The Transport Layer

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University of Lugano

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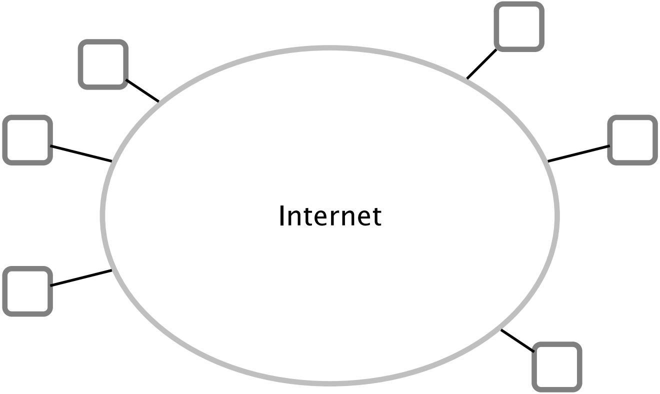
Outline

- Basic concepts in transport-layer protocols
- Multiplexing/demultiplexing
- UDP message format
- Reliable transfer

Transport Layer



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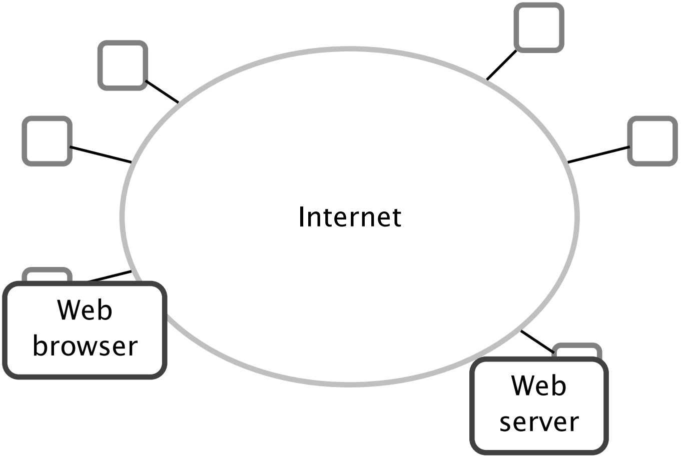

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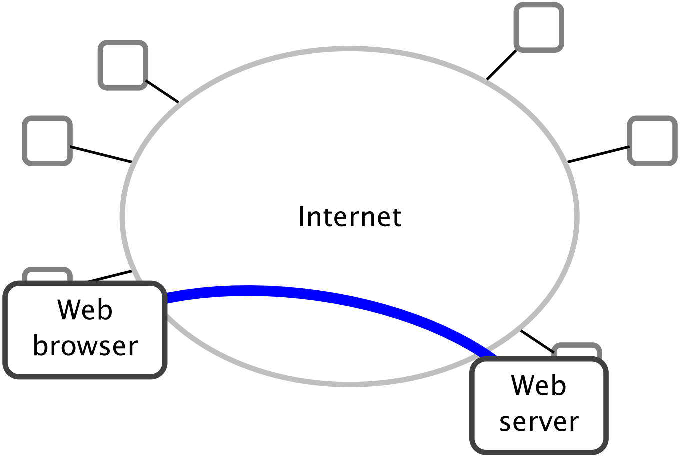

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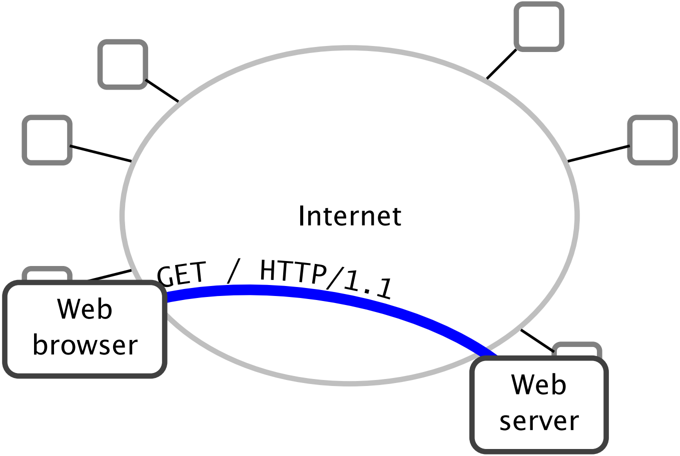

