Laboratory Session #03

Distributed Systems Programming

Daniele Bringhenti

WebSocket Features

- The **WebSocket** API is an advanced technology that allows to open a two-way **interactive** communication session between the user's browser and a server.
- The main features of WebSockets are:
  1) reliable low-latency general-purpose bidirectional channels;
  2) reuse of the Web infrastructure;
  3) framing and messaging mechanism with no message length limit;
  4) in-band additional closing mechanism.

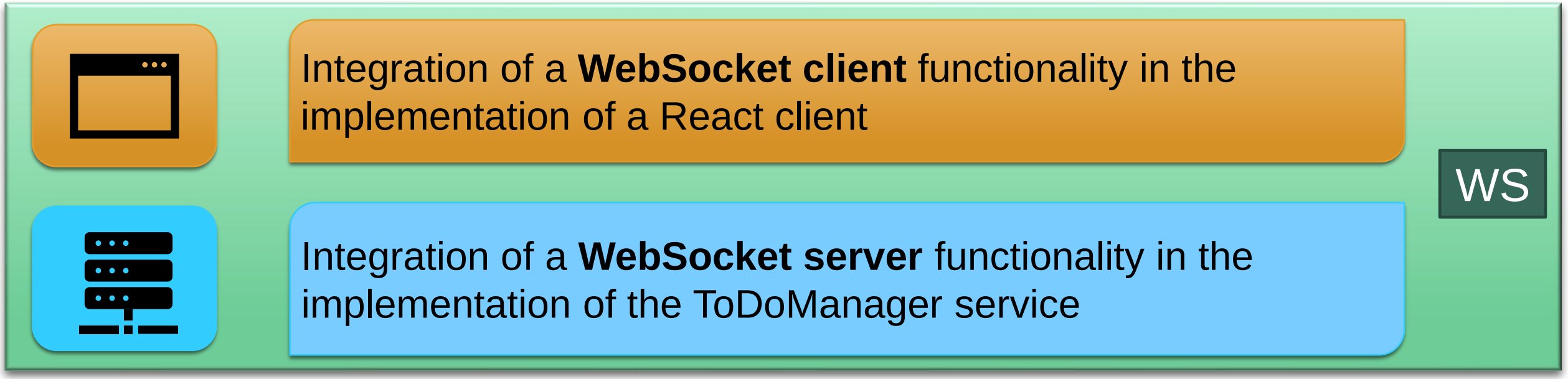
WebSocket Features

- The **WebSocket** API is an advanced technology that allows to open a two-way **interactive** communication session between the user's browser and a server.
- The main features of WebSockets are:
  1) reliable low-latency general-purpose bidirectional channels;
  2) reuse of the Web infrastructure;
  3) framing and messaging mechanism with no message length limit;
  4) in-band additional closing mechanism.

WebSockets are suitable for **continuous, highly interactive** communications.

Topics of the Laboratory Session

Laboratory Session #03 covers the following activities:



Topics of the Laboratory Session

Laboratory Session #03 covers the following activities:

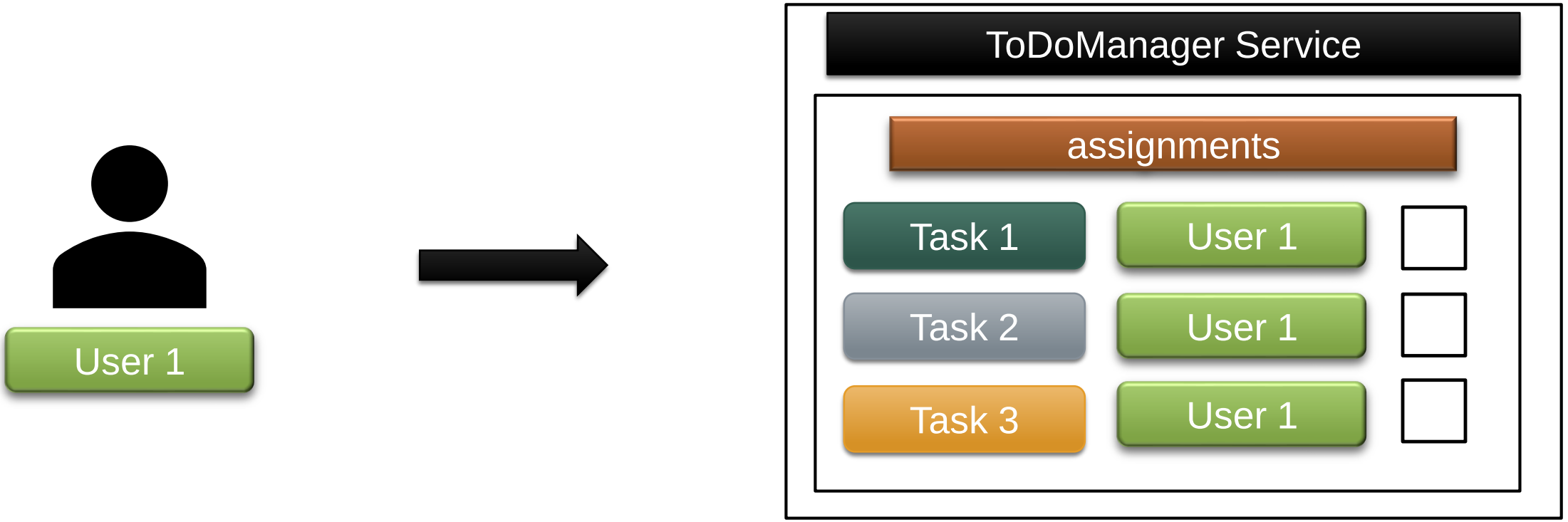
Integration of a **WebSocket client** functionality in the implementation of a React client

Integration of a **WebSocket server** functionality in the implementation of the ToDoManager service

WS

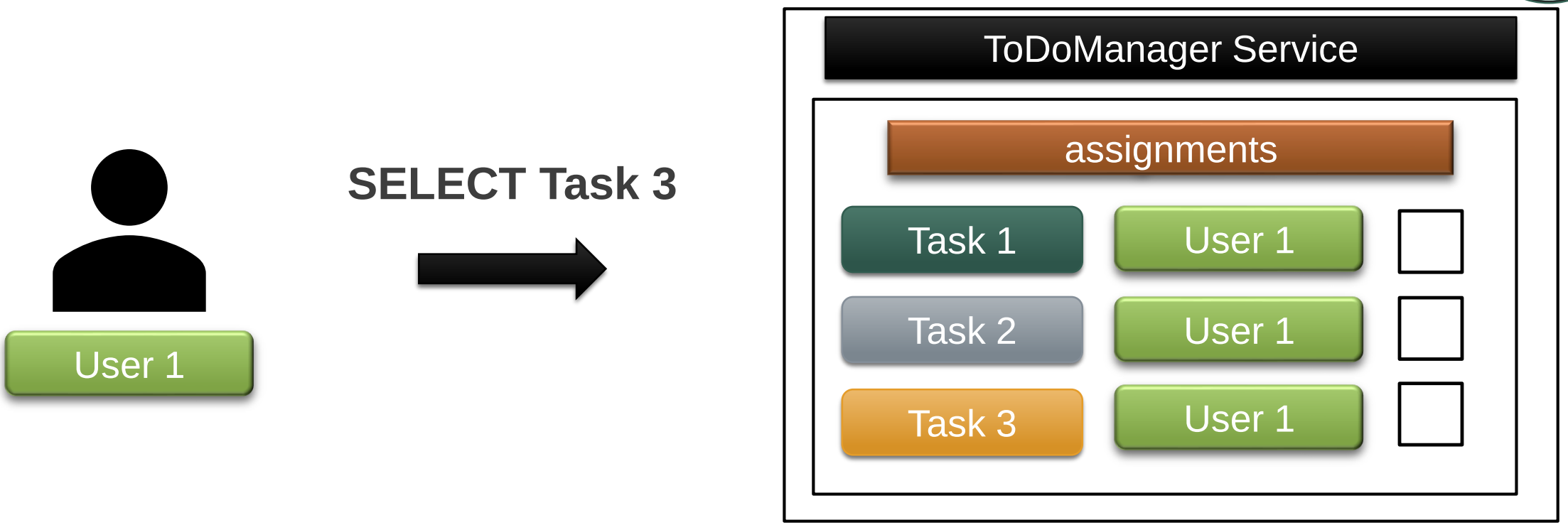
Definition of new **REST APIs** exposed by the ToDoManager service for the management of **task selection**

