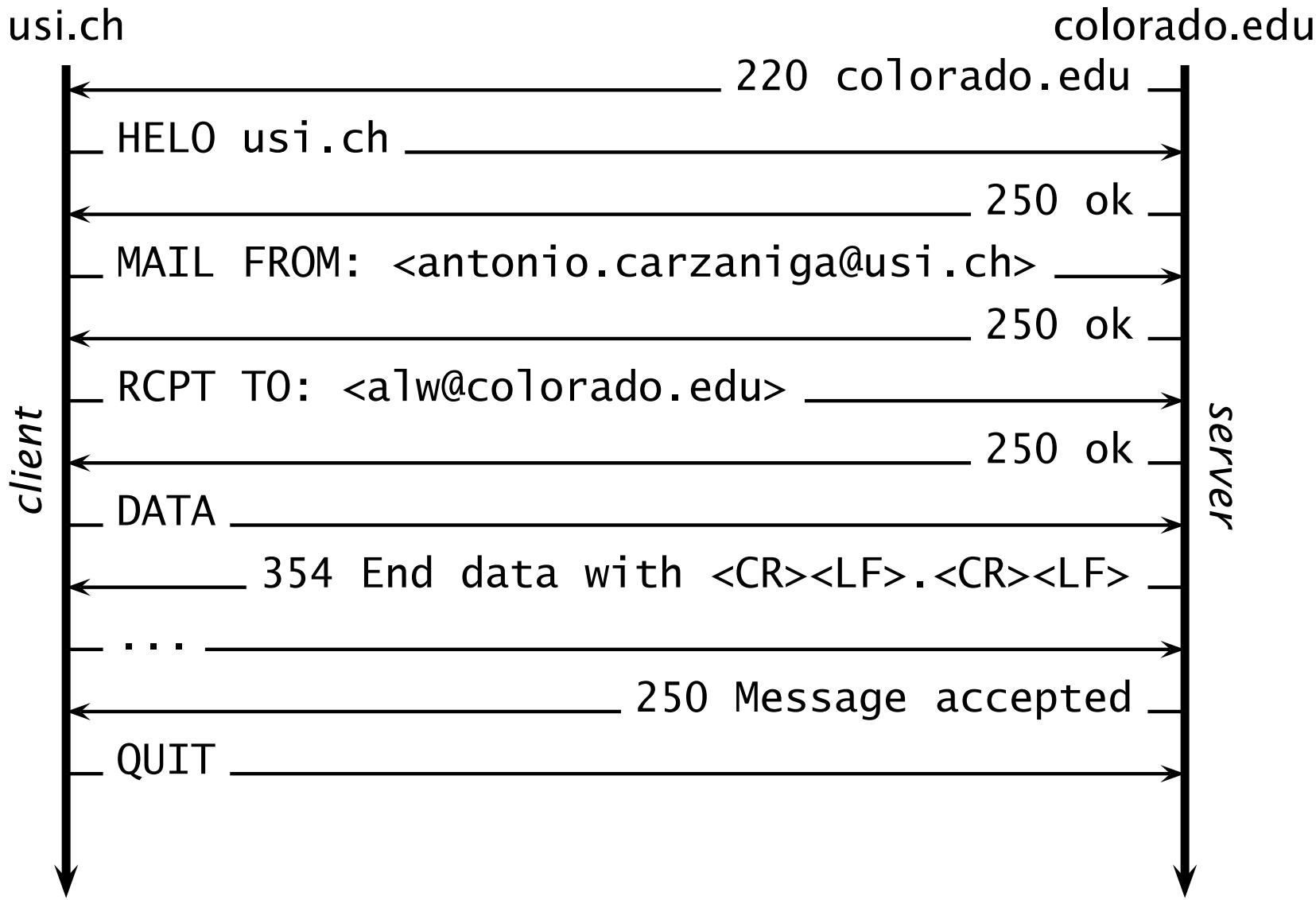

