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REST API
Minimal API in ASP.NET Core

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Agenda

- What is API? REST? REST API?
- How does it work?
- REST constraints
- Main concepts
- REST API Design Conventions
- HTTP Status Codes
- Demo (Minimal API in ASP.NET Core)
- Other topics

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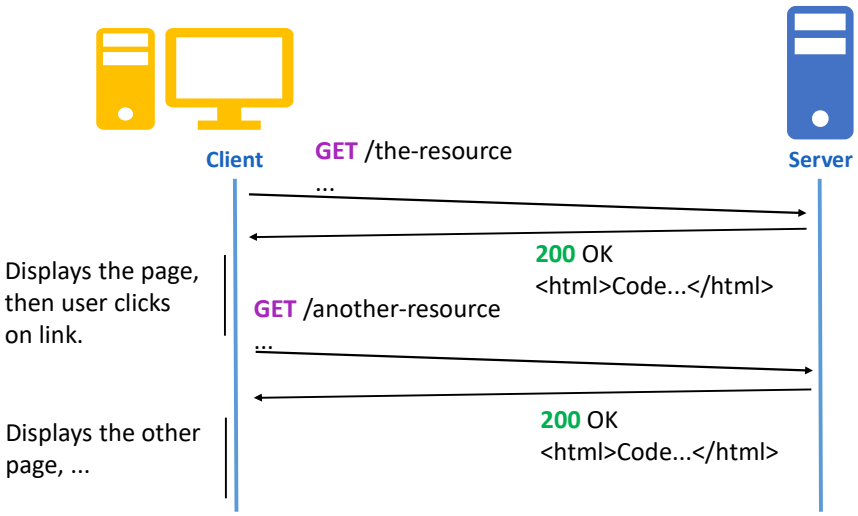
Traditional Web Applications



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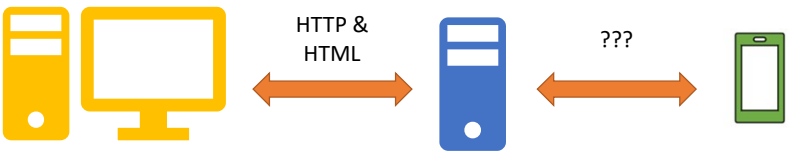
Traditional Web Applications

- Drawbacks
  - The client must understand both HTTP and HTML.
  - The entire webpage is replaced with another one.
  - No way to animate transitions between webpages.
  - Same data is usually sent in multiple responses. (E.g. HTML code for the layout.)
  - The GUI on smartphones does not use HTML.



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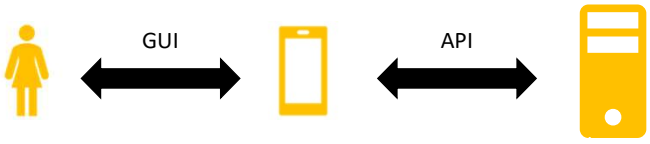
Application Programming Interface (API)

- A GUI is an interface for Human ↔ Machine communication.



- An API is an interface for Machine ↔ Machine communication.
- An API making use of HTTP is called a ***Web API***.

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Different Types of Web APIs

- Remote Procedure Call, **RPC**.
  - Clients can call functions on the server.
- Remote Method Invocation, **RMI**.
  - Clients can call methods on objects on the server.
- Representational State Transfer, **REST**.
  - Clients can apply CRUD operations on resources on the server.

RPC	REST
Actions	Resources
Programming semantics	HTTP semantics
Tight coupling	Loose coupling
Liberal usage of HTTP	Expressive usage of HTTP
Flexible	CRUD-focused
Relies on documentation	Intuitive
Non-public APIs	Public APIs

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What is REST?

- A style of software architecture for distributed hypermedia systems such as the World Wide Web.
- Introduced in the doctoral dissertation of Roy Fielding
  - One of the principal authors of the HTTP specification.
- A collection of network architecture principles which outline how resources are defined and addressed

Roy T. Fielding
https://roy.gbiv.com/

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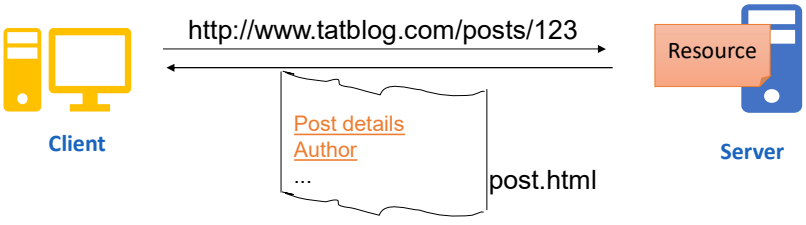
What Does REST Mean?