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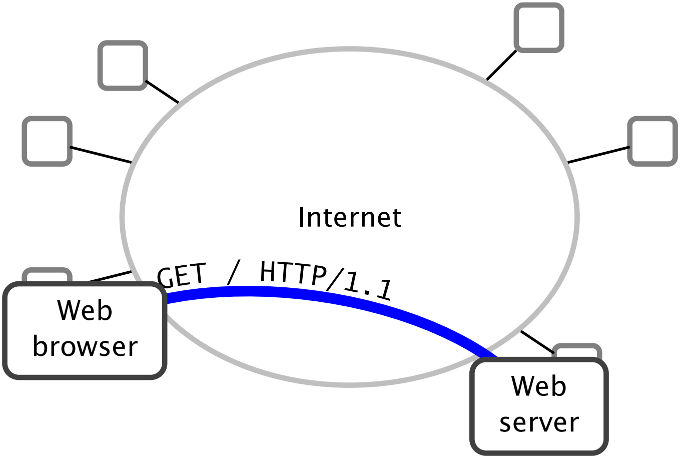


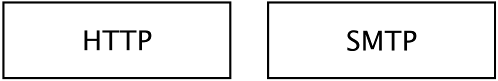
Primitive communication between applications

Type of Service

Type of Service

HTTP

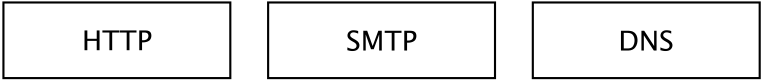
Type of Service



HTTP

SMTP

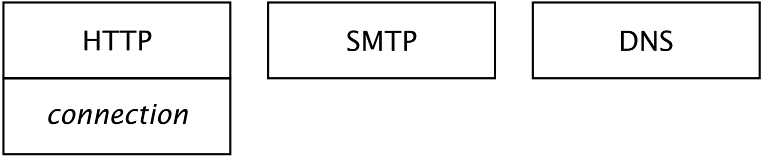
Type of Service


HTTP

SMTP

DNS

Type of Service



HTTP

SMTP

DNS

connection

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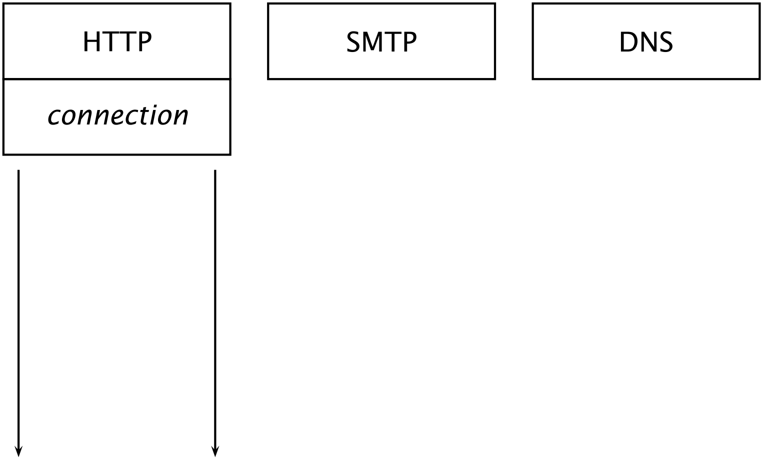

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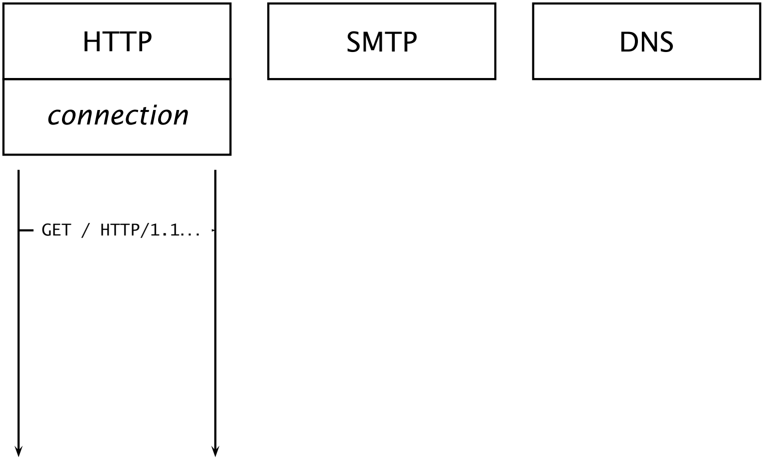