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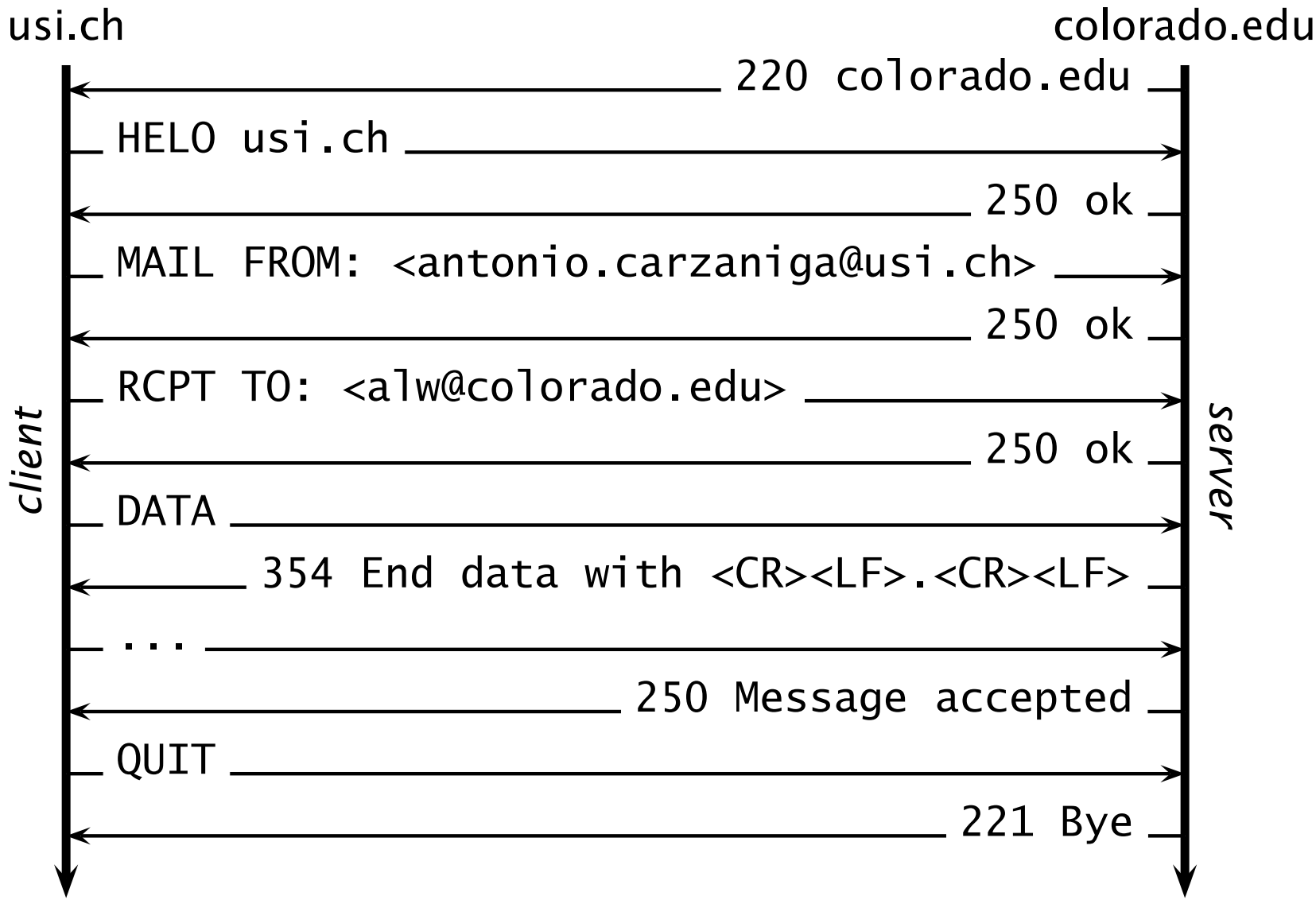

