Web APIs and Messaging for IoT

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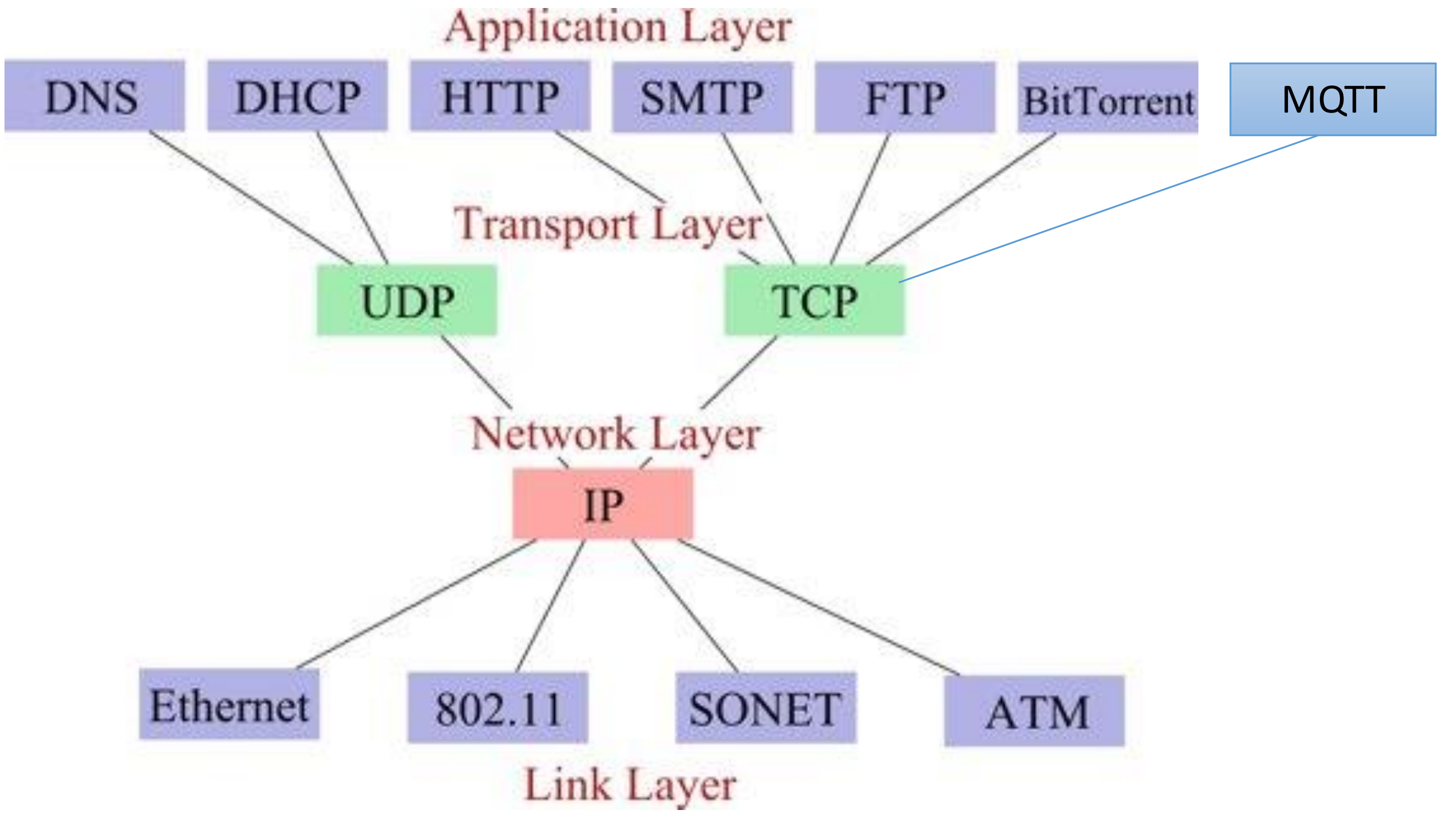
Arduino Web Page - Mozilla Firefox
File Edit View History Bookmarks Tools Help
Arduino Web Page
10.0.0.20
Goog

Hello from Arduino!