HTTP

SMTP

DNS

connection

```
GET / HTTP/1.1...
```

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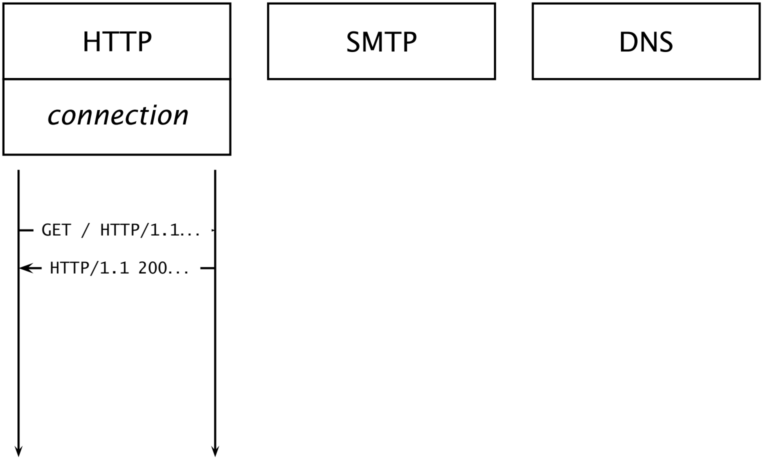

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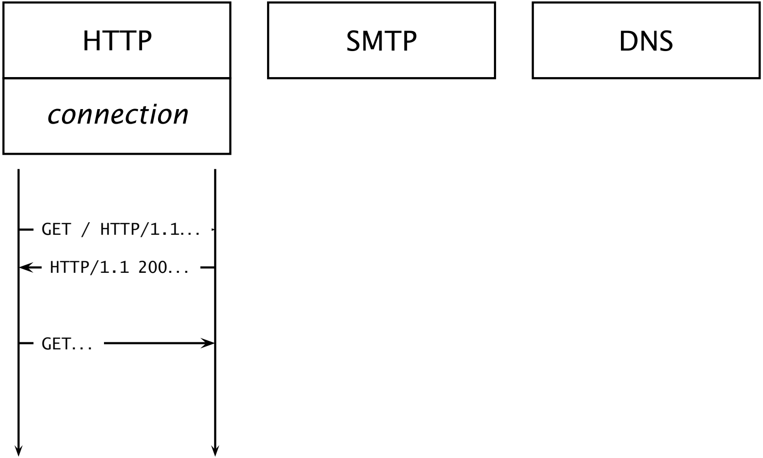

HTTP

connection

SMTP

DNS

GET / HTTP/1.1...

HTTP/1.1 200...

GET...

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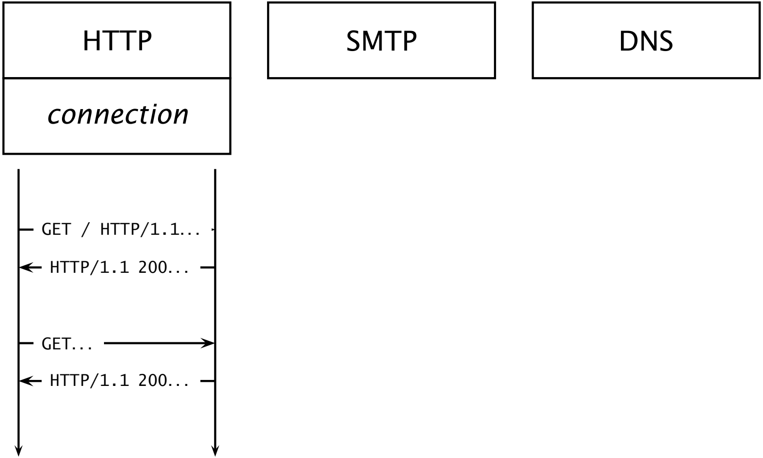

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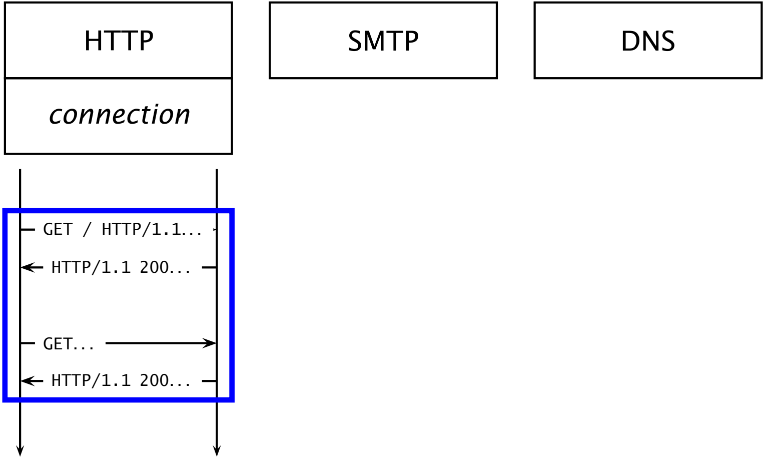