Task Selection in the ToDoManager service



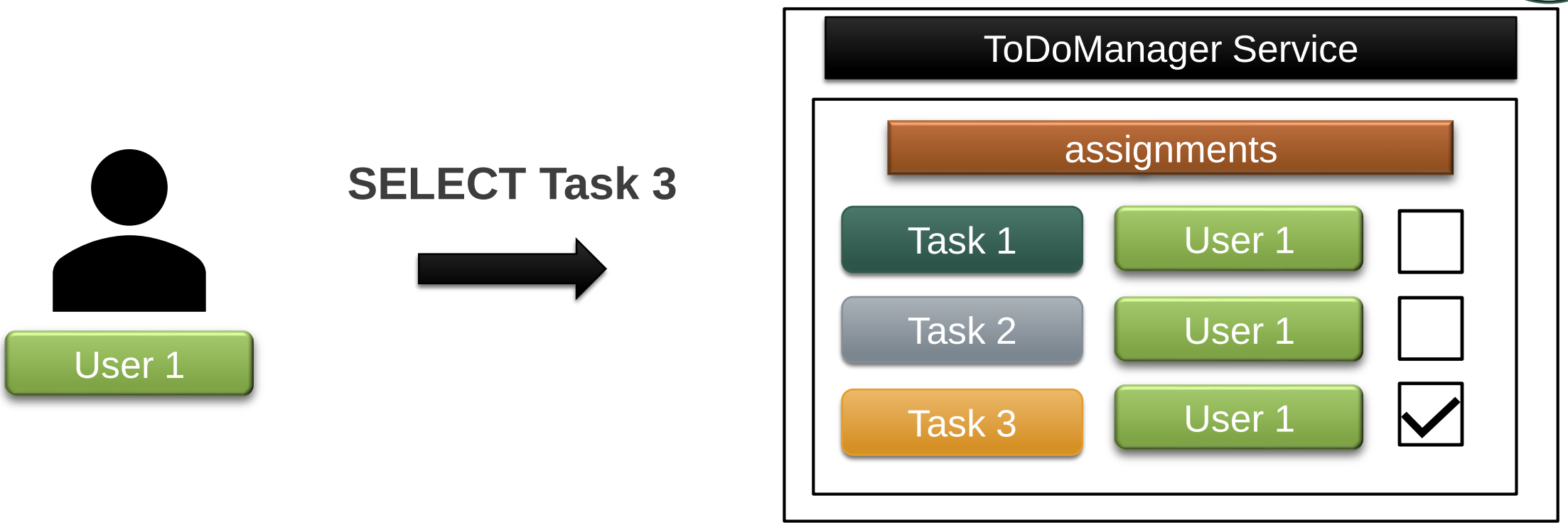
- A user can **select** a task as their active task.
- The active task of a user must be a task **previously assigned** to that user.
- There must exist **at most one** active task for each user.

Task Selection in the ToDoManager service



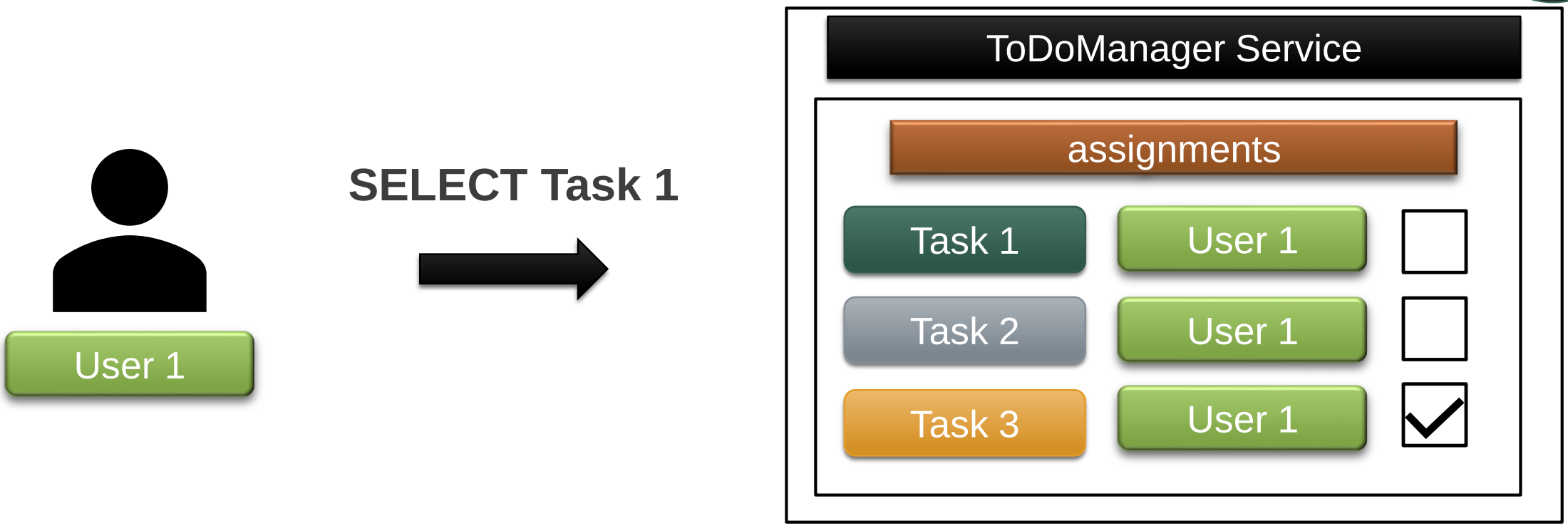
- A user can **select** a task as their active task.
- The active task of a user must be a task **previously assigned** to that user.
- There must exist **at most one** active task for each user.

Task Selection in the ToDoManager service



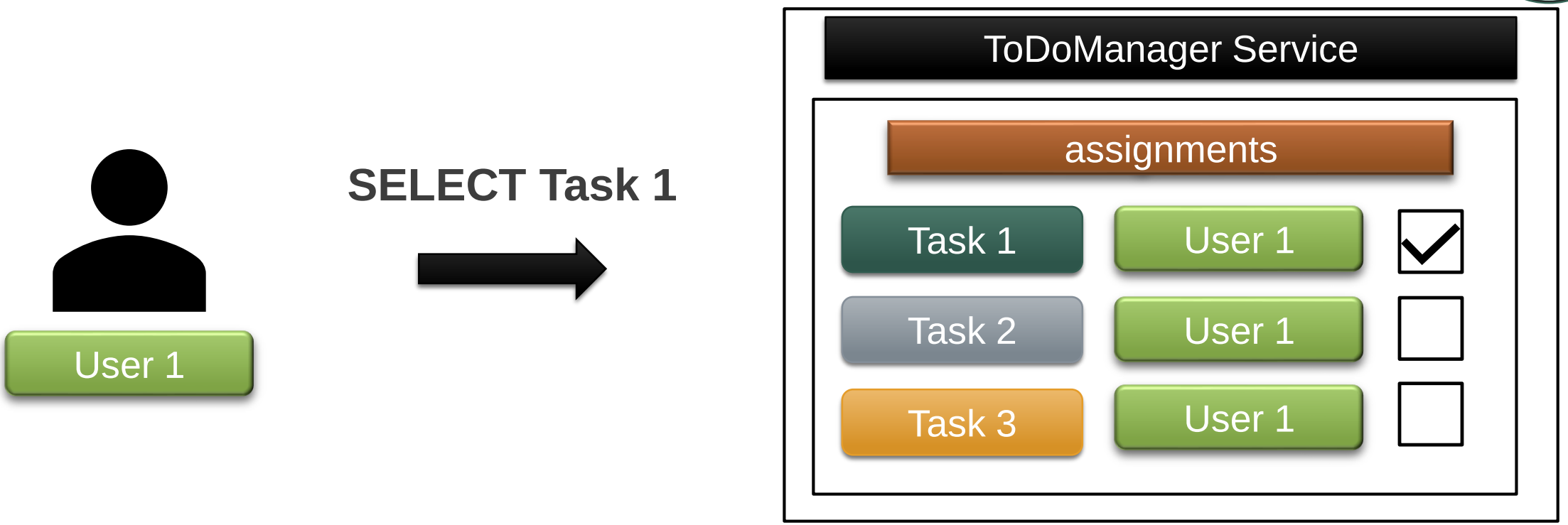
- A user can **select** a task as their active task.
- The active task of a user must be a task **previously assigned** to that user.
- There must exist **at most one** active task for each user.