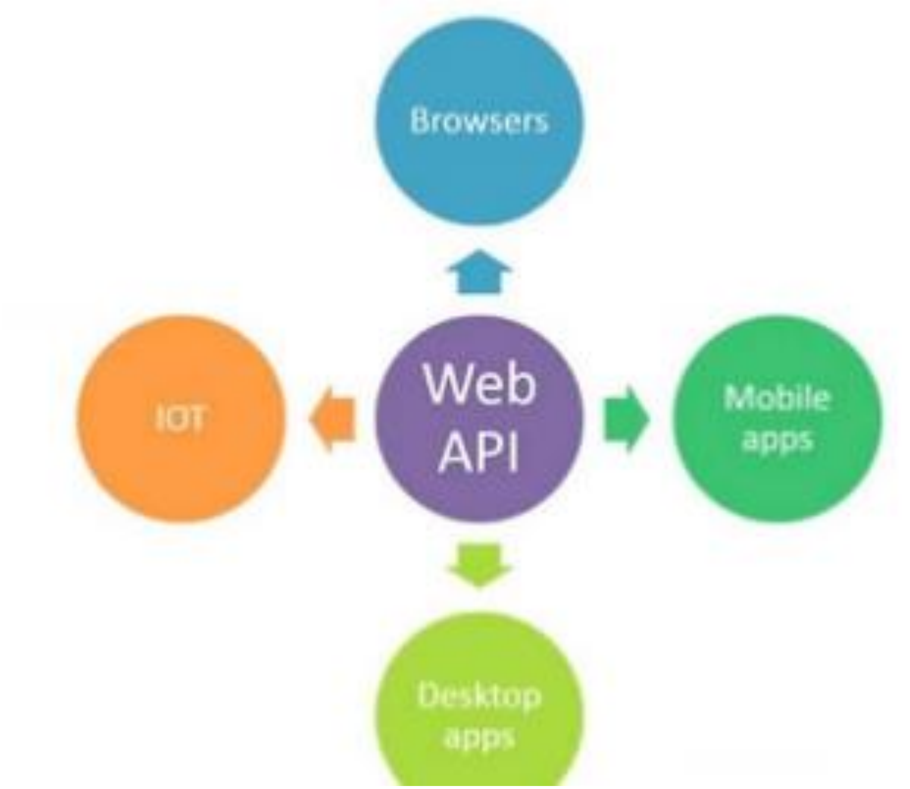
A web page from the Arduino server

TCP/IP Protocol Stack



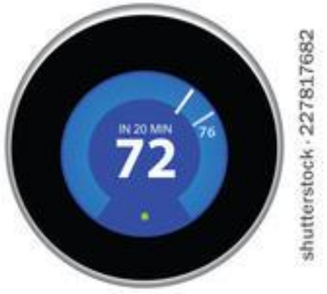
Web APIs

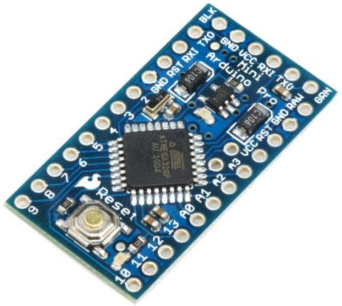
- Programmatic interface exposed via the web
- Uses open standards typically with request-response messaging.
    - Messages in JSON or XML
    - HTTP as transport
    - URIs
- Example would be Restful web service
- Typical use:
    - Expose application functionality via the web
    - Machine to machine communication
    - Distributed systems



What's a Web API

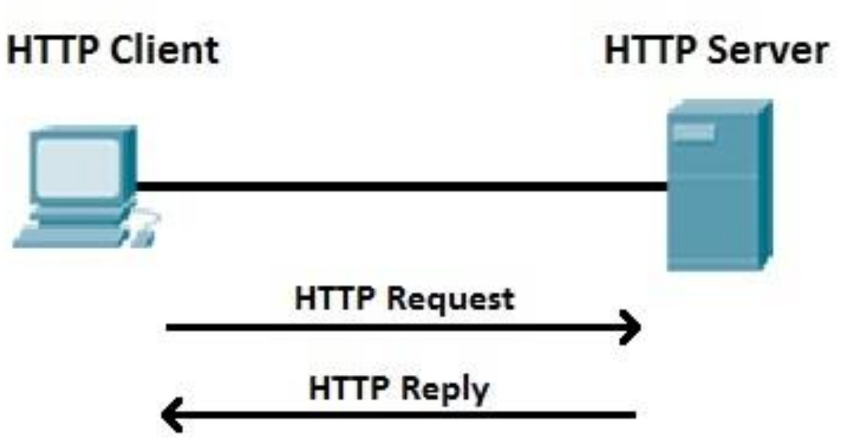
- Typically implements HTTP
  - processes HTTP requests
- Usually runs on machine connected to a network
  - Has an IP address
- Serves up resources
  - Ideally in a "restful" manner
- Many different types of devices can run a web API...