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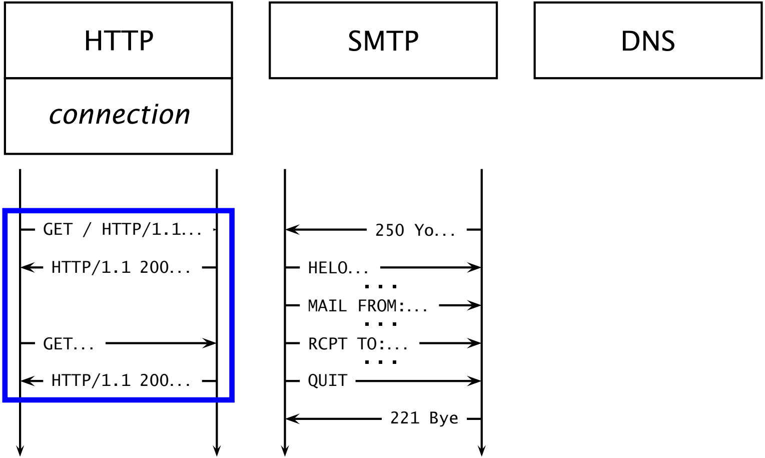

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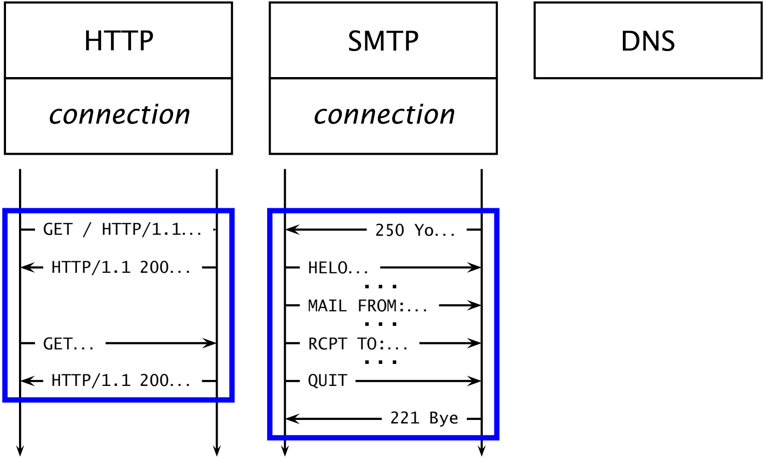

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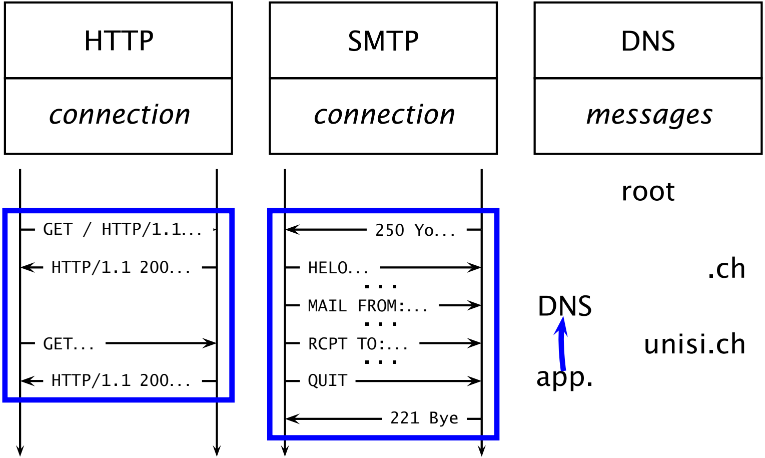