Task Selection in the ToDoManager service



- A user can **select** a task as their active task.
- The active task of a user must be a task **previously assigned** to that user.
- There must exist **at most one** active task for each user.

Task Selection in the ToDoManager service



- A user can **select** a task as their active task.
- The active task of a user must be a task **previously assigned** to that user.
- There must exist **at most one** active task for each user.

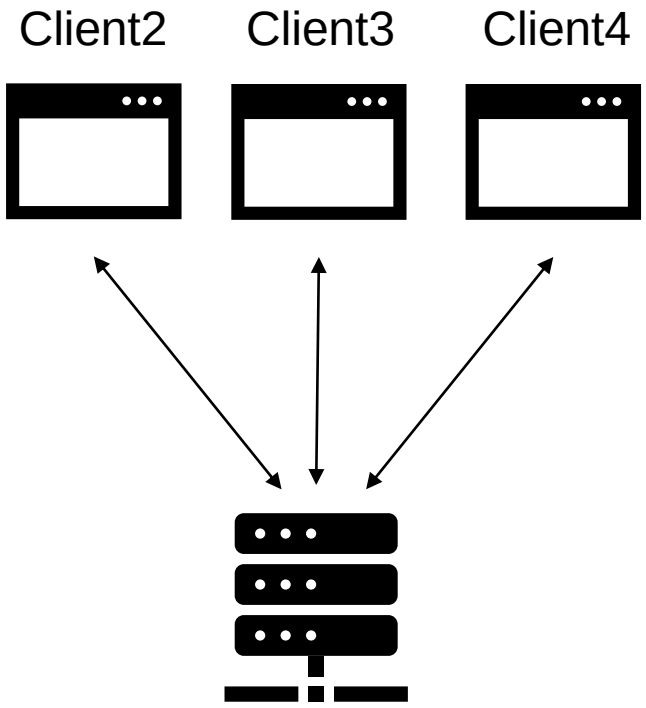
Status (logged-in users and active tasks)

- Both the ToDoManager service and the React client are **extended** with the functionality to communicate by using WebSockets channels:
  - **Server**: ToDoManager;
  - **Client**: an instance of the React client.

- These channels are used by the server to inform all the clients about:
  1) the current status of the **logged-in users**;
  2) the status of their **active tasks**.

How is the **WebSocket** communication organized?

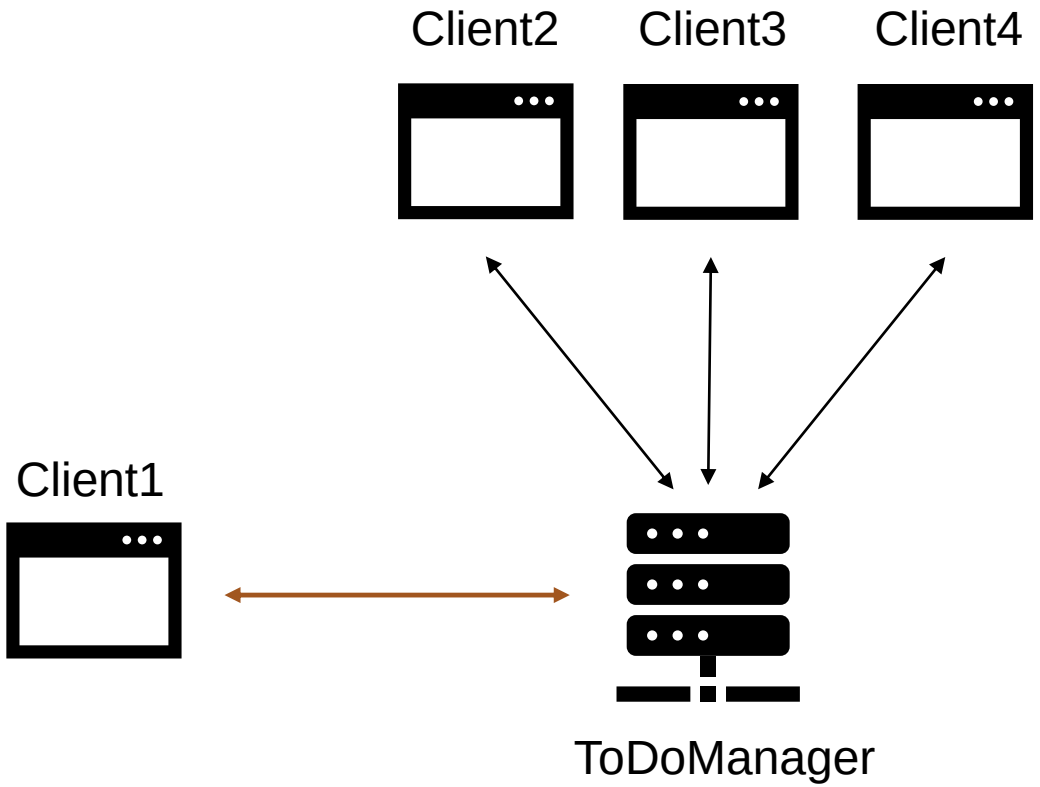
WebSocket communication (initial situation)



Status

userId	userName	taskId	taskName
2	Frank	5	Study JSON
3	Karen	-	-
4	Rene	7	Watch film

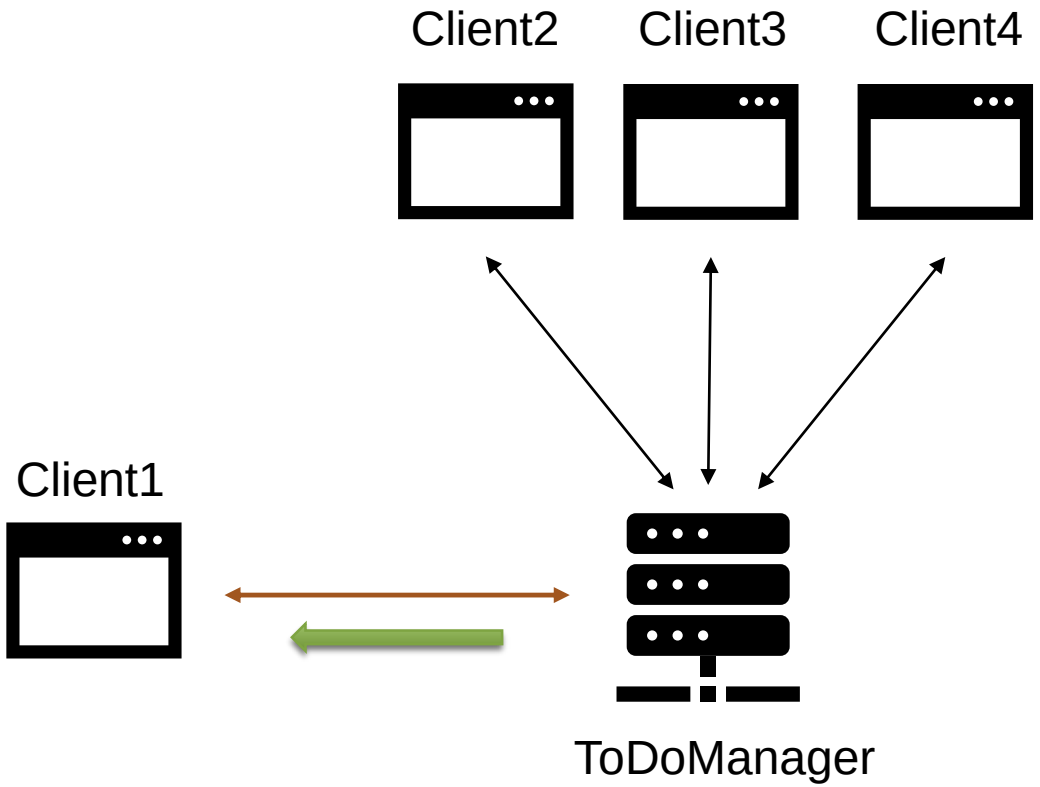
WebSocket communication (connection establishment)