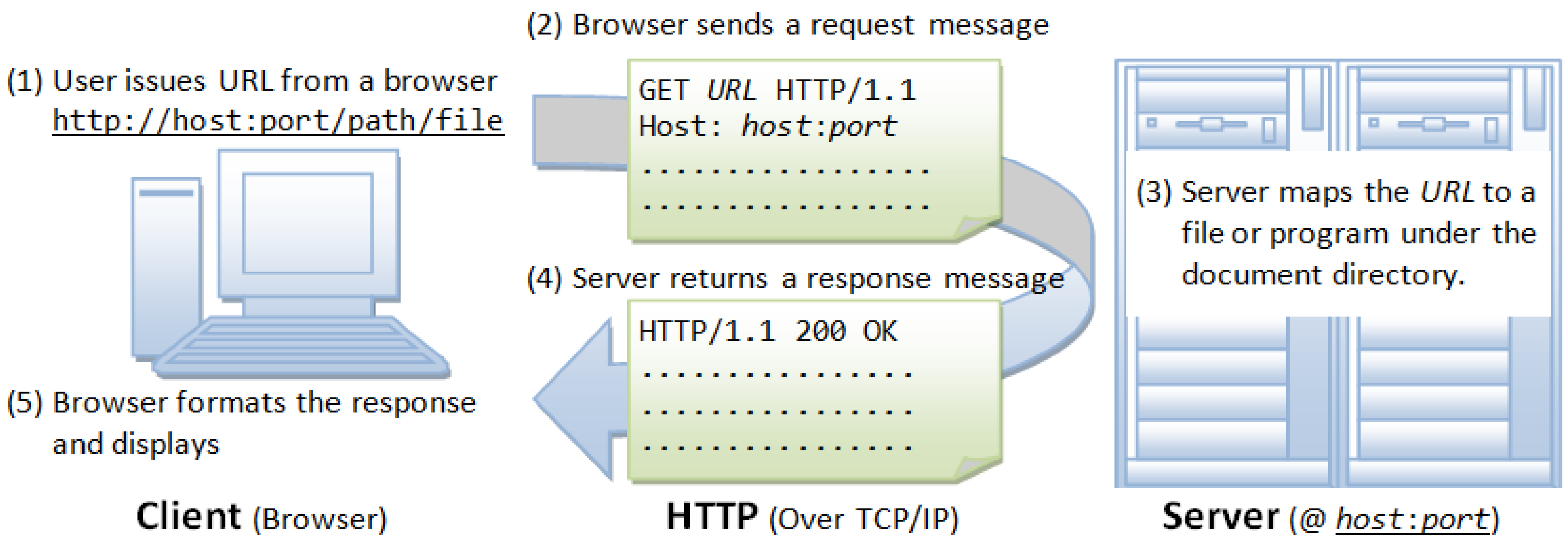
What’s HTTP

- HyperText Transfer Protocol
- Protocol used in World Wide Web
  - **http**://www.wit.ie
- Your browser communicates using HTTP (HTTP Client)
- Devices communicate using HTTP
- Simple, ubiquitous.



HTTP from browser

Browser:



(2) Browser sends a request message

```
GET URL HTTP/1.1
Host: host:port
.................
.................
```

(1) User issues URL from a browser
http://host:port/path/file

(3) Server maps the *URL* to a file or program under the document directory.

