Network Applications and the Web

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Outline

- General concepts for network applications
- Client/server architecture
- The world-wide web
- Basics of the HTTP protocol

Examples of Network Applications

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- Remote on-line banking
- Network telephony
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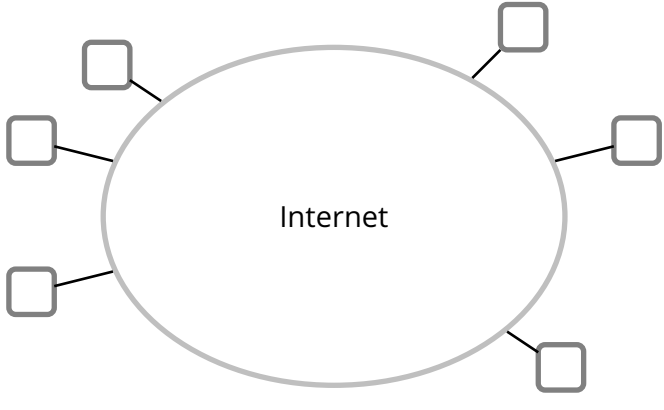

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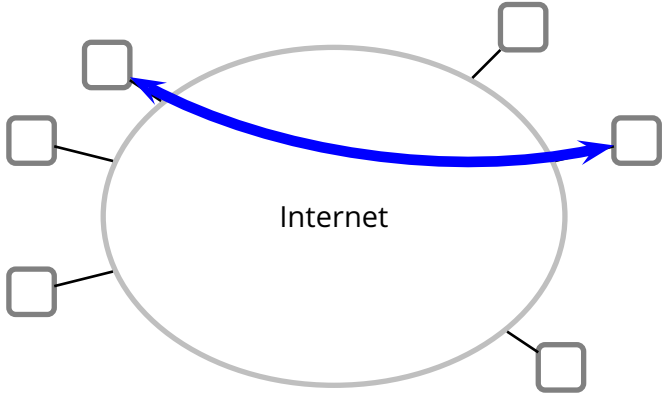

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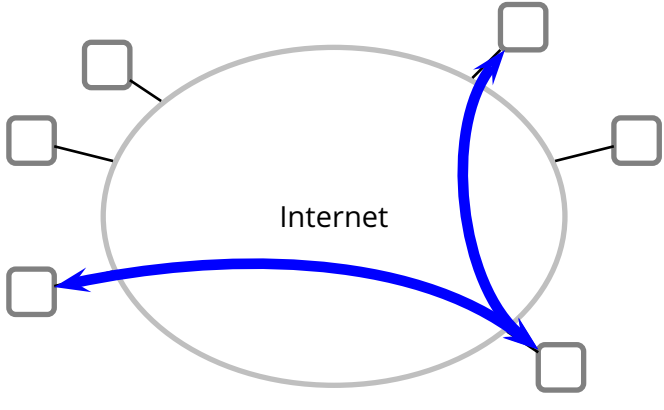

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- A single *sequential* program
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- Processes may exchange messages
  - obviously, received messages can be considered as input to a process (program)
- Different processes may be running on different end systems
  - possibly on different computers
  - running different operating systems
  - a process must be able to *address* another specific process

Example

```
while(browsing) {
  url = read_url(keyboard);
  page = get_web_page(url);
  display_web_page(page);
}
```

```
while(serving_pages) {
  page_name = read_web_request(network);
  page = read_file(page_name, disk);
  write_page(page, network);
}
```