Status

userId	userName	taskId	taskName
2	Frank	5	Study JSON
3	Karen	-	-
4	Rene	7	Watch film

WebSocket communication (connection establishment)

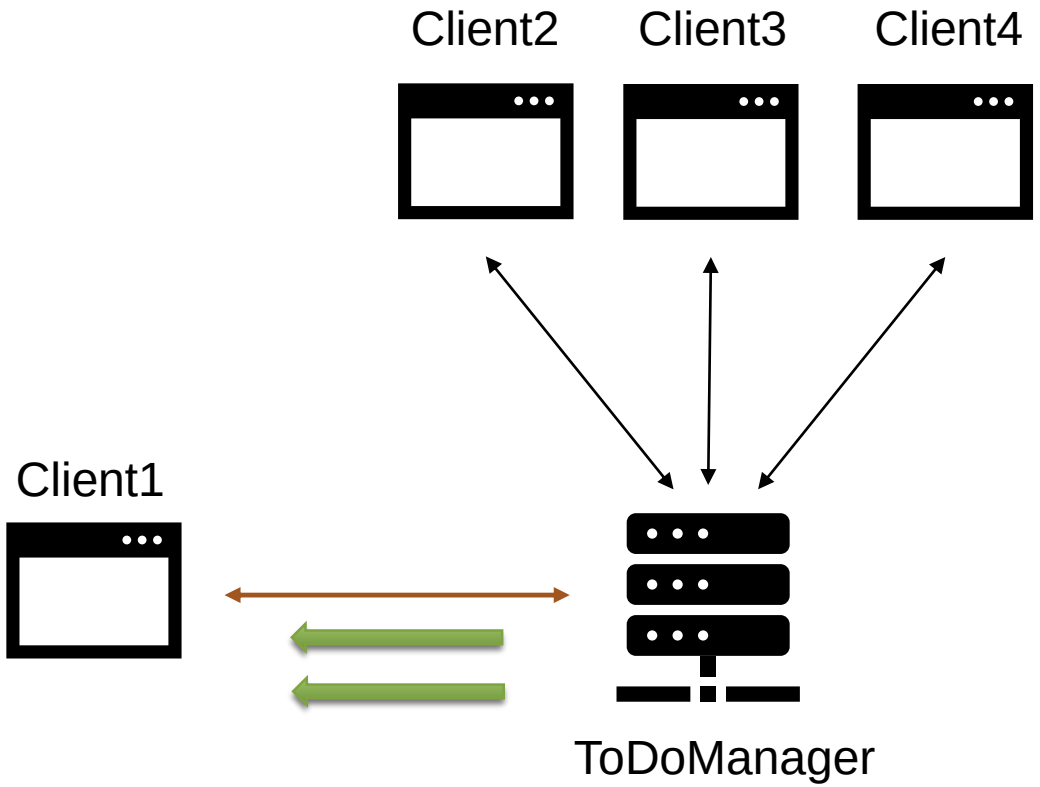


Status

userId	userName	taskId	taskName
2	Frank	5	Study JSON
3	Karen	-	-
4	Rene	7	Watch film

```
{
    "typeMessage" :"login",
    "userId: "2",
    "userName": "Frank",
    "taskId": "5",
    "taskName": "Study JSON"
}
```

WebSocket communication (connection establishment)

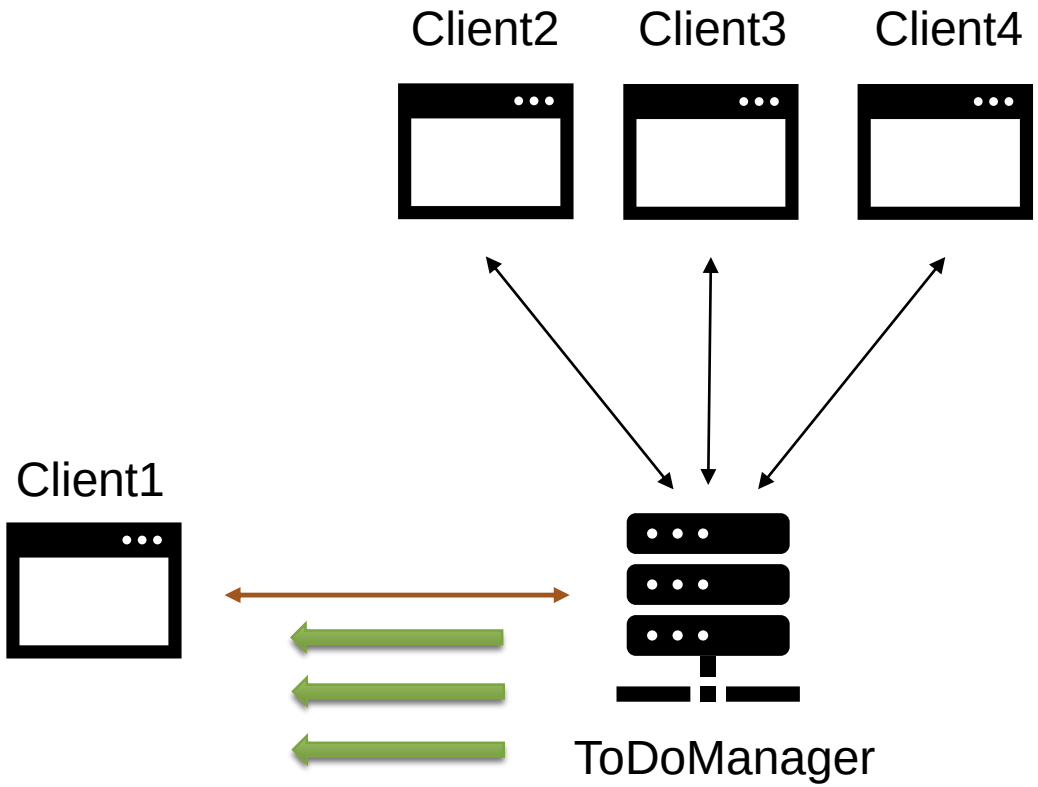


Status

userId	userName	taskId	taskName
2	Frank	5	Study JSON
3	Karen	-	-
4	Rene	7	Watch film

```
{
    "typeMessage" :"login",
    "userId: "3",
    "userName": "Karen"
}
```

WebSocket communication (connection establishment)