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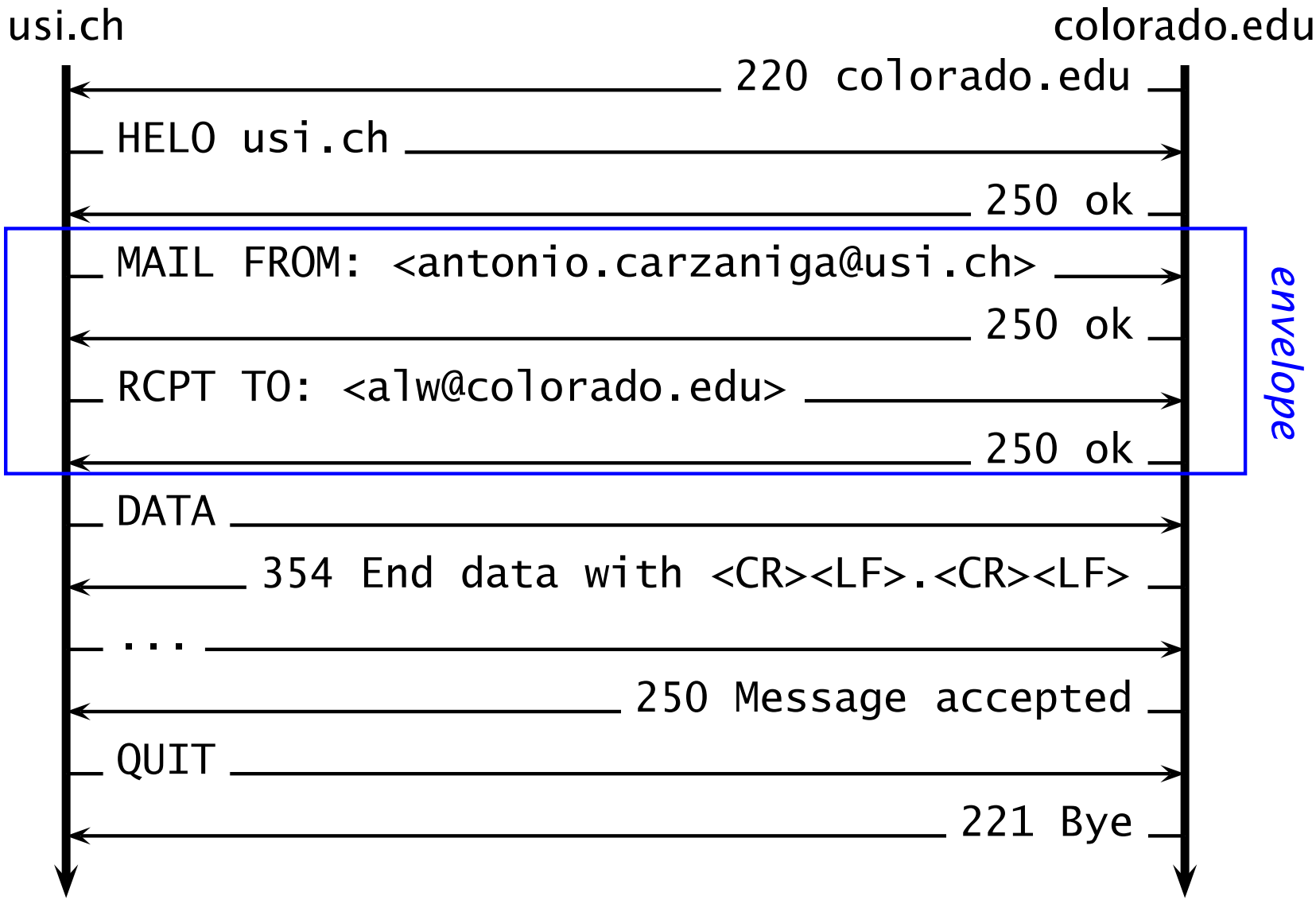