Example

```
while(chatting) {
  msg = read_message(keyboard);
  write_message(msg, network);
  msg = read_message(network);
  write_message(msg, screen);
}
```

```
while(chatting) {
  msg = read_message(network);
  write_message(msg, screen);
  msg = read_message(keyboard);
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- Some applications have processes that act both as clients and servers. This is often called *peer-to-peer* architecture
- *Caveat:* this classification is useful, but it is little more than nomenclature. Some applications and protocols mix and confuse those terms (e.g., FTP)

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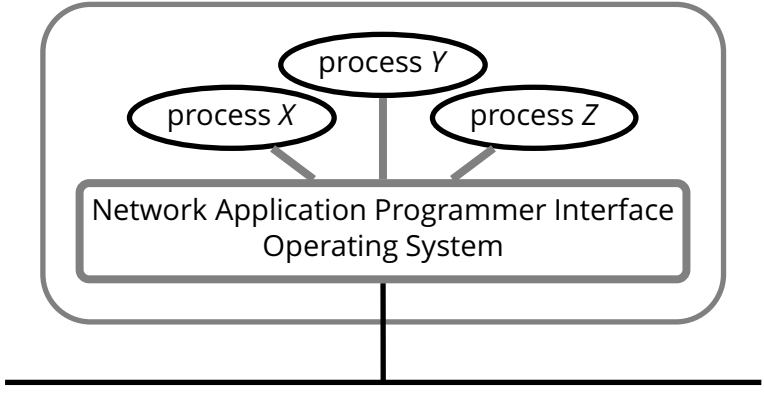

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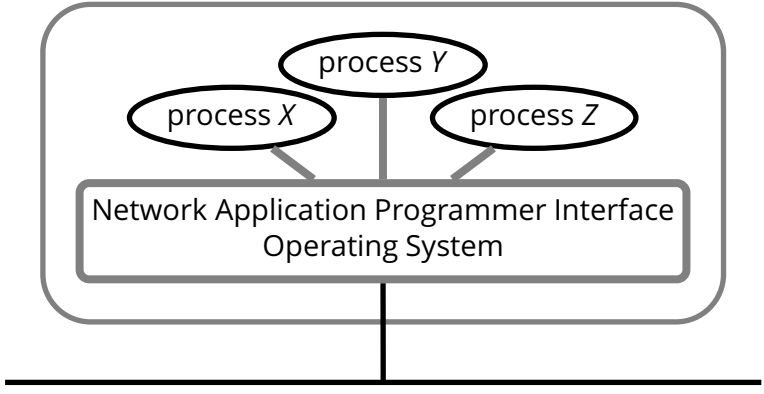

- A process is addressed (within its host) by its ***port number***

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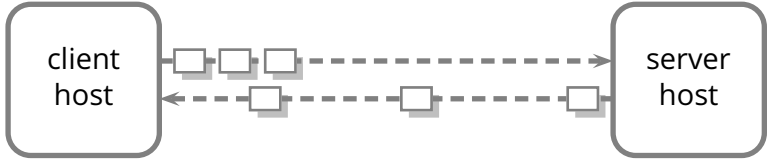

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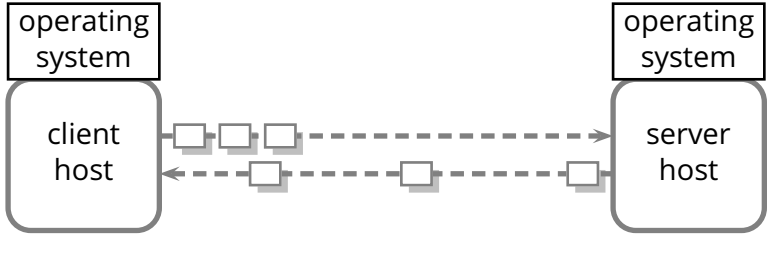

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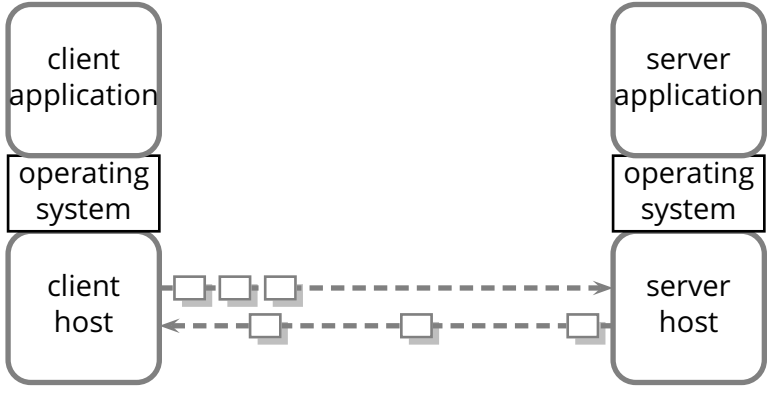

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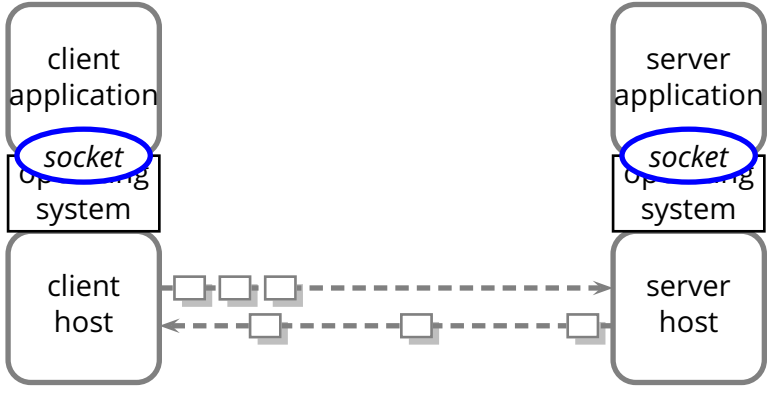

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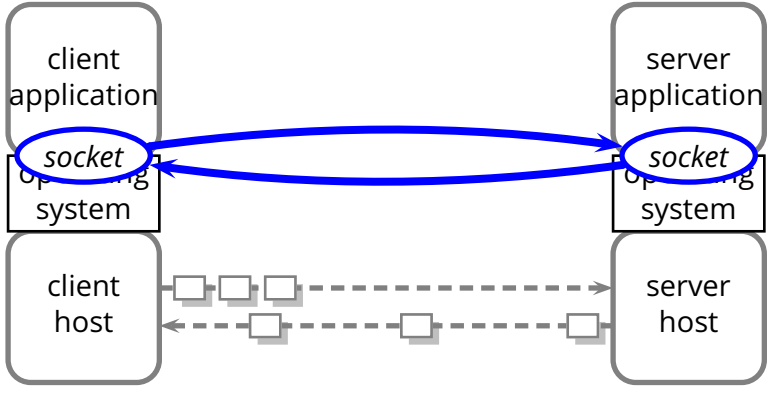

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while(browsing) {
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  socket = open_connection(url);
  request = compose_http_request(url);
  write_message(request, socket);
  reply = read_message(socket);
  display_web_page(reply); }
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while(serving_http) {
  socket = accept_connection();
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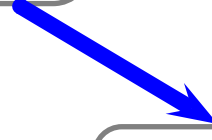

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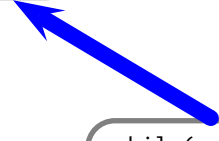

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  - the idea of *hypertext* and *links* was already quite old at the time HTTP was developed
- Success factors
  - simplicity (openness) of the HTML language and
  - simplicity of HTTP (a stateless protocol)
  - low entry barrier for “publishers”
  - GUI browsers (remember Netscape? Or Mosaic?!), search engines (AltaVista?!), etc.

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- ***browser***—also called *user agent* is the program that users run to get and display documents
- ***Web server***—is an application that houses objects, and makes them available through the HTTP protocol

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- Consists of ***a sequence of requests*** issued by the client, and ***responses*** issued by the server, each one in response to a single request
- HTTP is *stateless*
  - the behavior (semantics) of an HTTP request does not depend on any previous request

Example: Request

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- Client request