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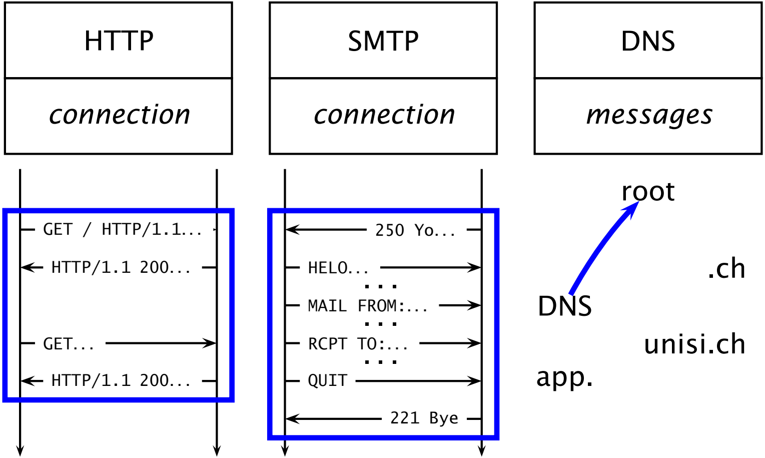


HTTP

connection

GET / HTTP/1.1...

HTTP/1.1 200...

GET...

HTTP/1.1 200...

SMTP

connection

250 Yo...

HELO...

...

MAIL FROM:...

...

RCPT TO:...

...

QUIT

221 Bye

DNS

messages

root

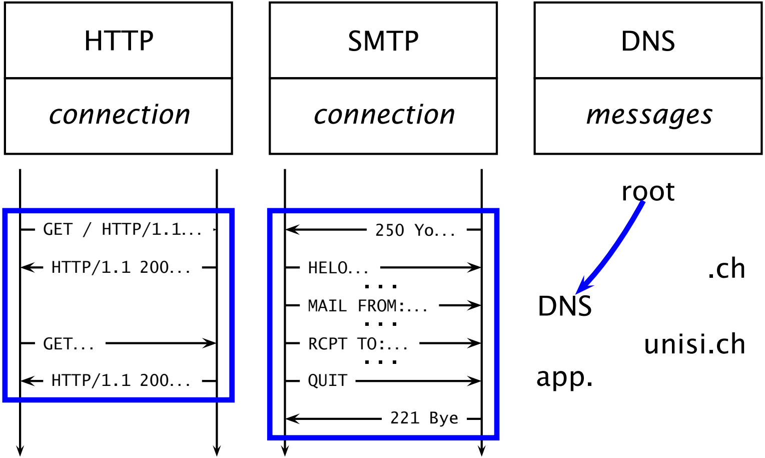
.ch

DNS

unisi.ch

app.

Type of Service



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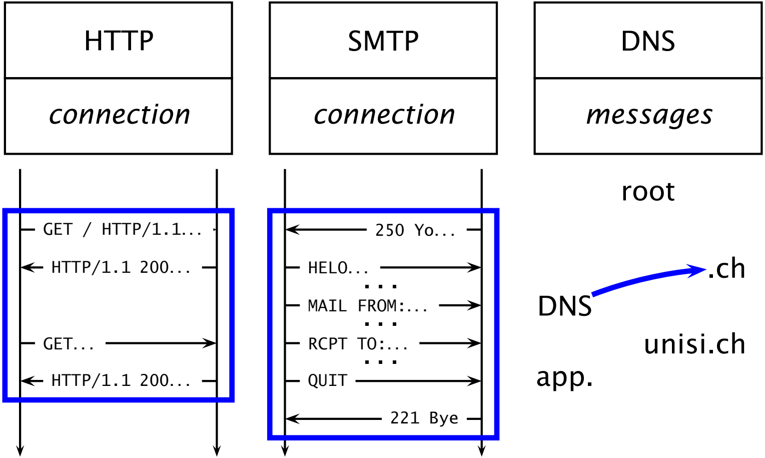

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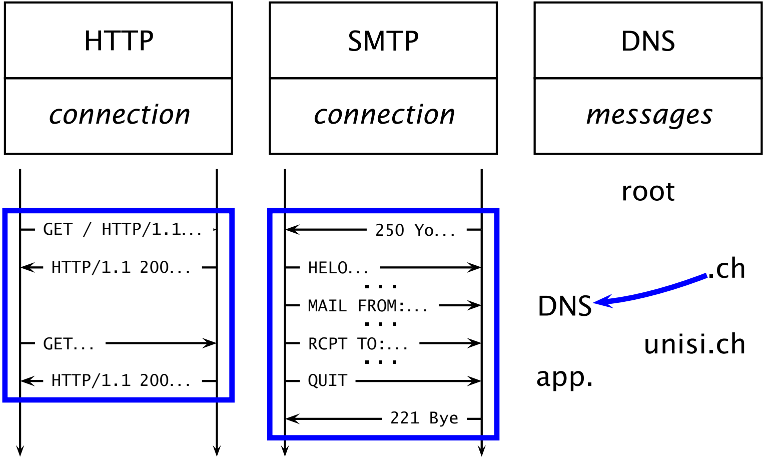