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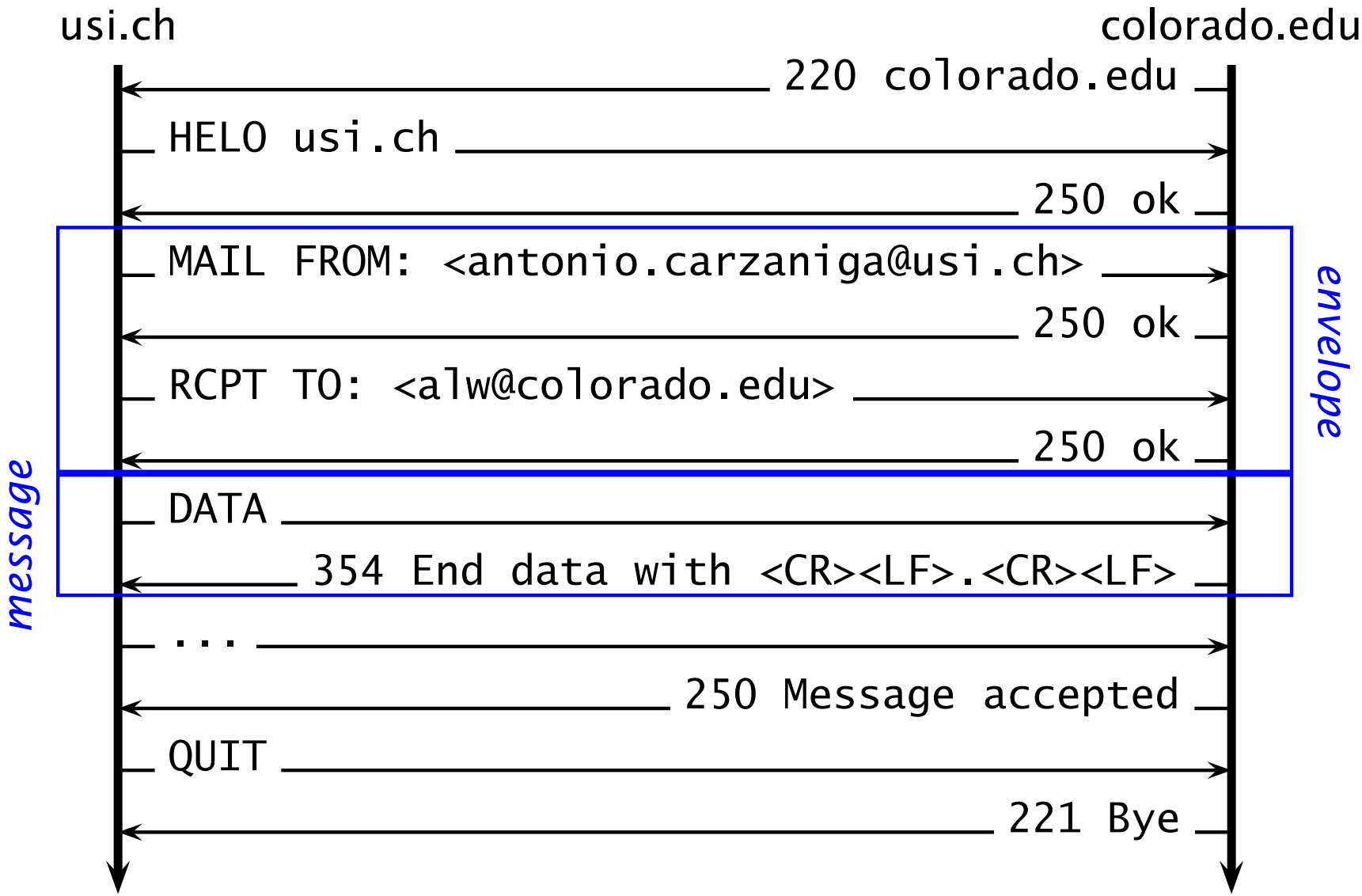

Message Format

Message Format

```
From:  antonio.carzaniga@usi.ch
Date:  Mon, 3 Apr 2005 16:48:22 -0600 (MDT)
To:  carzanig@cs.colorado.edu
Subject:  how to send fake e-mail messages

Hey Dude,
I heard this story about forging messages.
Do you know anything about that?
...
```