```
GET /carzaniga/index.html HTTP/1.1
Host: www.inf.usi.ch
Connection: close
User-agent: Mozilla/4.0
Accept-Language: it

```

Example: Reply

Example: Reply

- Server reply

```
HTTP/1.1 200 OK
Connection: close
Date: Tue, 15 Mar 2005 10:00:01 GMT
Server: Apache/1.3.0 (Unix)
Last-Modified: Tue, 8 Mar 2005 16:44:00 GMT
Content-Length: 2557
Content-Type: text/html

<!DOCTYPE HTML PUBLIC "-/W3C//DTD HTML 4.01//EN"
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  - content specification (type, length)
  - content

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- A mechanism to negotiate the protocol version allows the protocol design to change
  - *design for change*

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The Host Header

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- The *host name* is also passed as a parameter within the request, so that the server knows the full URL

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User-agent: Mozilla/4.0
Accept-Language: it
```

- The *host name* in the URL determines where the request goes
  - host name maps to a network address
- The *host name* is also passed as a parameter within the request, so that the server knows the full URL
  - this is to allow a single server to serve multiple “virtual” sites (e.g., atelier.inf.usi.ch and www.inf.usi.ch)

```
GET /carzaniga/index.html HTTP/1.1
Host: www.inf.usi.ch
Connection: close
User-agent: Mozilla/4.0
Accept-Language: it
```

```
HTTP/1.1 200 OK
Connection: close
Date: Tue, 15 Mar 2005 10:00:01 GMT
Server: Apache/1.3.0 (Unix)
Last-Modified: Tue, 8 Mar 2005 16:44:00 GMT
Content-Length: 2557
Content-Type: text/html

