1. Introduction to Proxy Traps

A Proxy object in JavaScript allows you to define custom behaviors for fundamental operations (e.g., property access, assignment) by defining "traps" in a handler object. Each trap corresponds to a specific operation you might want to intercept and customize.

2. Common Proxy Traps

2.1. get Trap

- **Purpose:** Intercepts property access.
- **Signature:** get(target, prop, receiver)
- **Parameters:**
    - target: The original object.
    - prop: The property name.
    - receiver: The proxy object itself.
- **Returns:** The value of the property.
- **Usage:** Useful for customizing or logging property access.

Example:

javascript

Copy code

```
const handler = {
  get(target, prop, receiver) {
    console.log(` Accessing property ${prop}` );
    return Reflect.get(target, prop, receiver);
  }
};


const proxy = new Proxy({ name: 'Alice' }, handler);
console.log(proxy.name); // Console: Accessing property name, Alice
```

2.2. set Trap

- **Purpose:** Intercepts property assignments.
- **Signature:** set(target, prop, value, receiver)
- **Parameters:**
    - target: The original object.
    - prop: The property name.
    - value: The new value.
    - receiver: The proxy object itself.
- **Returns:** true if the assignment was successful; otherwise, false.
- **Usage:** Useful for validation or transformation of property values.

Example:

javascript

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```
const handler = {
  set(target, prop, value, receiver) {
    if (typeof value !== 'string') {
      throw new TypeError('Value must be a string');
    }
    target[prop] = value;
    return true;
  }
};

const proxy = new Proxy({}, handler);
proxy.name = 'Alice'; // Works fine
// proxy.name = 123; // Throws TypeError
```

2.3. has Trap

- **Purpose:** Intercepts the in operator.
- **Signature:** has(target, prop)
- **Parameters:**
    - target: The original object.
    - prop: The property name.
- **Returns:** true if the property is considered to exist; otherwise, false.
- **Usage:** Useful for controlling or customizing property existence checks.

Example:

javascript

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```
const handler = {
  has(target, prop) {
    console.log(` Checking existence of ${prop}` );
    return prop in target;
  }
};


const proxy = new Proxy({ name: 'Alice' }, handler);
console.log('name' in proxy); // Console: Checking existence of name, true
console.log('age' in proxy); // Console: Checking existence of age, false
```

2.4. deleteProperty Trap

- **Purpose:** Intercepts property deletions.
- **Signature:** deleteProperty(target, prop)
- **Parameters:**
    - target: The original object.
    - prop: The property name.
- **Returns:** true if the property was successfully deleted; otherwise, false.

- **Usage:** Useful for controlling or logging property deletions.

Example:

javascript

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```
const handler = {
 deleteProperty(target, prop) {
  console.log(` Deleting property ${prop}` );
  if (prop in target) {
   delete target[prop];
   return true;
  }
  return false;
 }
};


const proxy = new Proxy({ name: 'Alice' }, handler);
delete proxy.name; // Console: Deleting property name
console.log(proxy.name); // undefined
```

2.5. ownKeys Trap

- **Purpose:** Intercepts operations that enumerate the keys of an object (e.g., Object.keys, for...in loops).
- **Signature:** ownKeys(target)
- **Parameters:**
    - target: The original object.
- **Returns:** An array of the keys (strings or symbols) of the target object.
- **Usage:** Useful for customizing the behavior of key enumeration.

Example:

javascript

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```
const handler = {
  ownKeys(target) {
    console.log('Enumerating keys');
    return Reflect.ownKeys(target);
  }
};

const proxy = new Proxy({ name: 'Alice', age: 25 }, handler);
console.log(Object.keys(proxy)); // Console: Enumerating keys, ['name', 'age']
```

2.6. getOwnPropertyDescriptor Trap

- **Purpose:** Intercepts the Object.getOwnPropertyDescriptor operation.
- **Signature:** getOwnPropertyDescriptor(target, prop)
- **Parameters:**
    - target: The original object.
    - prop: The property name.
- **Returns:** The property descriptor object or undefined if the property does not exist.
- **Usage:** Useful for customizing the behavior of property descriptor retrieval.

Example:

javascript

Copy code

```
const handler = {
  getOwnPropertyDescriptor(target, prop) {
    console.log(` Getting descriptor for ${prop}` );
    return Reflect.getOwnPropertyDescriptor(target, prop);
  }
};

const proxy = new Proxy({ name: 'Alice' }, handler);
```

```
console.log(Object.getOwnPropertyDescriptor(proxy, 'name'));
// Console: Getting descriptor for name
// Output: { value: 'Alice', writable: true, enumerable: true, configurable: true }
```

2.7. defineProperty Trap

- **Purpose:** Intercepts property definition operations (e.g., Object.defineProperty).
- **Signature:** defineProperty(target, prop, descriptor)
- **Parameters:**
  - target: The original object.
  - prop: The property name.
  - descriptor: The property descriptor.
- **Returns:** true if the property was successfully defined; otherwise, false.
- **Usage:** Useful for customizing property definitions or validations.

Example:

javascript

Copy code

```
const handler = {
  defineProperty(target, prop, descriptor) {
    console.log(` Defining property ${prop}` );
    return Reflect.defineProperty(target, prop, descriptor);
  }
};

const proxy = new Proxy({}, handler);
Object.defineProperty(proxy, 'name', { value: 'Alice', writable: true });
```

2.8. apply Trap

- **Purpose:** Intercepts function calls.
- **Signature:** apply(target, thisArg, argumentsList)
- **Parameters:**

    - target: The original function.
    - thisArg: The this value to use.
    - argumentsList: An array of arguments to pass.
- **Returns:** The result of the function call.
- **Usage:** Useful for logging or modifying function calls.

Example:

javascript

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```
const handler = {
  apply(target, thisArg, argumentsList) {
    console.log(` Function called with arguments ${argumentsList}` );
    return target.apply(thisArg, argumentsList);
  }
};

function sum(a, b) {
  return a + b;
}

const proxy = new Proxy(sum, handler);
console.log(proxy(1, 2)); // Console: Function called with arguments 1,2, 3
```

2.9. construct Trap

- **Purpose:** Intercepts construction of new instances (using new).
- **Signature:** construct(target, args, newTarget)
- **Parameters:**
    - target: The original constructor.
    - args: The arguments to pass to the constructor.
    - newTarget: The constructor that was used to create the instance.

- **Returns:** The newly created instance.
- **Usage:** Useful for logging or customizing instance creation.

Example:

javascript

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```
const handler = {
  construct(target, args, newTarget) {
    console.log(` Constructing with arguments ${args}` );
    return new target(...args);
  }
};


function Person(name) {
  this.name = name;
}


const proxy = new Proxy(Person, handler);
const person = new proxy('Alice'); // Console: Constructing with arguments Alice
console.log(person.name); // Alice
```

3. Summary

JavaScript's Proxy API provides a way to define custom behavior for fundamental operations on objects. The common traps include:

- **get:** Intercepts property access.
- **set:** Intercepts property assignments.
- **has:** Intercepts checks for property existence.
- **deleteProperty:** Intercepts property deletions.
- **ownKeys:** Intercepts key enumeration.
- **getOwnPropertyDescriptor:** Intercepts property descriptor retrieval.
- **defineProperty:** Intercepts property definition.

- **apply:** Intercepts function calls.
- **construct:** Intercepts instance creation.