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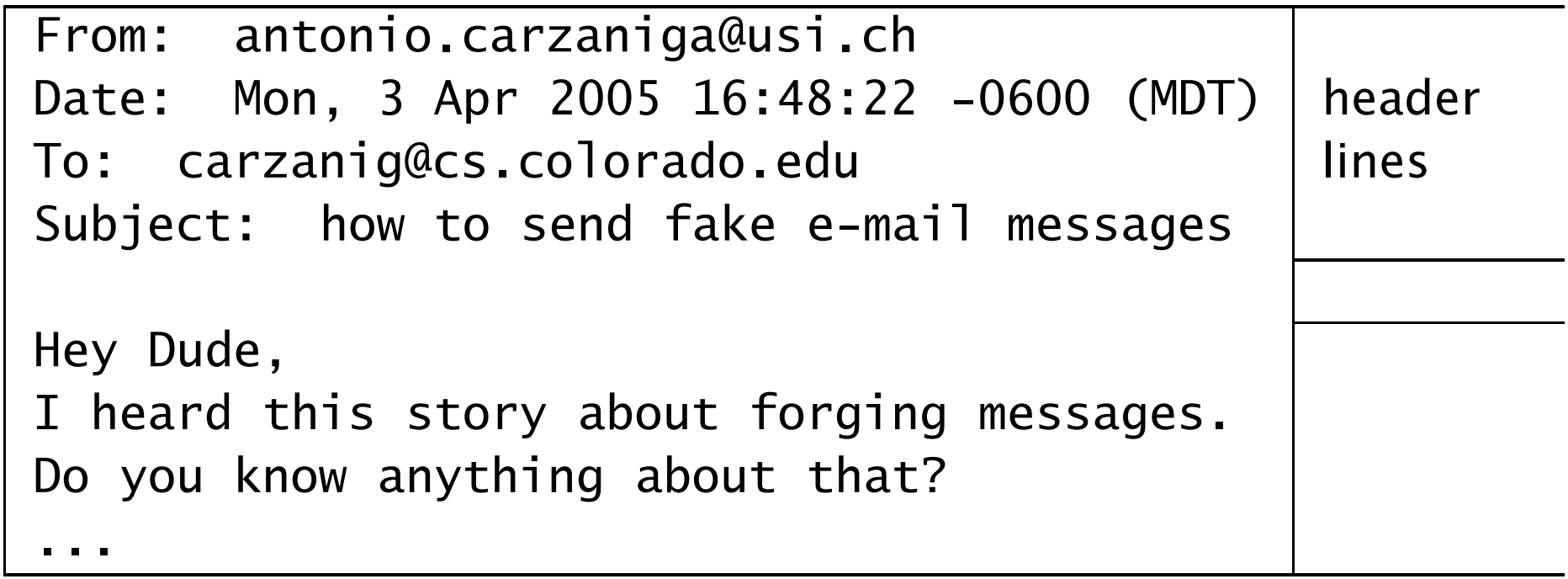

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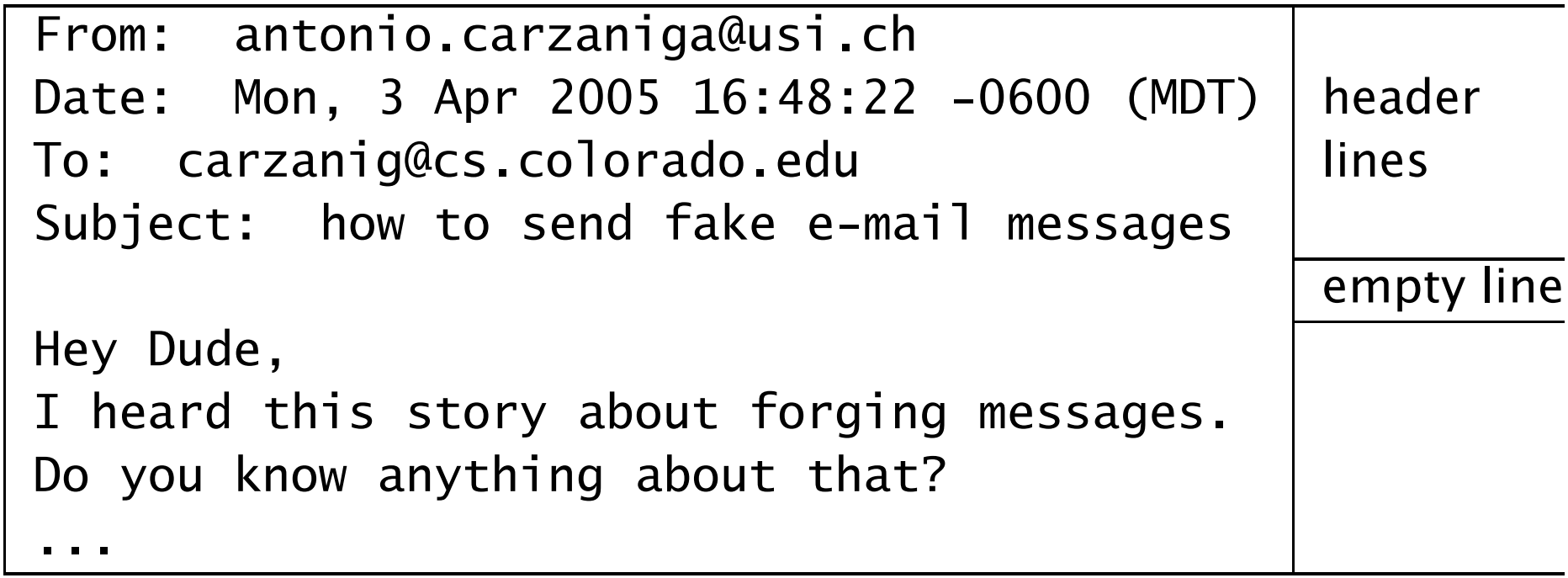