- The Client references a Web resource using a URL. A **representation** of the resource is returned (in this case as an HTML document).
- The representation (e.g., post.html) places the client application in a **state**. The result of the client traversing a hyperlink in post.html is another resource accessed. The new representation places the client application into yet another state.
- Thus, the client application changes (**transfers**) state with each resource representation --> Representation State Transfer!

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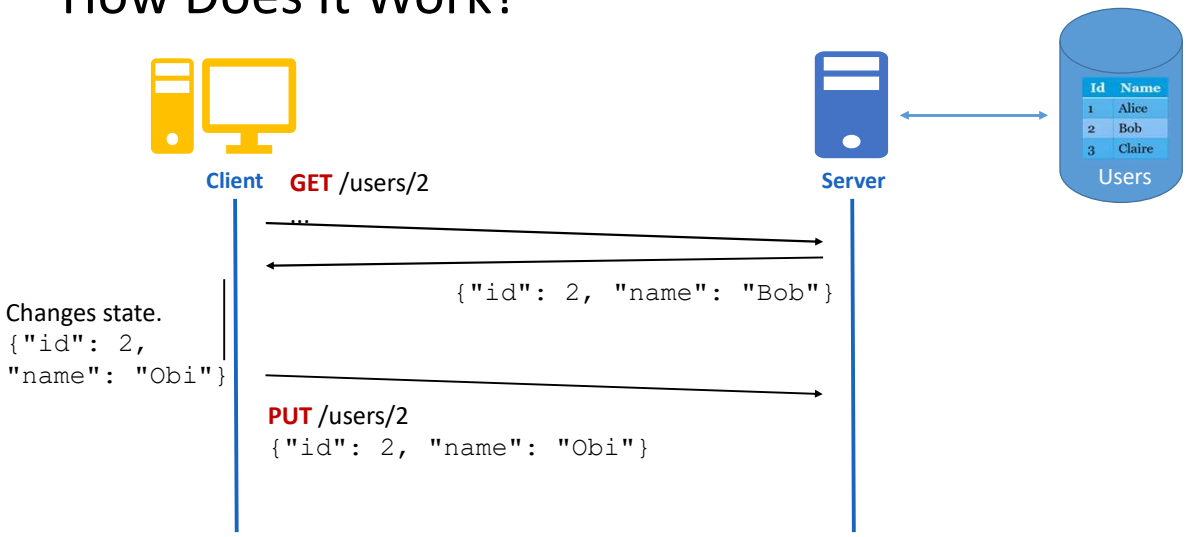
How Does It Work?



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The 6 constraints of REST

- Client-Server architecture
- Statelessness
- Cacheability
- Uniform Interface
- Layered System
- Code on demand (Optional)

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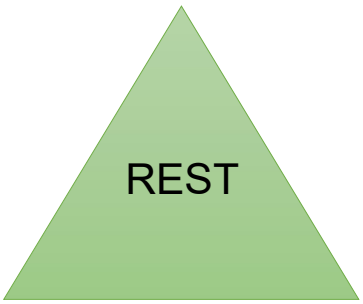
Main Concepts

Nouns (Resources)
unconstrained
i.e., http://tatblog.com/posts/12345



Verbs
constrained
i.e., GET

Representations
constrained
i.e., XML

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Resources

- The key abstraction of information in REST is a resource.
- A resource is a conceptual mapping to a set of entities
  - Any information that can be named can be a resource: a document or image, a temporal service (e.g. "today's weather in Los Angeles"), a collection of other resources, a non-virtual object (e.g. a person), and so on
- Represented with a global identifier (URI in HTTP)
  - http://www.tatblog.com/post/747

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Verbs

- Represent the actions to be performed on resources
- HTTP methods are typically used in REST based architectures

HTTP Method	CRUD Operation	Description
GET	**SELECT**	Fetches a resource. The resource is never changed via a GET request.
POST	**INSERT**	Adds or creates a resource.
PUT	**UPDATE**	Updates or overrides an entire resource.
PATCH	**UPDATE**	Updates parts of a resource.
DELETE	**DELETE**	Deletes a resource.

