Internet Applications

Understanding the HTTP Protocol

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What is HTTP?

- **HTTP** stands for **Hypertext Transfer Protocol**
- It is an **application-level protocol** used to exchange information between:
  - **Client:** typically a web browser or app
  - **Server:** hosts web content or APIs
- **Stateless:** Each request is independent and has no memory of previous interactions

Example:
When you type https://www.example.com
→ Browser sends an HTTP request
→ Server responds with the requested page

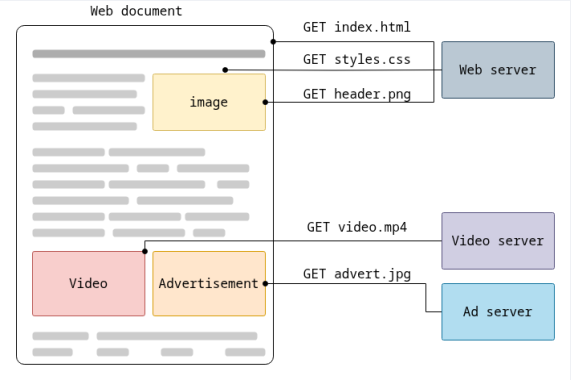
The HTTP Request-Response Cycle

1. **Client sends a request**
   - Method (GET, POST, etc.)
   - URL
   - Headers
   - Optional body
2. **Server processes the request**
   - Finds the resource
   - Generates a response
3. **Server sends a response**
   - Status line (e.g., 200 OK)
   - Headers
   - Body (HTML, JSON, etc.)

This cycle happens for every HTTP interaction.

Fetching HTML documents

Document is typically constructed from resources such as text content, layout instructions, images, videos, scripts, and more.



HTTP Request Structure

Example Request:

```
GET /index.html HTTP/1.1
Host: [www.example.com](http://www.example.com)
User-Agent: Mozilla/5.0
Accept: text/html
```

1. **Request line** → method, path, version
2. **Headers** → metadata (browser type, content type, etc.)
3. **Body (optional)** → data sent with POST/PUT

HTTP Response Structure

Example Response:

```
HTTP/1.1 200 OK
Content-Type: text/html
Content-Length: 1234

<html>
  <body>Hello World!</body>
</html>
```

1. **Status line** → protocol, status code, message
2. **Headers** → metadata about the response
3. **Body** → the actual content (HTML, JSON, etc.)

Common HTTP Methods

Method	Description	Typical Use
GET	Retrieve data	Loading a web page
POST	Send data to server	Submitting a form
PUT	Update a resource	Editing content
DELETE	Remove a resource	Deleting a record
HEAD	Like GET, but no body	Checking resource availability

Methods define what action the client wants to perform.

HTTP Status Codes

Code	Meaning	Example
200 OK	Request succeeded	Page loaded successfully
301 Moved Permanently	Resource moved	URL redirection
404 Not Found	Resource missing	Page not found
500 Internal Server Error	Server problem	Code issue on server

Status codes help clients understand what happened with the request.

Request Headers Examples

Header	Purpose	Example
Host	Domain of the server	Host: example.com
User-Agent	Browser info	User-Agent: Chrome/120
Accept	Content types accepted	Accept: text/html
Authorization	Credentials	Authorization: Bearer token

Headers provide context and control how the server handles the request.

Response Headers Examples

Header	Purpose	Example
Content-Type	Data type returned	Content-Type: text/html
Set-Cookie	Store session data	Set-Cookie: sessionID=123
Cache-Control	Caching behavior	Cache-Control: no-cache
Location	Redirect destination	Location: /login

These headers help browsers manage content and behavior.

Cookies and Sessions

- **Cookies** are small data pieces stored in the browser
- Used to remember:
  - Login sessions
  - Preferences
  - Shopping carts

Since HTTP is **stateless**, cookies help maintain **state** across multiple requests.

HTTP Versions

- **HTTP/1.0 (1996)** → simple, one request per connection
- **HTTP/1.1 (1999)** → persistent connections, caching
- **HTTP/2 (2015)** → multiplexing, compression, binary format
- **HTTP/3 (2022)** → based on QUIC, faster and more secure

HTTP evolves to improve **speed**, **security**, and **efficiency**.

HTTPS: Secure HTTP

- **HTTPS = HTTP + TLS (encryption layer)**
- Ensures:
  - **Confidentiality** – data is encrypted
  - **Integrity** – data not modified in transit
  - **Authentication** – verifies server identity
- Uses **port 443** instead of **port 80**

Example: https://www.example.com → Encrypted, secure connection

RESTful APIs and HTTP

- **REST (Representational State Transfer)** uses HTTP for APIs
- Operations mapped to HTTP methods:
  - `GET /users` → Retrieve users
  - `POST /users` → Add user
  - `PUT /users/1` → Update user
  - `DELETE /users/1` → Remove user

HTTP is the foundation of modern **web APIs**.

Summary

- HTTP defines how web clients and servers communicate
- Uses **requests** and **responses** with defined structure
- Supports multiple **methods** and **status codes**
- **HTTPS** adds security
- Widely used for **web apps** and **REST APIs**

HTTP = The language of the Web

References:

- **MDN Web Docs: HTTP Overview** (https://developer.mozilla.org/en-US/docs/Web/HTTP/Overview)
- **HTTP Status Codes** (https://developer.mozilla.org/en-US/docs/Web/HTTP/Status)
- **HTTP Methods** (https://developer.mozilla.org/en-US/docs/Web/HTTP/Methods)