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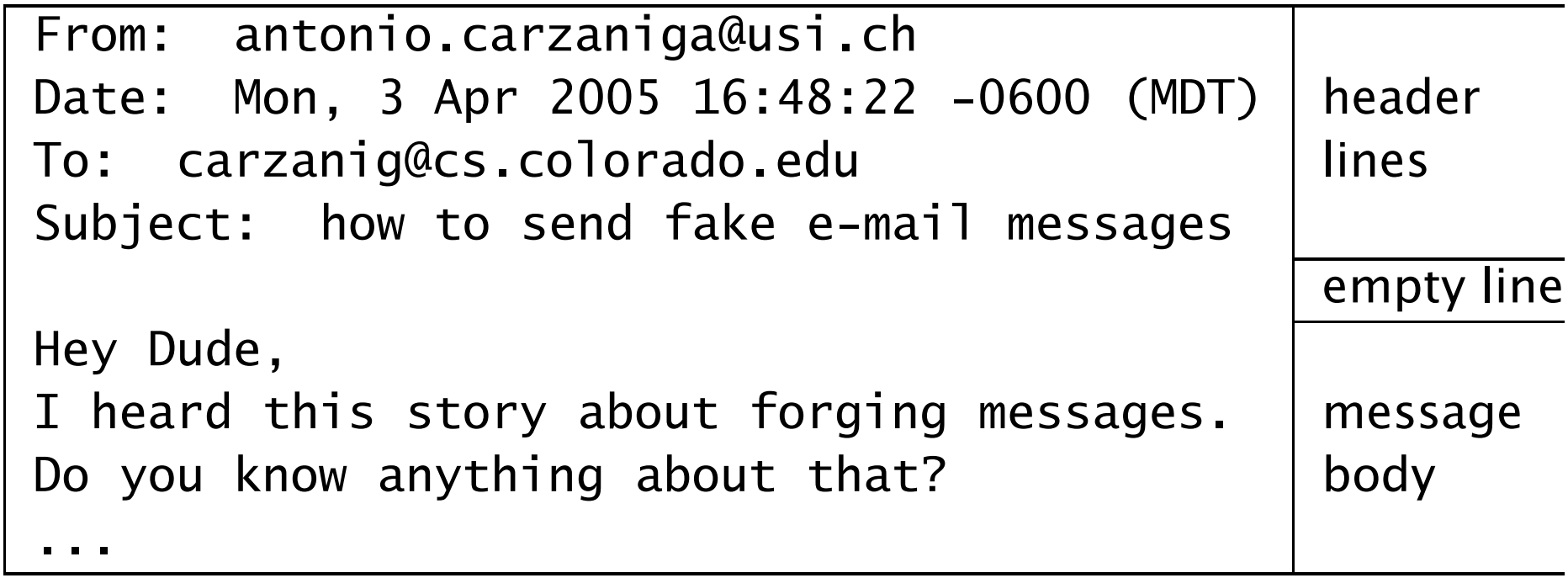

`Received:` Headers

- SMTP is almost completely oblivious to the content of a message. One exception is the `Received:` header.
- Every receiving SMTP server must add a `Received:` header.

