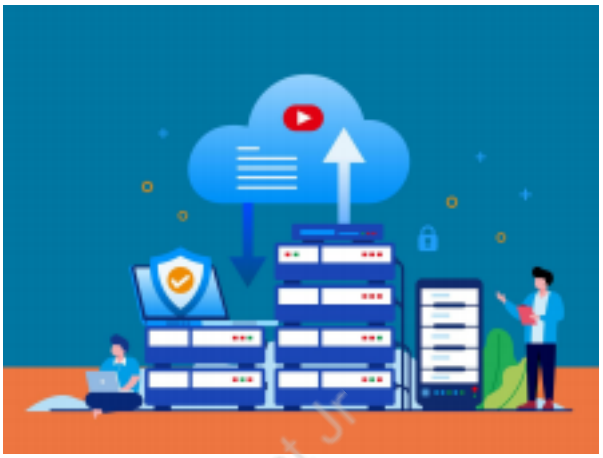
REAL-TIME DATABASE



What is our GOAL for this MODULE?

In this class, you learned the importance of using a real-time database to create multiplayer games – how to connect, read and write data into a remote real-time database.

What did we ACHIEVE in the class TODAY?

- Created Firebase database
- Synchronised ball movement across multiple browsers

Which CONCEPTS / CODING BLOCKS did we cover today?

- Firebase Database
- Debugging

How did we DO the activities?

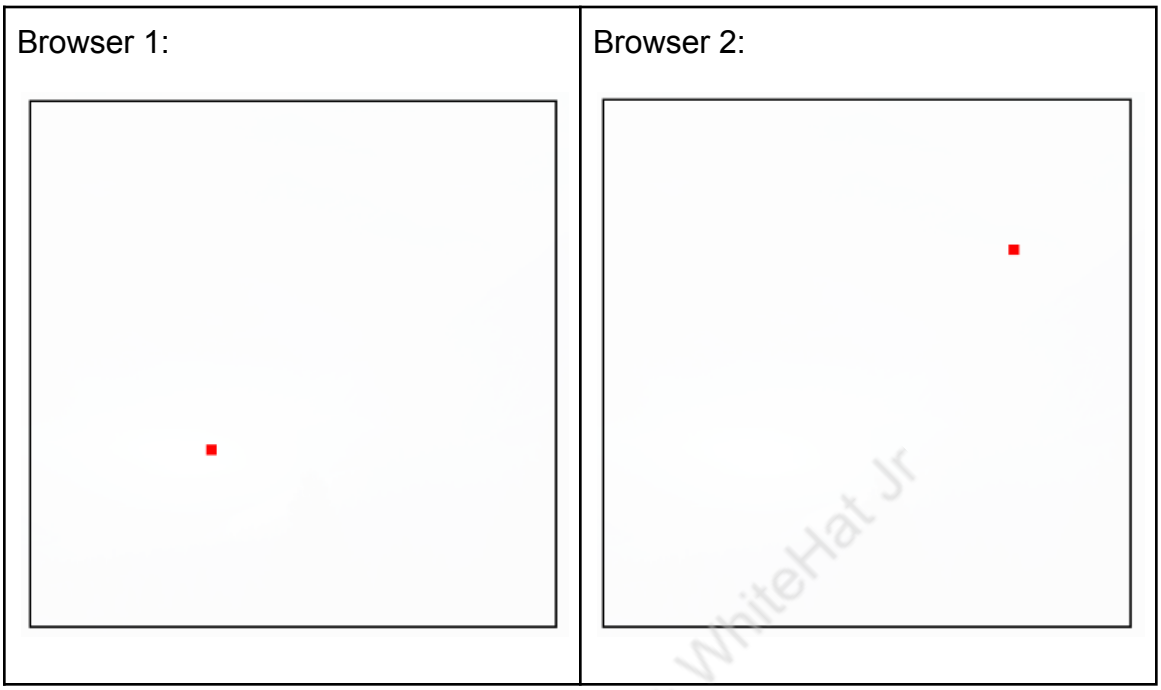
1. Run the boilerplate code to move a ball sprite on a canvas in two browsers.
    - Code in **Sketch.js:**

```
var ball;

function setup(){
    createCanvas(500,500);
    ball = createSprite(250,250,10,10);
    ball.shapeColor = "red";
}

function draw(){
    background("white");
    if(keyDown(LEFT_ARROW)){
        changePosition(-1,0);
    }
    else if(keyDown(RIGHT_ARROW)){
        changePosition(1,0);
    }
    else if(keyDown(UP_ARROW)){
        changePosition(0,-1);
    }
    else if(keyDown(DOWN_ARROW)){
        changePosition(0,+1);
    }
    drawSprites();
}

function changePosition(x,y){
    ball.x = ball.x + x;
    ball.y = ball.y + y;
}
```