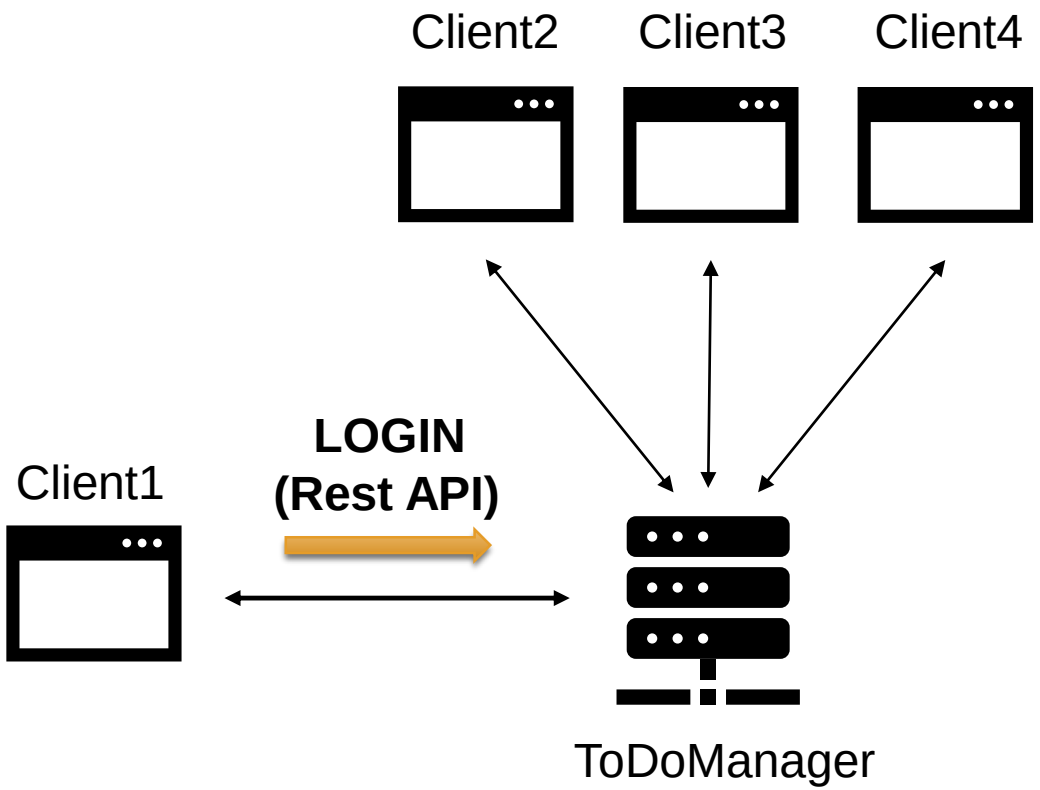


Status

userId	userName	taskId	taskName
2	Frank	5	Study JSON
3	Karen	-	-
4	Rene	7	Watch film

```
{
    "typeMessage" :"login",
    "userId: "2",
    "userName": "Rene",
    "taskId": "7",
    "taskName": "Watch film"
}
```

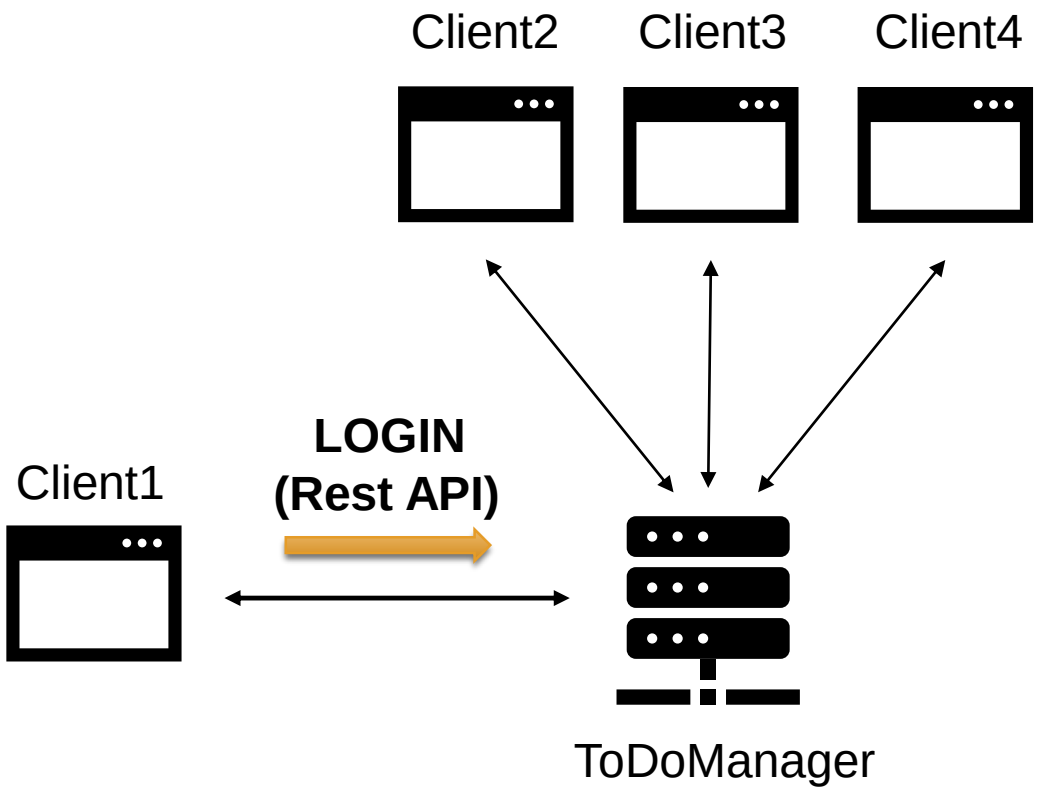
WebSocket communication (login)



Status

userId	userName	taskId	taskName
2	Frank	5	Study JSON
3	Karen	-	-
4	Rene	7	Watch film

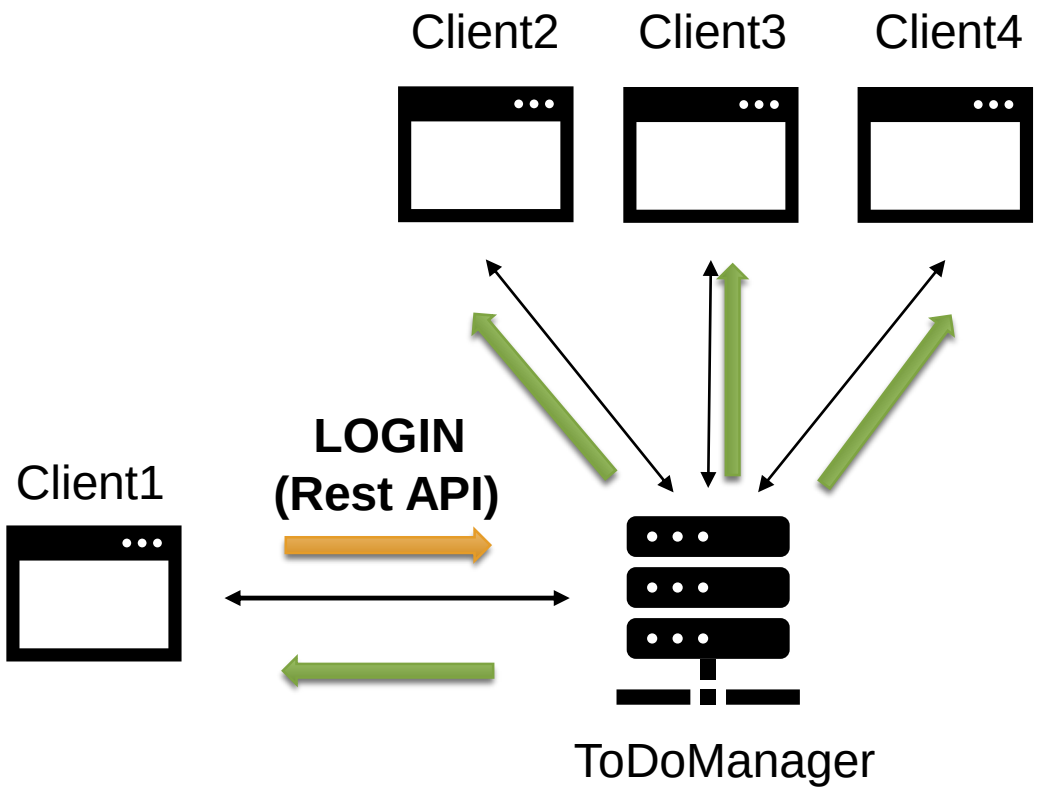
WebSocket communication (login)