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- Every receiving SMTP server must add a Received: header.

```
Received:  from mroe.cs.colorado.edu (mroe-fs.cs.colorado.edu
    [128.138.242.197])
    by serl.cs.colorado.edu (Postfix) with ESMTP id 9AC463D07
    for <carzanig@serl.cs.colorado.edu>; Mon, 3 Apr 2006 13:39:28 -0600
Received:  from max.colorado.edu (max.colorado.edu [128.138.129.234])
    by mroe.cs.colorado.edu (Postfix) with ESMTP id 541C8577A
    for <carzanig@cs.colorado.edu>; Mon, 3 Apr 2006 13:43:59 -0600
Received:  from cs.colorado.edu (host132-91.pool82107.interbusiness.it
    [82.107.91.132])
    by max.colorado.edu (8.13.6/8.13.6/Hesiod+SSL) with ESMTP id ...
    for <carzanig@cs.colorado.edu>; Mon, 3 Apr 2006 13:38:12 -0600
```

Message vs. Envelope

Consider the following SMTP client directives

Message vs. Envelope

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1. `MAIL FROM: <antonio.carzaniga@usi.ch>`

Message vs. Envelope

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1. `MAIL FROM: <antonio.carzaniga@usi.ch>`
2. `RCPT TO: <carzanig@cs.colorado.edu>`

Message vs. Envelope

Consider the following SMTP client directives

1. MAIL FROM: <antonio.carzaniga@usi.ch>
2. RCPT TO: <carzanig@cs.colorado.edu>
3. From: Barak H. Obama <president@whitehouse.gov>
   To: Deserters <all@iobject.org>
   Subject: warning...

   You can run, but you can't hide!

Message vs. Envelope

Consider the following SMTP client directives

1. `MAIL FROM: <antonio.carzaniga@usi.ch>`
2. `RCPT TO: <carzanig@cs.colorado.edu>`
3. ```
   From:  Barak H. Obama <president@whitehouse.gov>
   To:  Deserters <all@iobject.org>
   Subject:  warning...

   You can run, but you can't hide!
   ```

- Anything wrong with this exchange?
   ```

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- The `MAIL FROM:` and `RCPT TO:` *SMTP messages* specify *envelope addresses*
- `From:` and `To:` (and `Cc:`) *headers within a message* define *message addresses*
- There are many situations in which it is perfectly legitimate to have envelope addresses that don't match up with the message addresses

Message vs. Envelope

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- The *Multipurpose Internet Mail Extensions (MIME)* specification (RFC 2045 and RFC 2046) defines *extensions* of the basic message format that support all of the above

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- Supports different encodings for text (different from ASCII)
- Supports messages consisting of multiple parts
  E.g.,
  - a message containing some text and an image
  - a message containing a binary attachment (e.g., an executable program, a document, etc.)
  - a message containing another message
  - a message containing some Italian text plus another message containing German text
  - a message containing another message, conataining another message, ...

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The primary mechanism used by MIME extensions consists of added *MIME headers*

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- This format is naturally recursive

MIME Example

```
MIME-Version:  1.0
Content-Type:  multipart/mixed; boundary="gJ7ppttFJL"
Content-Transfer-Encoding:  7bit
Date:  Fri, 15 Apr 2005 15:24:31 +0200
From:  Antonio Carzaniga <antonio.carzaniga@usi.ch>
To:  Antonio Carzaniga <carzanig@cs.colorado.edu.ch>
Subject:  Immagini e testo

-gJ7ppttFJL
Content-Type:  text/plain; charset=iso-8859-15
Content-Description:  message body text
Content-Transfer-Encoding:  quoted-printable

questo =E8 un esempio di un messaggio che usa il formato MIME.

-A


-gJ7ppttFJL
Content-Type:  image/png
Content-Disposition:  inline;
filename="anto.png"
Content-Transfer-Encoding:  base64

iVBORw0KGgoAAAANSUhEUgAAAMgAAADICAIAAAAiOjnJAAAACXBIWXMAAAIxAAACMQF3BQBZAAAA
B3RJTUUH1AwdCiYGBdI1HQAAIABJREFUeNqEu1mMJteVJnaWe2P5l/wz88+tcqusnRT3fRMpiqOW
Wt0De9w9bczAGAM2jPHAfvOLDcNvfvODAW8YeOClDbeN7ullZnpa6kUttZqiKIoiWawiWaxibVlZ
uVTu+a+x3HvO8UOq7cEAxsRTRCAiXuLDud928T/7L/6hoDZazYnu8kxnbqLdbbab7Xa71ZxoNZt5
...
Ts2sSh8efiVxP3z3GtgR5/9Wz/8DNJKaidrd/8MAAAAASUVORK5CYII=
-gJ7ppttFJL-
```