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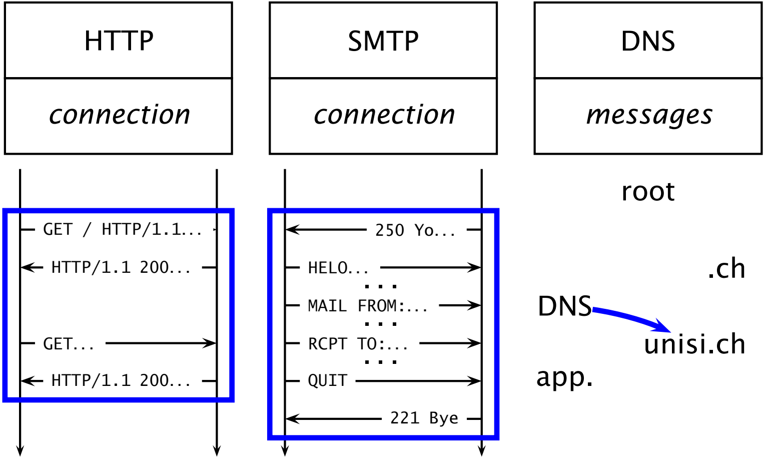

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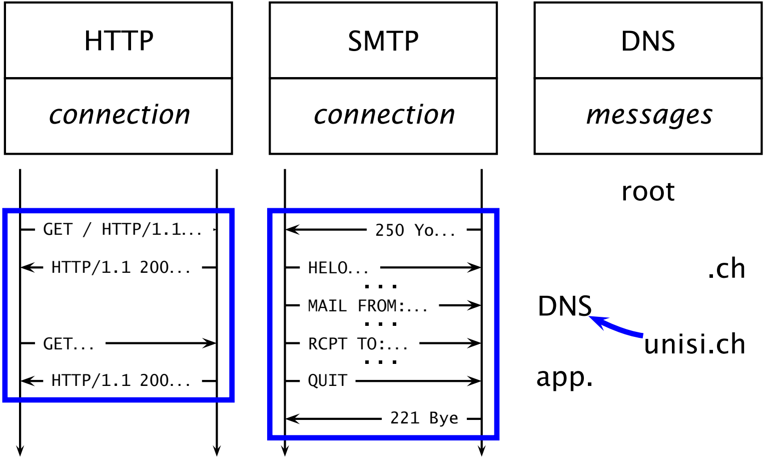

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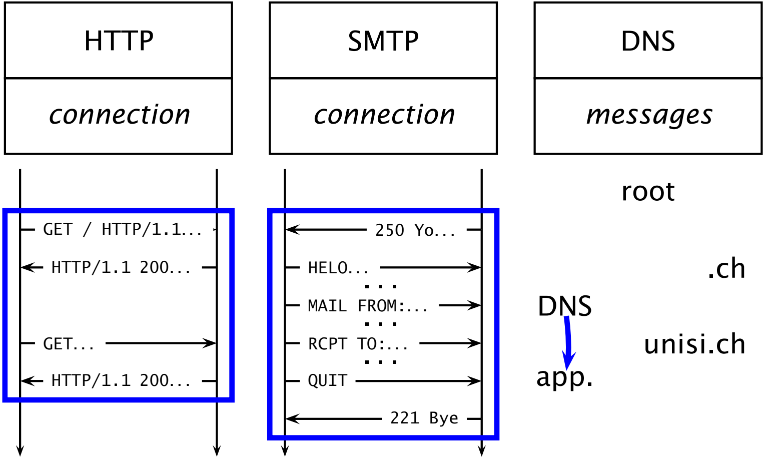

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- Basic assumptions on the underlying network layer
  - every host has one unique *IP address*
  - best-effort delivery service
    - no guarantees on the integrity of segments
    - no guarantees on the order in which segments are delivered

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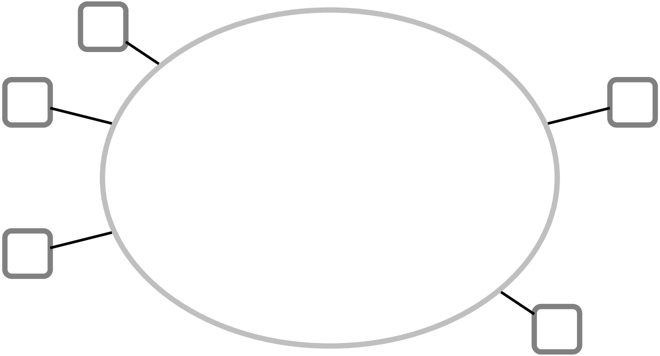
  - i.e., streams
  - can be seen as the same as ordered delivery
- *Congestion control*
  - i.e., end-to-end traffic (admission) control so as to avoid destructive congestions within the network