- Code in **style.css:**

```
html, body {
    margin: 0;
    padding: 0;
}
canvas{
    margin-left: 25%;
    margin-right: 25%;
    margin-top: 100px;
    border: 2px solid black;
}
```

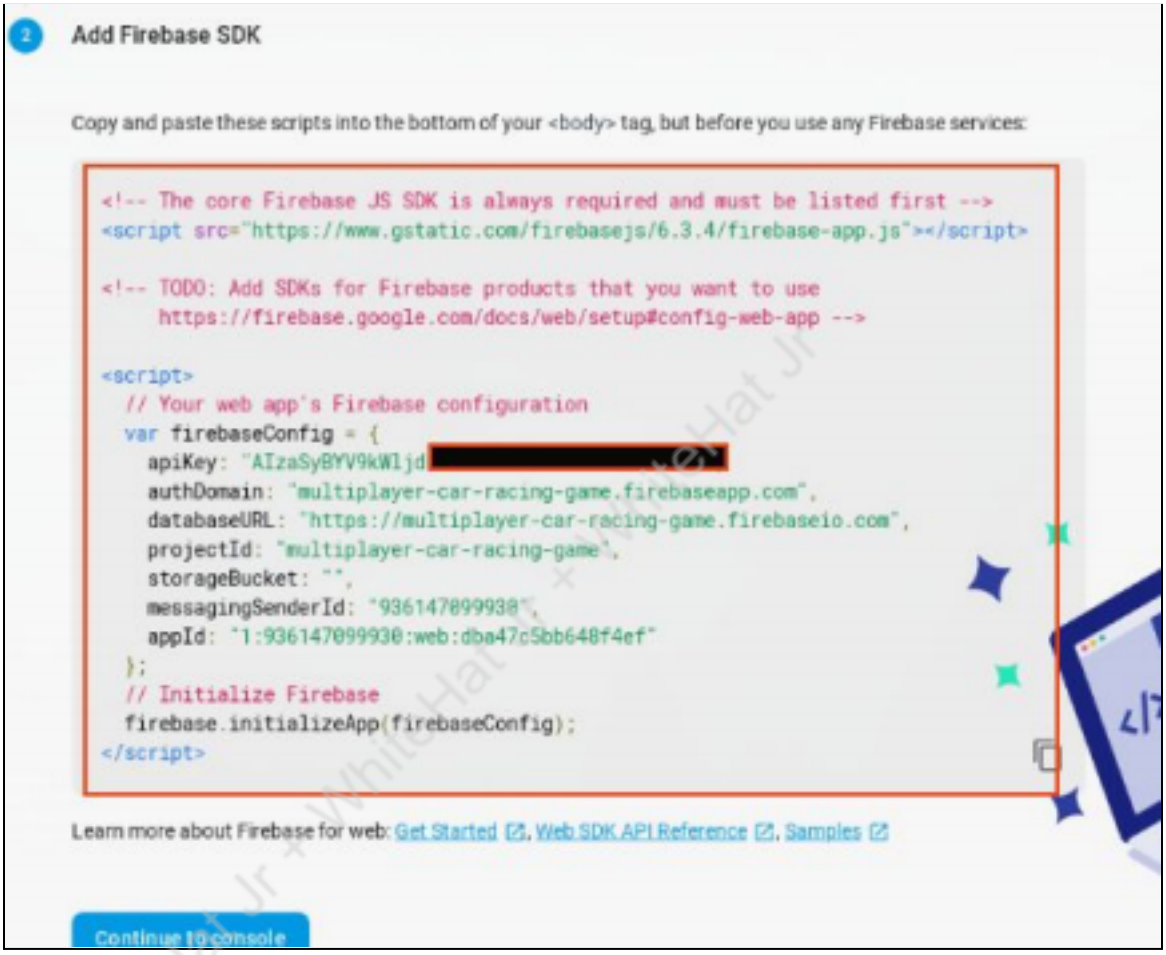
- Output shows that the movement of the ball is different in both browsers; their movements are asynchronous.



