Typescript is a statically typed superset of Javascript that adds optional static typing to the Language. Developed & maentained by Microsoft, Typescript enhances Javascript's capabilities while still being compatible with existing code.

1. Static Typing :-

- Typescript allows developers to specify types for Voriables, Fonction parameters, return values & objects. This can catch type-related errors during development rather than at runtime.

2. Type inference :-

Typescript can infer types when they are not explicitly provided, making the code cleaner & reducing the need for redundant type annotations.

3. Interfaces :-

Interfaces in typescript allow developers to define custom types. They can be used to describe the shape of an object, ensuring that objects adhere to a specific structure.

4. Generics :-

Typescript supports generics, which enable developers to write reusable and flexible functions, classes, and interfaces.

5. Namespaces and Modules :-

Namespaces are a way to organize code & avoid naming conflicts. Modules provide a better way to organize and share code by splitting it into smaller files.

6. Advanced Type features

Typescript includes advanced types features like union types, intersection types, type guards, & type aliases, which allow for more expressive type definitions.

7. Support for Modern Javascript features

Typescript supports features from the latest ECMAScript standards, such as async/await, destructuring & template literals, providing a modern development experience.

8. Tooling and integration

Typescript offers excellent tooling support, including integration with popular editors like visual Studio code. Features like intellisense, code navigation, and refactoring are enhanced with Typescript

Benefits of using Typescript.

1. Enhanced code quality and maintainability.
   - Static typing catch errors early, improving code quality & reducing runtime errors. It also makes the code easier to understand & maintain.

2. Better Developer Experience :-
   - Features like autocompletion, type checking, & advanced refactoring tools lead to a more productive development environment.

3. Scalability
   - Typescript is particularly beneficial for large codebases, as the explicit types makes it easier to manage and refactor the code.

4. Interoperability
   - Typescript is fully compatible with Javascript, meaning existing javascript code can be incrementally adopted into a Typescript project.

5. Community and ecosystem

Typescript has a strong community and a growing ecosystem of libraries & frameworks, many of which provide type definitions to enhance the development experience.

Data Type usage

1. Integer and Floating - point :-

```
function addNumbers(a: number, b: number): number {
    return a + b;
}

// Example Usage:
let result: number = addNumbers(5, 3.5);
console.log(result); // output: 8.5
```

2. Boolean

variable ↙ datatype ↙

```
function isEven(number: number): Boolean {
    return number % 2 == 0;
}

// console.log(isEven(4)); // output: True
// Console.log(isEven(7)); // output: False.
```

3. String

```
function greet(name: string): string
{
    return `Hello ${name}`;
}

console.log(greet("Alice"); // output: Hello Alice!
console.log(greet("Bob"); // output: Hello Bob!
```

4. Array

```
function findMax(numbers: number[]): number | undefined {
    if (numbers.length === 0) { return undefined; }
    let maxNumber: number = numbers[0];
    for (let num of numbers) {
        if (num > maxNumber) maxNumber = num;
    }
    return maxNumber;
}
```

5. Object (Dictionary-like)

```
Interface Person {
    name : string;
    age : number;
    city : string;
}

function printPersonInfo(person: Person): void {
    console.log(`Name : ${person.name}`);
    console.log(`Age : ${person.age}`);
    console.log(`city : ${person.city}`);
}

let personInfo : person = { name: 'Alice', age: 30, city: "Ny" };
printPersonInfo(personInfo);
```

In Typescript, "any" is a special type that represents a value of any type. It allows you to opt-out of type checking and can be used when you don't know or don't care about the type of a particular value.

```
function identity(value: any): any {
    return value;
}

let result: any;
result = identity(5); // result is number
console.log(result); // output is 5.

result = identity("hello"); // result is string
console.log(result); // output is hello.

result = identity(true); // result is boolean
console.log(result); // output is true.
```

In React using Typescript

The difference between `useState<user[] | null>(null)` and `useState<user[]>([])` lies in the initial state value and the type of the state.

`useState<user[] | null>(null)` vs `useState<user[]>([])`

1. Type Safety

- `useState<user[] | null>(null)`: allows the state to be null or an array of User objects.
- `useState<user[]>([])`: ensures the state is always an array of User objects, even if it's empty initially.

2. Initial State:

- `useState<user[] | null>(null)` starts with null, representing an absence of data.
- `useState<user[]>([])` starts with an empty array, representing no users yet.

3. **Handling Initial State :**

- With NULL initial state, you often need a conditional check for null before rendering.
- With an empty array initial state, you can directly iterate over the array, but you may want to check 'users.length' to display a loading message or handle an empty state differently.

(Typescript)

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