<!DOCTYPE HTML PUBLIC "-/W3C//DTD HTML 4.01//EN"
. . .
```

Connection

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Host: www.inf.usi.ch
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  - the default behavior is to use persistent connections
  - "`Connection: close`" in the request and response indicates the intention, of the client and server, respectively, to *not* use a persistent connection

How HTTP Uses Persistent Connections

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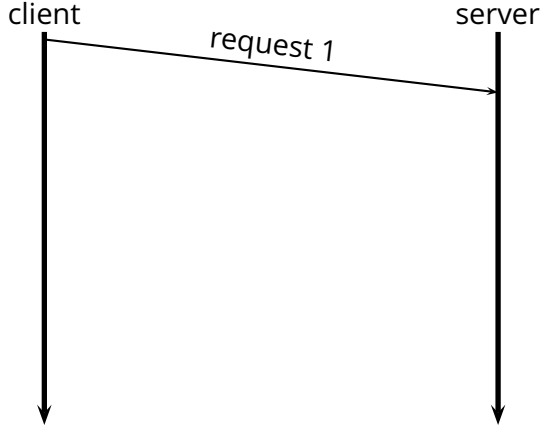

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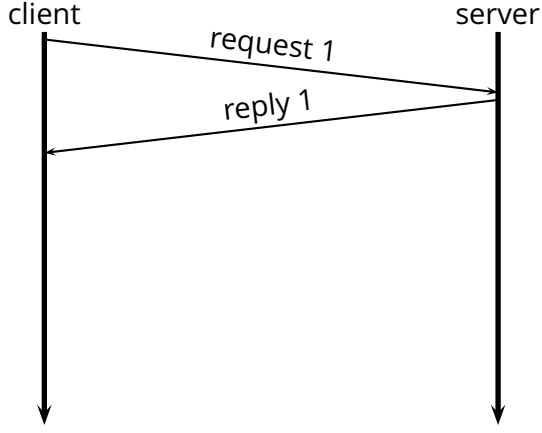

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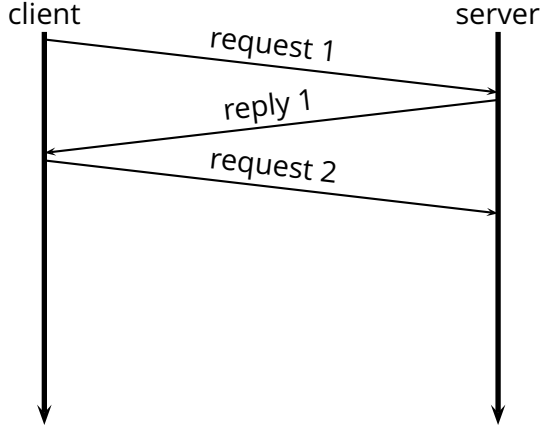

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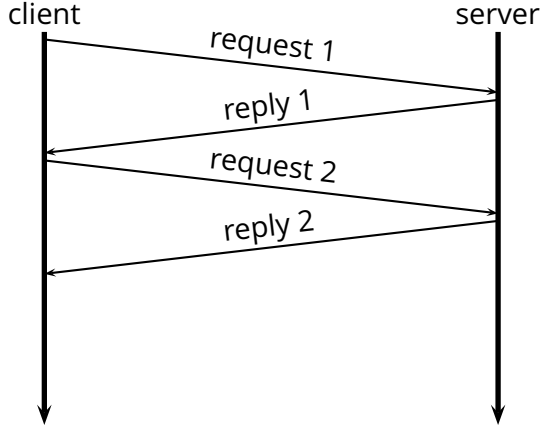

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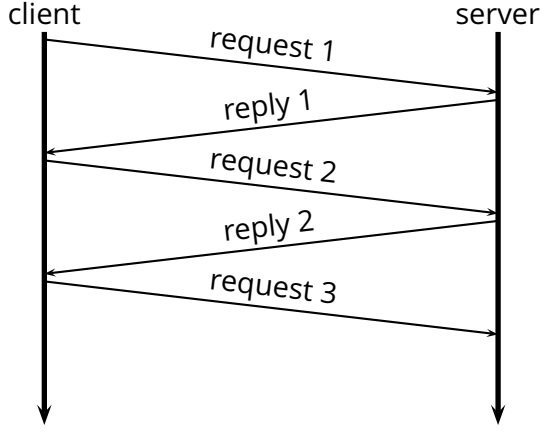

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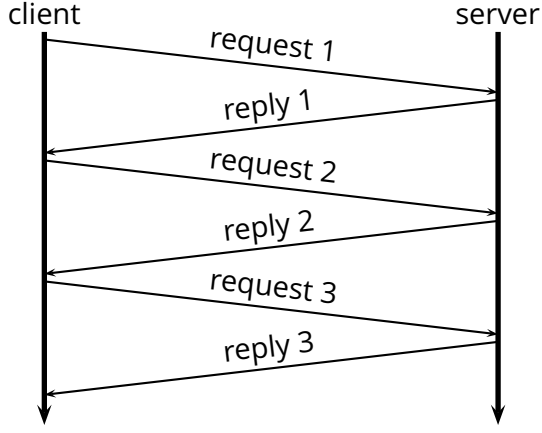

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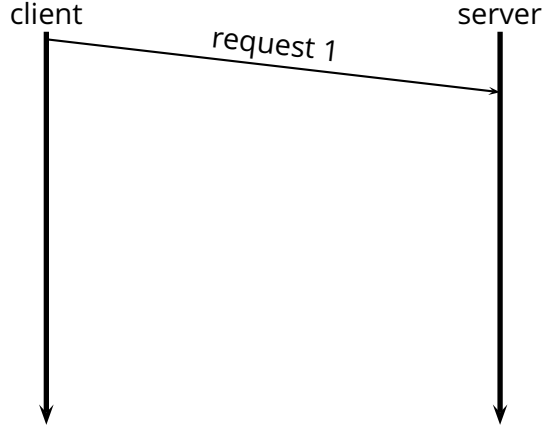

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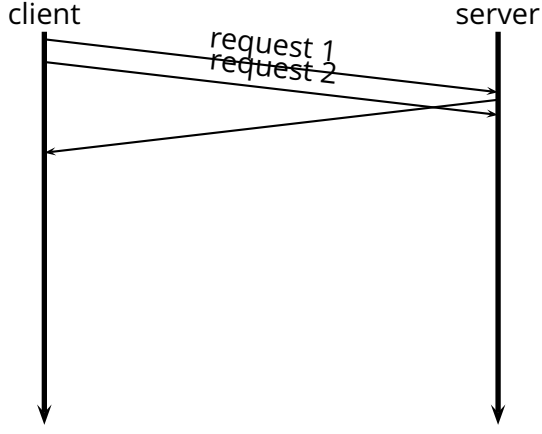

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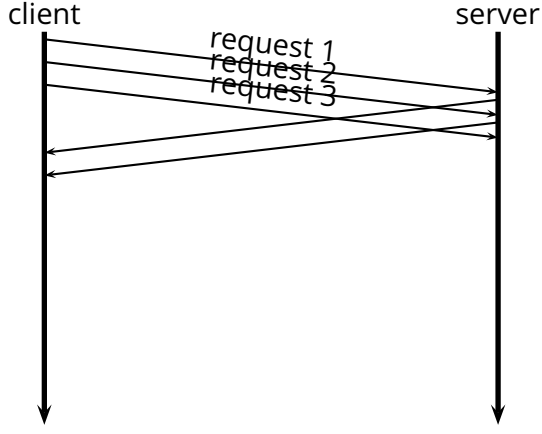

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