Status

userId	userName	taskId	taskName
2	Frank	5	Study JSON
3	Karen	-	-
4	Rene	7	Watch film
1	User	-	-

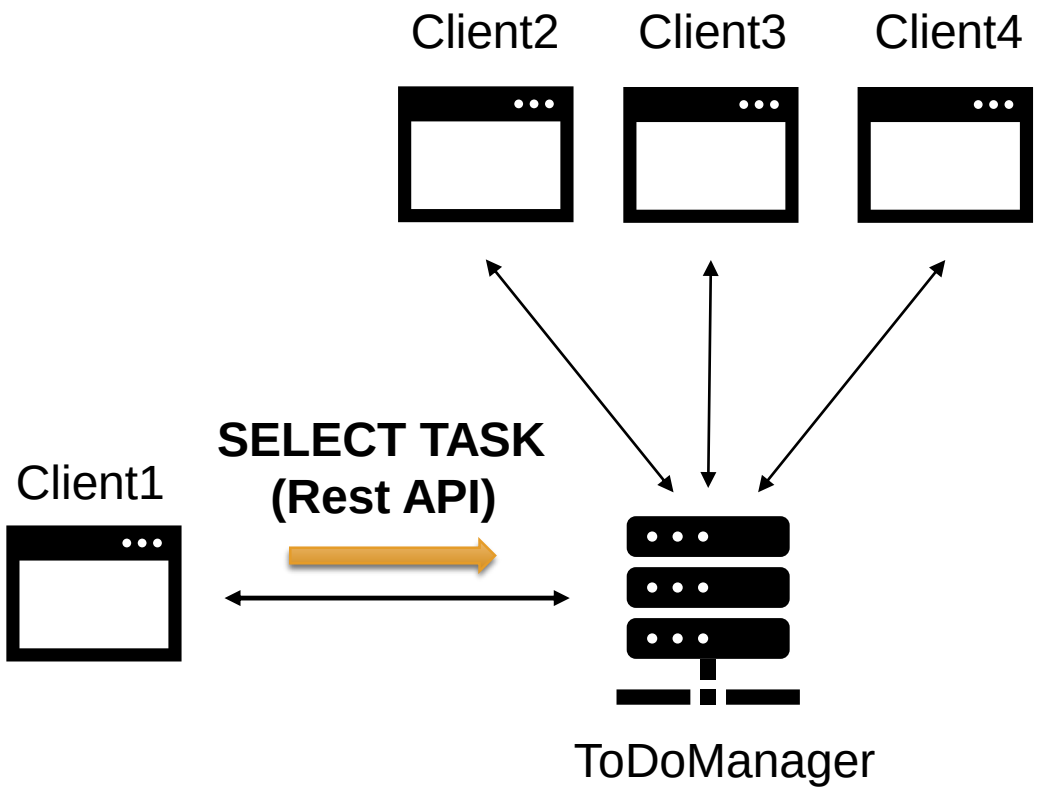
WebSocket communication (login)



Status			
userId	userName	taskId	taskName
2	Frank	5	Study JSON
3	Karen	-	-
4	Rene	7	Watch film
1	User	-	-

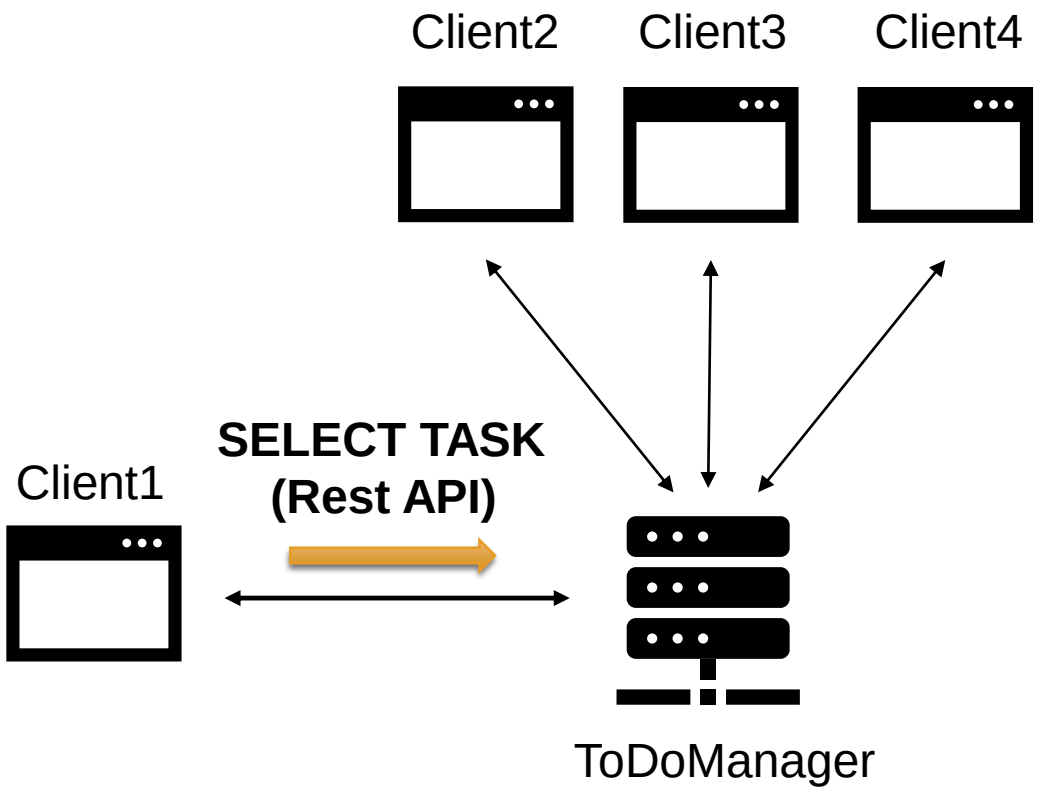
```
{
      “typeMessage” :“login”,
      “userId: “1”,
      “userName”: “User”
}
```

WebSocket communication (task selection)



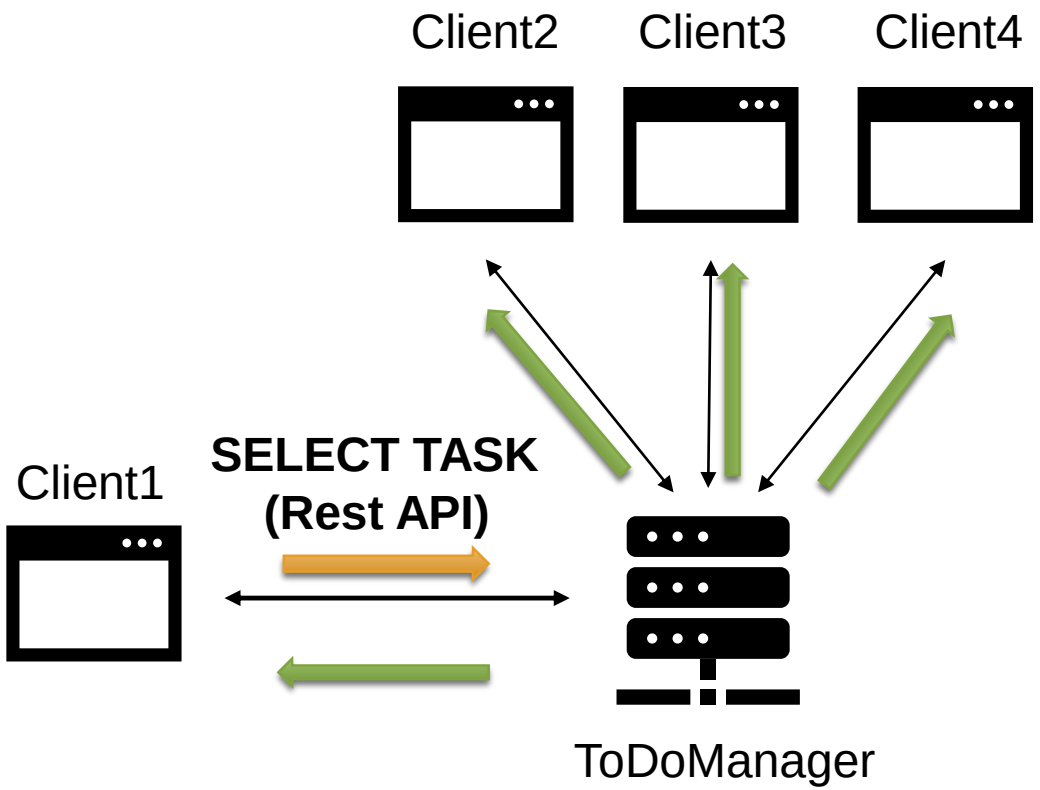
Status			
userId	userName	taskId	taskName
2	Frank	5	Study JSON
3	Karen	-	-
4	Rene	7	Watch film
1	User	-	-