Multiplexing/Demultiplexing



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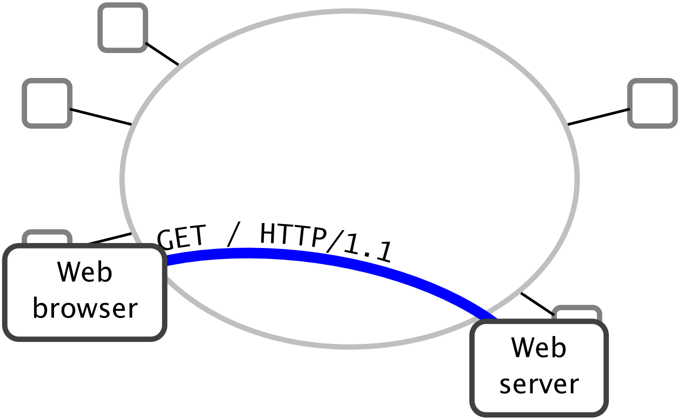

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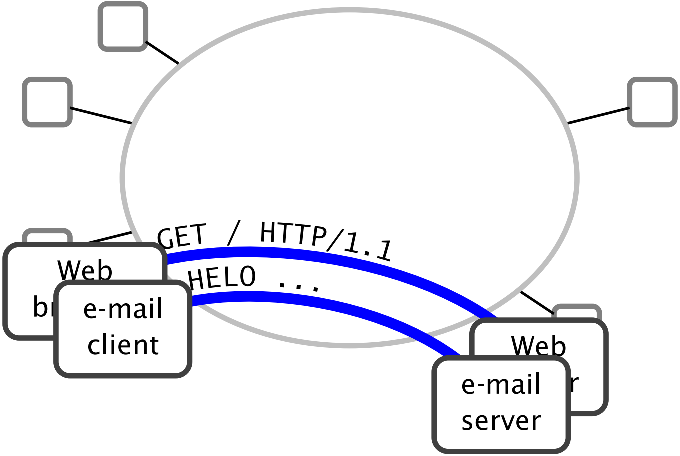

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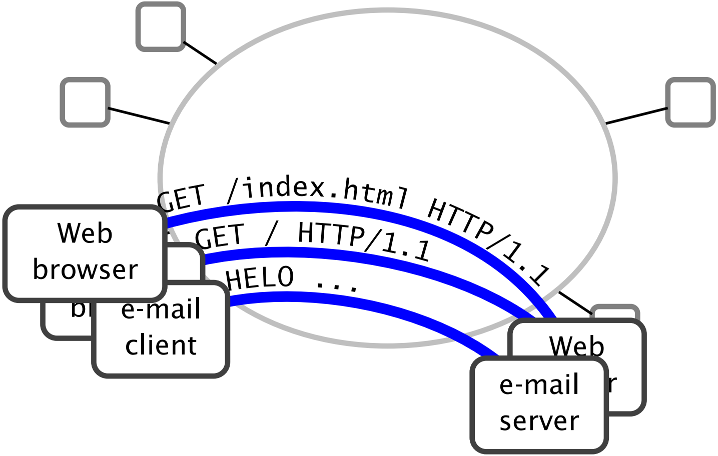

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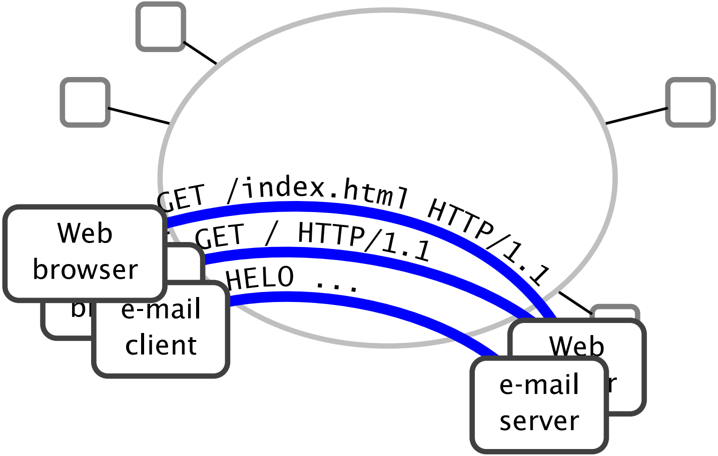

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Ports

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- How do we find out which application (host and port number) to connect to?
  - outside the scope of the definition of the transport layer
  - but of course we can have "well-known" service numbers

Ports

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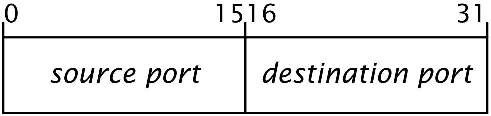

0 … 15	16 … 31
source port	*destination port*

. . .