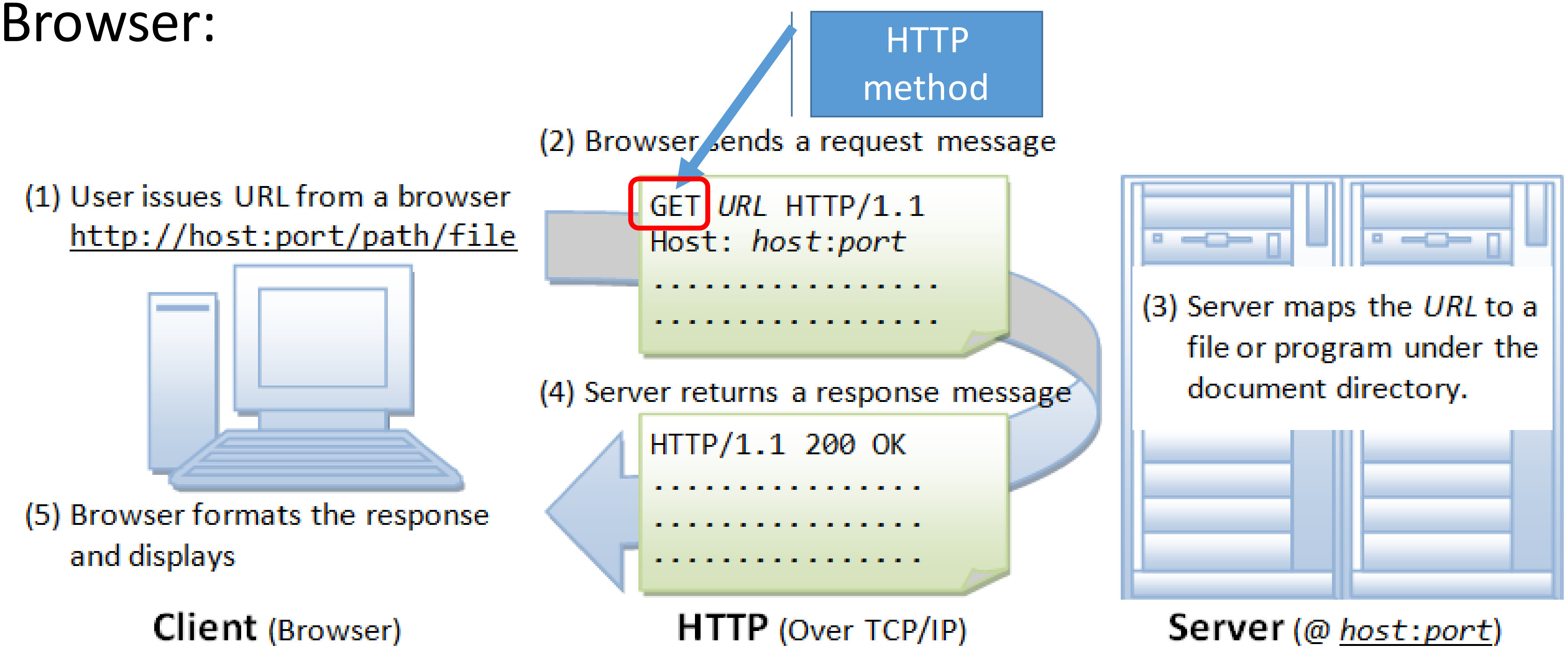
(4) Server returns a response message

```
HTTP/1.1 200 OK
................
................
................
```

(5) Browser formats the response and displays

HTTP from browser

Browser:


HTTP method
(2) Browser sends a request message
(1) User issues URL from a browser
http://host:port/path/file
GET URL HTTP/1.1
Host: host:port
....
....
(3) Server maps the URL to a file or program under the document directory.
(4) Server returns a response message
HTTP/1.1 200 OK
....
....
....
(5) Browser formats the response and displays
Client (Browser)
HTTP (Over TCP/IP)
Server (@ host:port)

URL

- A URL (Uniform Resource Locator) uniquely identifies a resource over the web. *protocol://hostname:port/path*
- There are 4 parts in a URL:
  - *Protocol*: The application-level protocol used by the client and server, e.g., HTTP, FTP, and telnet.
  - *Hostname*: The domain name (e.g., www.nowhere123.com) or IP address (e.g., 192.128.1.2) of the server.
  - *Port*: The TCP port number that the server is listening for incoming requests from the clients.
  - *Path-and-file-name*: The name and location of the requested resource, under the server document base directory.
- Example, for http://www.nowhere123.com/docs/index.html
  - the communication protocol is HTTP
  - he host is www.nowhere123.com.
  - The port number was not specified, and takes default number, which is TCP port 80 for HTTP.
  - The path for the resource to be located is "/docs/index.html".

HTTP Protocol (Request)

- HTTP clients (e.g. a browser) translates a URL into a request message according to the specified protocol; and sends the request message to the server.
- For example, the browser translated the URL http://www.nowhere123.com/doc/index.html into the following request message:

```
GET /docs/index.html HTTP/1.1
Host: www.nowhere123.com
Accept: image/gif, image/jpeg, */*
Accept-Language: en-us
Accept-Encoding: gzip, deflate
User-Agent: Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.1)
(blank line)
```

HTTP Protocol (Response)

- When this request message reaches the server, the server can take either one of these actions:
  1. The server interprets the request received, maps the request into a file under the server's document directory, and returns the file requested to the client.
  2. The server interprets the request received, maps the request into a program kept in the server, executes the program, and returns the output of the program to the client.
  3. The request cannot be satisfied, the server returns an error message.

An example of the HTTP response message is below:

```
HTTP/1.1 200 OK
Date: Sun, 18 Oct 2009 08:56:53 GMT
Server: Apache/2.2.14 (Win32)
Last-Modified: Sat, 20 Nov 2004 07:16:26 GMT
Content-Length: 44
Connection: close
Content-Type: text/html

 <html><body><h1>It works!</h1></body></html>
```

HTTP Query String

- Query string used to include data in a URL. For example

Query String

https://www.myhome.com/heating?status=on

- The server can use the query string to execute logic associated with that resource. In this example, it could be used to set the status of the resource (heating) to true.

HTTP Methods

- GET
  - Request objects without sending data
- POST
  - Modify objects with data that you are sending
- PUT
  - Create new objects with data that your are sending
- DELETE
  - Delete objects without sending data