WebSocket communication (task selection)



Status			
userId	userName	taskId	taskName
2	Frank	5	Study JSON
3	Karen	-	-
4	Rene	7	Watch film
1	User	9	Read book

WebSocket communication (task selection)

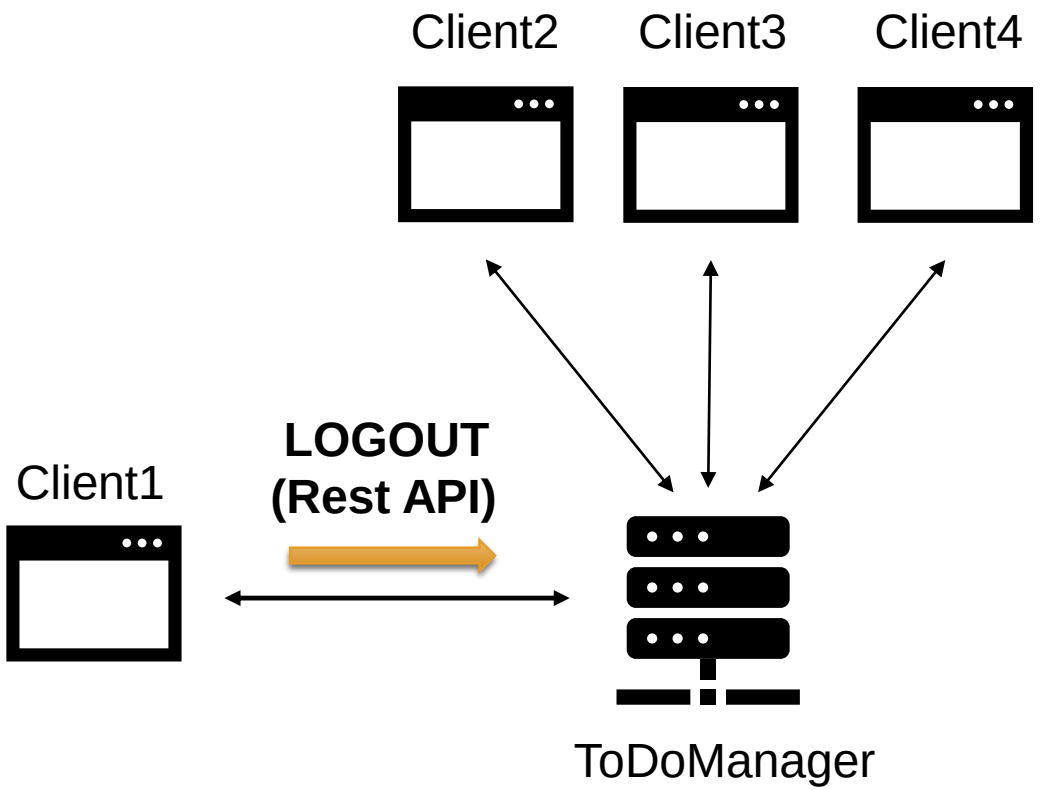


Status

userId	userName	taskId	taskName
2	Frank	5	Study JSON
3	Karen	-	-
4	Rene	7	Watch film
1	User	9	Read book

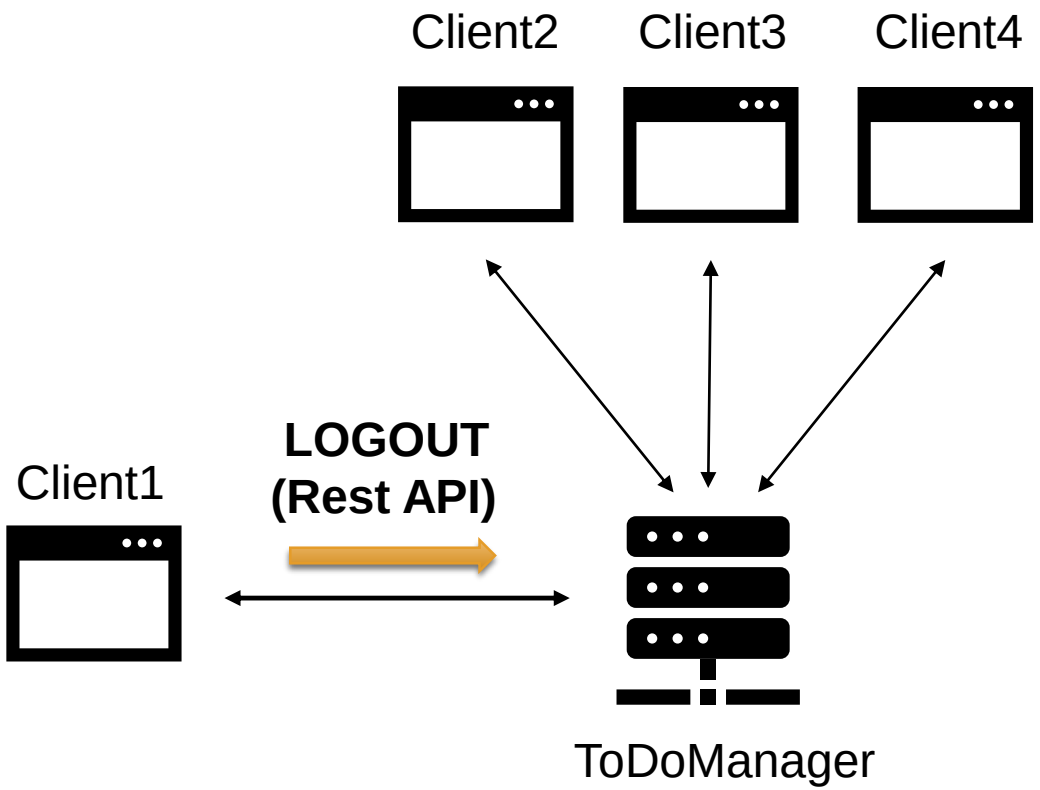
```
{
    "typeMessage" :"update",
    "userId: "1",
    "userName": "User",
    "taskId": "9",
    "taskName": "Read book"
}
```

WebSocket communication (logout)