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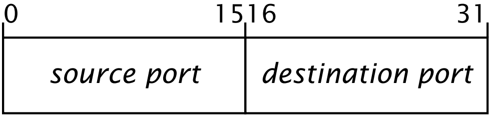

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source port *destination port*

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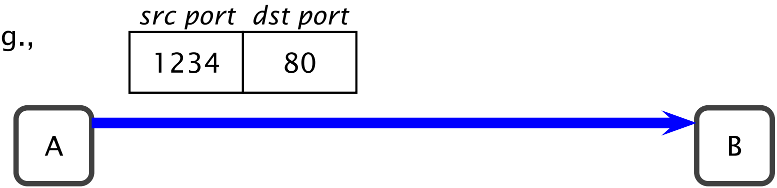
- E.g.,



src port *dst port*

1234 80

A B

Ports

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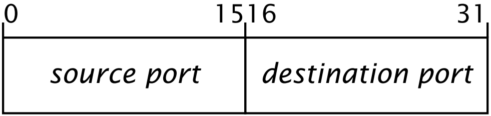

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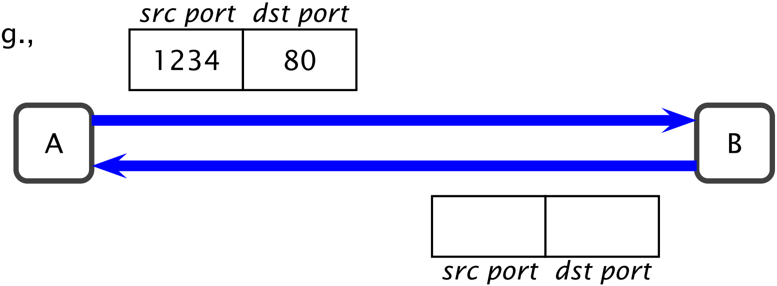

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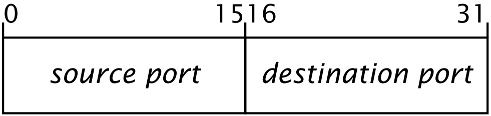

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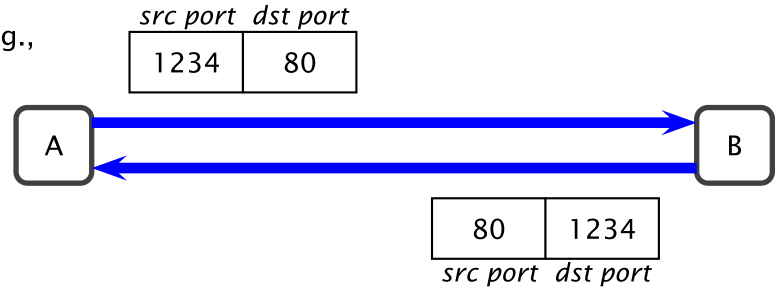

src port *dst port*

1234 80

A

B

80 1234

src port *dst port*

UDP Packet Format

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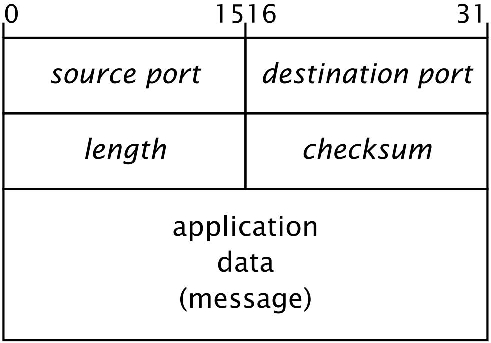
- The UDP message format is very simple



0 15 16 31

source port *destination port*

length *checksum*

application
data
(message)

UDP Features

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- What if there is no application at the other end?
- How is the checksum computed?
  - which parts of the segment does it cover?
- What should happen when the checksum doesn’t check?