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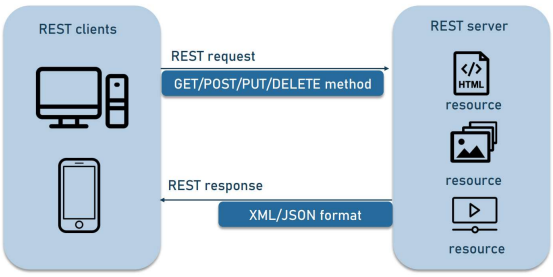
Representations

- How data is represented or returned to the client for presentation.
- Two main formats:
  - JavaScript Object Notation (JSON)
  - XML
- It is common to have multiple representations of the same data



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Representations

- How to specify data format for the resource?
- **Accept header** is used by HTTP clients to tell the server which type of content (the media type of the resource) they expect/prefer as response.
- **Content-Type header** can be used both by clients and servers to help the other part interpret correctly the information.
  - In responses, a Content-Type header tells the client what the content type of the returned content actually is.
  - In requests, such as POST or PUT, the client tells the server what type of data is actually sent.

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REST API Design

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Conventions

- Use plural nouns but no verbs in path/URI
  - GET /posts
  - GET /posts/2
  - GET /posts/pages/1
  - GET /posts/2022/12
  - GET /posts?keyword=windows
  - GET /tags?page=1&pagesize=10
- If a resource is related to another resource, use sub-resources
  - GET /authors/1/posts/
- Keep the URI simple
- Make the API as easy as possible to used by other programmers

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Conventions

- GET method should not alter the resource state
- Do not use GET method with query parameters for state change
  - GET /users/123?activate
- Use POST, PUT, DELETE methods to alter the state
- The data format has to be specified in the HTTP headers so client and server know which format is used for the communication
- Make the API version mandatory and use simple ordinal number
  - /blog/api/v1/posts

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Conventions

Purpose	Method	URI
Retrieves a list of posts	GET	/posts
Get details of a single post	GET	/posts/123
Create a new post	POST	/posts
Update an existing post	PUT	/posts/123
Delete an existing post	DELETE	/posts/123

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Conventions

- Every HTTP request results in a status code to be sent back to the client
- HTTP Status Codes

Codes	Description
1xx	Informational. Communicates transfer protocol-level information.
2xx	Success. Indicates that the client's request was accepted successfully.
3xx	Redirection. Indicates that the client must take some additional action in order to complete their request.
4xx	Client error. The client sent a request that did not make sense.
5xx	Server error. The request made by the client appears to be fine but the server is experiencing some difficulty.

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Handle Errors with HTTP Status Code

Code	Description	Code	Description
200	OK (Everything is working)	301	Moved Permanently (New permanent URI has been assigned to the client's requested resource)
201	Created (New resource has been created)	302	See Other (The response to the request can be found under another URI using the GET method.)
202	Accepted (Start of an asynchronous action)	304	Not Modified (Indicates that the resource has not been modified)
204	No Content (Resource successfully deleted)	307	Temporary Redirect (A temporary URI has been assigned to the client's requested resource)

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Handle Errors with HTTP Status Code

Code	Description	Code	Description
400	Bad Request (The request was invalid or cannot be served. The exact error should be explained in the error payload)	406	Not Acceptable (The server doesn't find any content that conforms to the criteria given by the user agent in the Accept header sent in the request.)
401	Unauthorized (The request requires an user authentication)	409	Conflict (A conflict with the current state of the resource.)
403	Forbidden (The server understood the request, but is refusing it or the access is not allowed)	412	Precondition Failed (The client has indicated preconditions in its headers which the server does not meet.)
404	Not Found (There is no resource behind the URI)	415	Unsupported Media Type (The media-type in Content-type of the request is not supported by the server.)
405	Method not allowed	500	Internal server error