2. In order to synchronise the movement,
    - We need to store the ball's position in a common, remote database.
    - Our code should be able to read the ball's position from the common remote database and update the ball's position,when it changes.

3. Create an account in Google's **Firebase Realtime Database** for this purpose.
    - **Step 1:** Go to https://console.firebase.google.com and log in with your Gmail ID.
    - **Step 2:** Click **Create a New Project**.
    - **Step 3:** Enter the name of your project. Accept terms and click **Continue**.
    - **Step 4:** Disable the use of Google Analytics.
    - **Step 5:** Visit the Database section of the dashboard and click **Create Database**.
    - **Step 6:** Create the database in test mode for now.
    - **Step 7:** Add a child to create nodes, which can hold the ball's x and y positions.

4. Connect the Firebase database to our code.
    - **Step 1:** Import a few Firebase libraries, which will allow us to read and write to our database.
    - **Step 2:** Click "**Project Settings**". Choose to add to Web to get started.



Step 3: Add this to the **index.html** file along with the **src** library for Firebase database.

```
<script src="https://cdnjs.cloudflare.com/ajax/libs/p5.js/0.9.0/addons/p5.dom.min.js"></script>
<script src="https://cdnjs.cloudflare.com/ajax/libs/p5.js/0.9.0/addons/p5.sound.min.js"></script>
<script src="p5.play.js"></script>

<script src="https://www.gstatic.com/firebasejs/6.3.4/firebase-app.js"></script>
<script src="https://www.gstatic.com/firebasejs/6.3.0/firebase-database.js"></script>

<script>
  // Your web app's Firebase configuration
  var firebaseConfig = {
    apiKey: "AIzaSyBYV9kWljd-8zlRsYSLGIv2zBX4MhkNAo8",
    authDomain: "multiplayer-car-racing-game.firebaseapp.com",
    databaseURL: "https://multiplayer-car-racing-game.firebaseio.com",
    projectId: "multiplayer-car-racing-game",
    storageBucket: "",
    messagingSenderId: "936147099930",
    appId: "1:936147099930:web:dba47c5bb648f4ef"
  };
  // Initialize Firebase
  firebase.initializeApp(firebaseConfig);
</script>
<link rel="stylesheet" type="text/css" href="style.css"/>
</head>
<body>
<script src="sketch.js"></script>
</body>
</html>
```

5. To add the reference to the position of the ball in the database:
   - **.ref()** is used to refer to the location of the database value that we care about.
   - **.on()** creates a listener, which keeps listening to the changes in the database.
   - Every time a change in the database values of position (reference) occurs, the **readPosition()** function is called.
   - If there was any error in reading the values in the database, the **showError()** function is called.

```
var hypnoticBall, database;
var position;


function setup(){
  database = firebase.database();
  console.log(database);
  createCanvas(500,500);

  hypnoticBall = createSprite(250,250,10,10);
  hypnoticBall.shapeColor = "red";


  var hypnoticBallPosition = database.ref('ball/position');
  hypnoticBallPosition.on("value", readPosition, showError);
}

function draw(){
  background("white");
```

6. In the **readPosition()** function, we can read the position of the value in the database.
7. We assign the x and y values of the ball's position in the database to the ball sprite.

```
37
38  function readPosition(data){
39    position = data.val();
40    console.log(position.x);
41    hypnoticBall.x = position.x;
42    hypnoticBall.y = position.y;
43  }
```