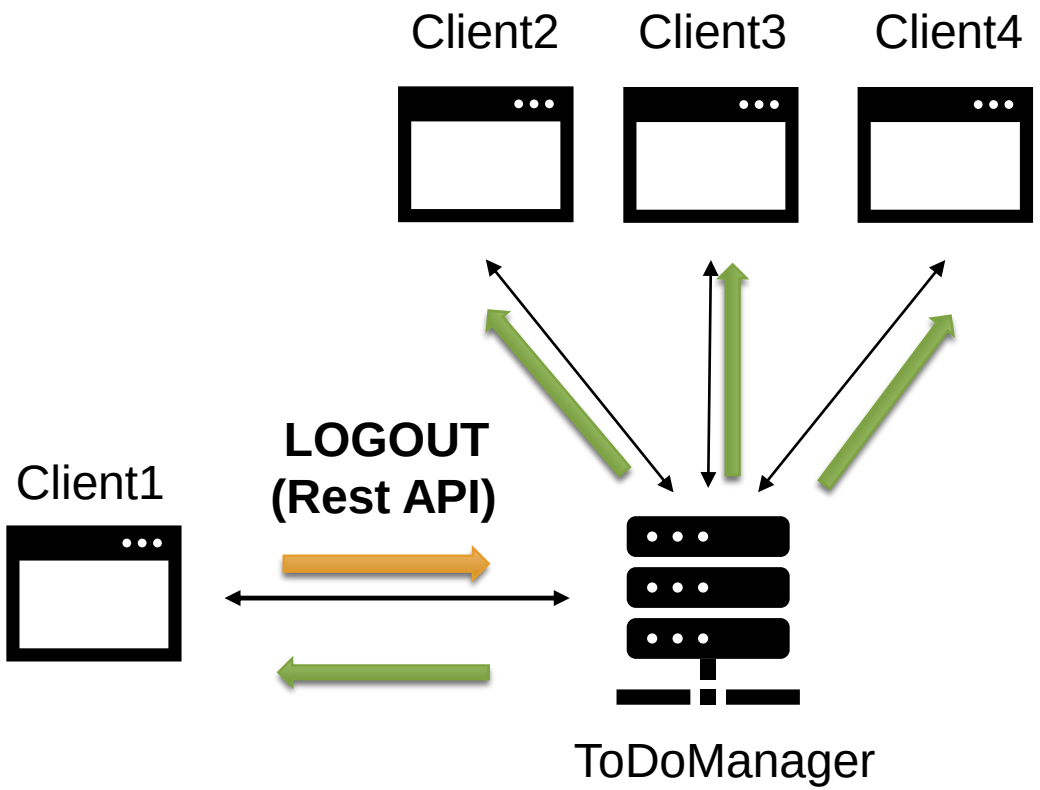
Status			
userId	userName	taskId	taskName
2	Frank	5	Study JSON
3	Karen	-	-
4	Rene	7	Watch film
1	User	9	Read book

WebSocket communication (logout)



Status			
userId	userName	taskId	taskName
2	Frank	5	Study JSON
3	Karen	-	-
4	Rene	7	Watch film

WebSocket communication (logout)



Status			
userId	userName	taskId	taskName
2	Frank	5	Study JSON
3	Karen	-	-
4	Rene	7	Watch film

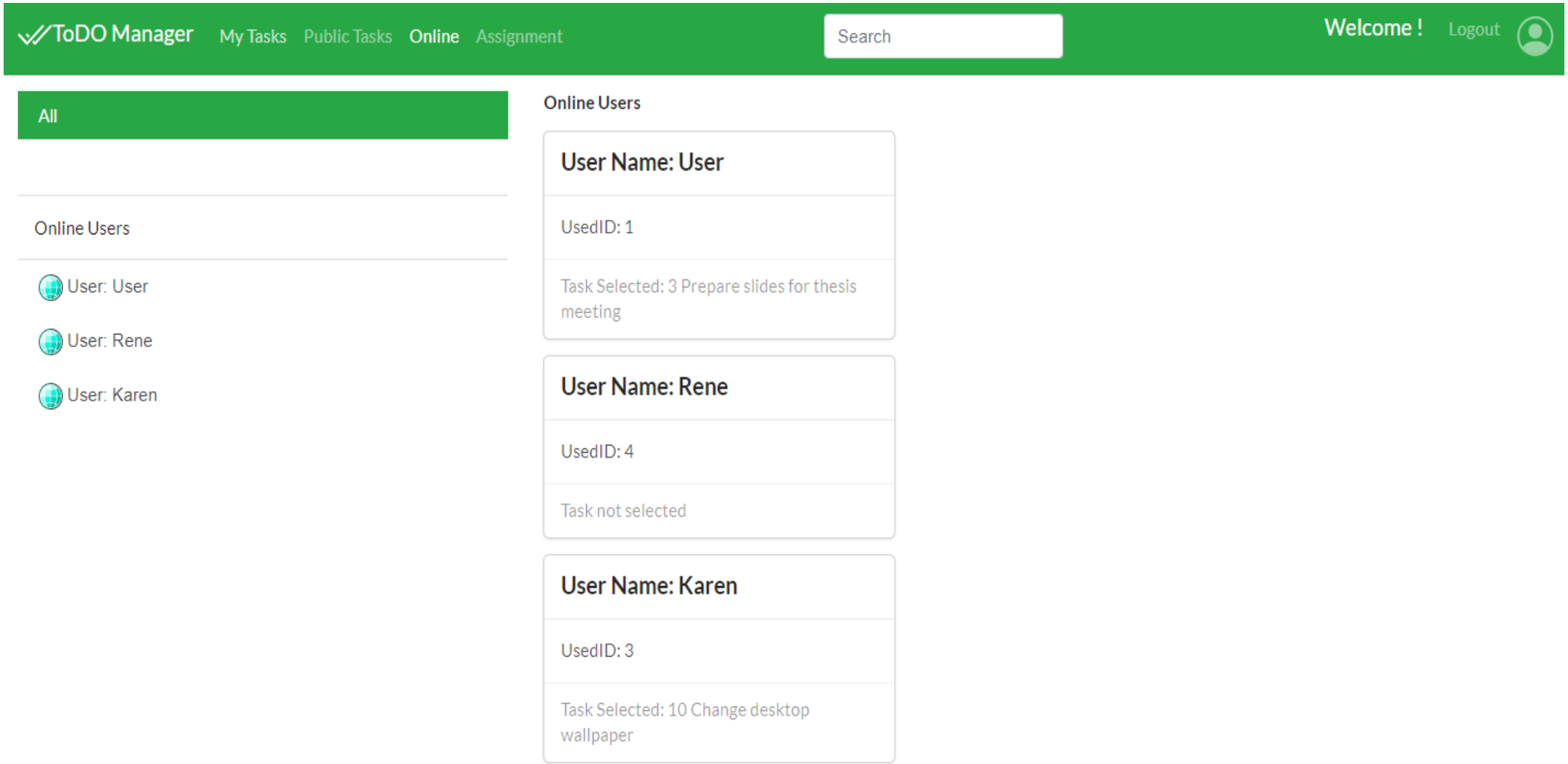
```
{
      "typeMessage" :"logout",
      "userId: "1"
}
```

How does the React client *react*?

- The **Online** page displays:
  - the list of users that are **currently logged-in** the ToDoManager service;
  - for each listed user, the user name and the user id;
  - for each listed user, the task name and task id of the active task (if any).
- **All the pages** (My Tasks, Public Tasks, Online and Assignment) display:
  - a list of the logged-in users in the left column;
  - for each entry of this list, the user id and the user name.

➢ Both the content of the Online page and the left column are **updated** as soon as the client **receives** a message in the WebSocket communication.

How does the React client *react*?



How should you make the React client *react*?

- In this activity, you must mainly focus on the WebSocket communication
  - generation and sending of the messages server-side;
  - receiving the messages client-side (in **App.js** file, **componentsDidMount** function).

- For the reaction of the *React* client, you only need to:
  - update the ***this.state.usersList*** array, with the latest message related to each logged-in user;
  - call ***this.setState({ usersList: this.state.usersList });*** to refresh the displayed content.

How should you make the React client *react*?

- In this activity, you must mainly focus on the WebSocket communication
  - generation and sending of the messages server-side;
  - receiving the messages client-side (in **App.js** file, **componentsDidMount** function).

- For the reaction of the *React* client, you only need to:
  - update the ***this.state.usersList*** array, with the latest message related to each logged-in user;
  - call ***this.setState({ usersList: this.state.usersList });*** to refresh the displayed content.

Let's see how the React client should *react*!

Thanks for your attention!

Daniele Bringhenti
daniele.bringhenti@polito.it