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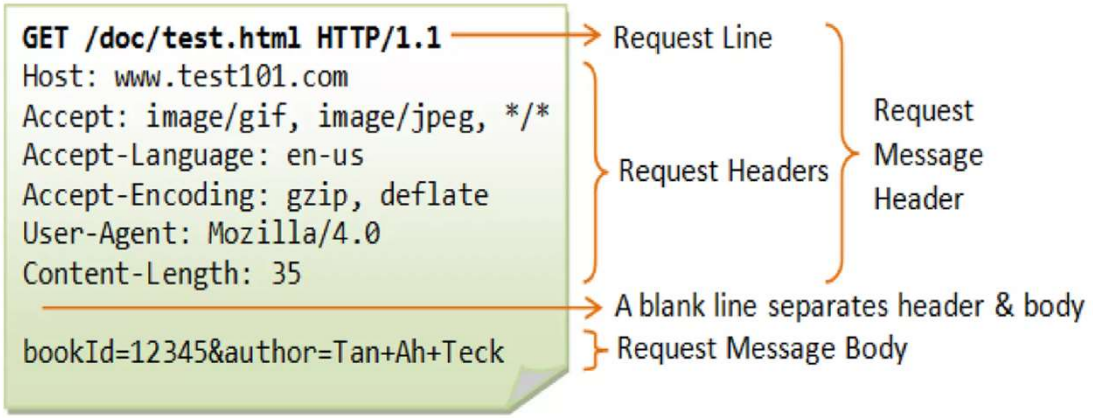
HTTP Request Example



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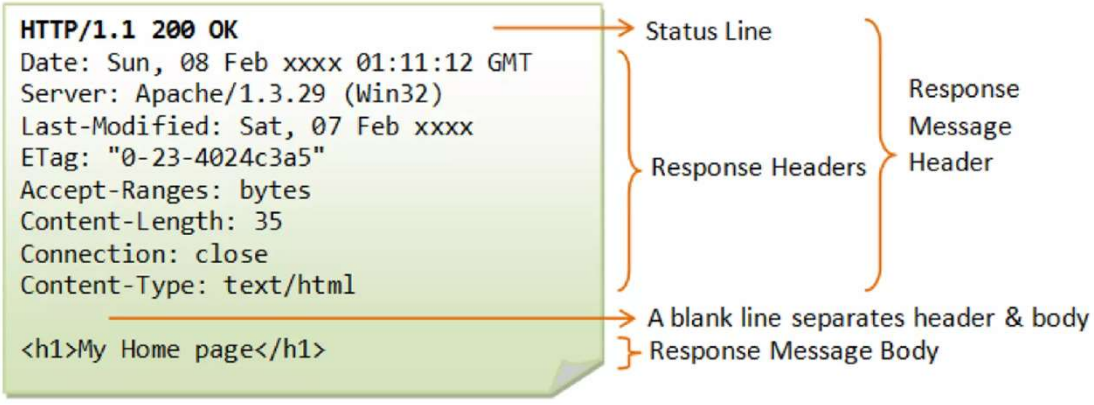
HTTP Response Example



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HTTP REST Request

GET https://www.myhost.com/api/v1/user/1/cities

Read, All the cities for user whose id is 1

```
GET /user/1/cities http/1.1
host: https://www.myhost.com/api/v1
Content-Type: application/json
Accept-Language: us-en
state_id: 2
```

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HTTP REST Response

```
HTTP/1.1 200 OK (285ms)
Date: Fri, 21 Apr 2017 10:27:20 GMT
Server: Apache/2.4.6 (CentOS) OpenSSL/1.0.1e-fips PHP/7.0.16
X-Powered-By: PHP/7.0.16
Content-Length: 109
Keep-Alive: timeout=5, max=100
Connection: Keep-Alive
Content-Type: application/json; charset=UTF-8
```

{"status":"success","message":"City List","data":[{"city_name":"Visakhapatnam"},{"city_name":"Vijayawada"}]}

HTTP REST API Response

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Demo
Build REST API
using ASP.NET Core Minimal API

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Endpoints

Endpoints	HTTP Method	Description
/api/authors	GET	Get a list of authors
/api/authors/{id:int}	GET	Get detail information of an author
/api/authors/{id:int}/posts	GET	Get a list of posts by author
/api/authors	POST	Add new author
/api/authors/{id:int}/picture	POST	Set image for an author
/api/authors/{id:int}	PUT	Update an existing author
/api/authors/{id:int}	DELETE	Delete an existing author

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Other Topics

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Learn more …

- CORS
- Caching
- Versioning
- Rate limit
- OData
- GraphQL
- OAuth/OpenID Connect
- Unit testing
- Evaluating & Benchmarking

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END

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