8 The **.set()** function is used to set the value in the database.

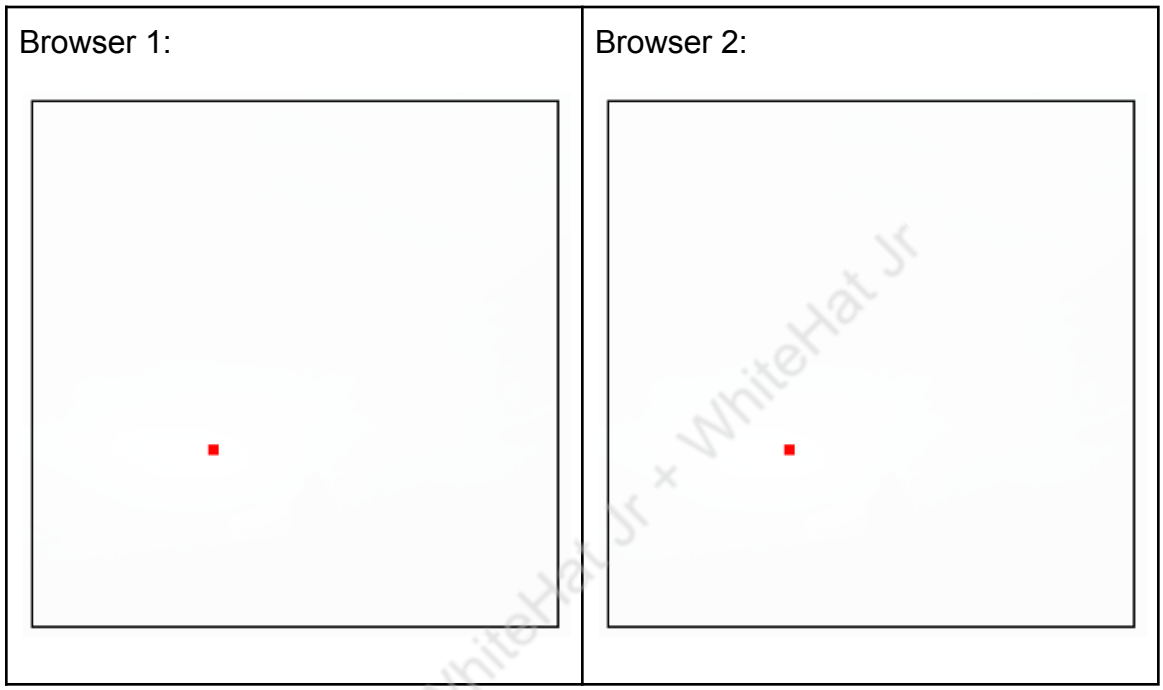
```
18  function draw(){
19    background("white");
20
21      if(keyDown(LEFT_ARROW)){
22        writePosition(-1,0);
23      }
24      else if(keyDown(RIGHT_ARROW)){
25        writePosition(1,0);
26      }
27      else if(keyDown(UP_ARROW)){
28        writePosition(0,-1);
29      }
30      else if(keyDown(DOWN_ARROW)){
31        writePosition(0,+1);
32      }
33      drawSprites();
34
35  }
36
37  function writePosition(x,y){
38    database.ref('ball/position').set({
39      'x': position.x + x ,
40      'y': position.y + y
41    })
42  }
```


8. To fix the bug of delay in ball movement, we can add a condition in the **draw()** function.

```
12
13
14    var hypnoticBallPosition = database.ref('ball/position');
15    hypnoticBallPosition.on("value", readPosition, showError);
16  }
17
18  function draw(){
19    background("white");
20    if(position !== undefined){
21      if(keyDown(LEFT_ARROW)){
22        writePosition(-1,0);
23      }
24      else if(keyDown(RIGHT_ARROW)){
25        writePosition(1,0);
26      }
27      else if(keyDown(UP_ARROW)){
28        writePosition(0,-1);
29      }
30      else if(keyDown(DOWN_ARROW)){
31        writePosition(0,+1);
32      }
33      drawSprites();
34    }
35
36  }
37
38  function writePosition(x,y){
39    database.ref('ball/position').set({
40      'x': position.x + x ,
41      'y': position.y + y
42    })
43  }
```

9. Run the code to see the synchronous movement of the ball.

OUTPUT:



What's next?

In the next class, we will start working on a multiplayer car racing game using the Firebase Database.

EXTEND YOUR KNOWLEDGE

You can learn about Google's Firebase Realtime Database through the following document:
https://firebase.google.com/docs