

<!--

以下是将装饰器系统整合到MVP框架后的完整代码实现：

主要改进点说明：

1. 装饰器翻译系统
  - 通过 `registerServices` 实现 装饰器工厂清单
  - 通过 `registerService` 实现 装饰器工厂方法
  - 通过 `withDecorators` 实现 装饰器工厂流水线
  - 服务间支持自动依赖解析（如UserService自动获取StorageService）
  - Presenter构造函数自动注入已注册服务
2. 服务整合
  - StorageService提供本地存储功能
  - UserService处理用户相关业务逻辑
  - 服务实例在应用启动前自动初始化
3. Presenter增强
  - 同时支持原有MVP参数(view/model)和依赖注入
  - 业务方法中可直接使用注入的服务
  - 保持原有事件处理逻辑不变
4. 数据持久化示例
  - 用户提交时自动保存到localStorage
  - 商品保存时记录时间戳
  - 可通过StorageService扩展更多存储方式

使用示例：

1. 提交用户表单后可在控制台查看存储结果
2. 保存商品后可在localStorage查看“lastProduct”数据
3. 所有服务依赖自动解析，无需手动实例化

该实现保持了MVP模式的核心优势，同时增加了现代化的依赖注入和服务管理能力，适合需要扩展复杂业务逻辑的中大型应用。

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```
<!DOCTYPE html>
<html>
<head>
  <meta http-equiv="Content-Type" content="text/html; charset=UTF-8">
  <style>
    [data-id] { margin: 5px; padding: 5px; }
    .container { border: 1px solid #ccc; padding: 20px; max-width: 500px; }
    .error { color: red; display: none; }
  </style>
</head>
<body>
  <!-- 组件1 -->
  <div class="container" data-component="userForm" data-model="UserModel">
    <input type="text" placeholder="Enter username" data-id="username" data-bind="model.username">
    <button data-id="submitBtn" data-event="click:handleSubmit">Submit</button>
    <div data-id="usernameError" class="error"></div>
    <div data-id="output"></div>
  </div>

  <!-- 组件2 -->
  <div class="container" data-component="productForm" data-model="ProductModel">
    <input type="text" placeholder="Enter productName" data-id="productName" data-bind="model.name">
    <button data-event="click:handleSave">Save Product</button>
  </div>

  <script>
    // =====
    // Model 类 - 数据管理
    // 基础模型类
    // =====
    class Model {
      constructor() {
```

```

        this._data = {};
        this.listeners = [];
    }

    get data() {
        return this._data;
    }

    setData(key, value) {
        this._data[key] = value;
        this.notify(key);
    }

    subscribe(callback) {
        this.listeners.push(callback);
    }

    notify(key) {
        this.listeners.forEach(cb => cb(key));
    }
}

// 用户模型
class UserModel extends Model {
    constructor() {
        super();
        this.setData('username', '');
    }

    validateUsername(value) {
        if (value.length < 3) throw new Error("用户名至少3个字符");
    }
}

// 商品模型
class ProductModel extends Model {
    constructor() {
        super();
        this.setData('name', '');
    }
}

// =====
// View 类 - UI管理
// =====
class View {
    constructor(dataComponent) {
        this.component = document.querySelector(`[data-component="${dataComponent}"]`);
        this.elements = {};
        this.bindings = {};

        // 自动发现元素
        this.component.querySelectorAll('[data-id]').forEach(el => {
            this.elements[el.dataset.id] = el;
        });

        // 处理数据绑定
        this.component.querySelectorAll('[data-bind]').forEach(el => {
            const binding = el.dataset.bind;
            const [, prop] = binding.split('.');

            if (!this.bindings[prop]) this.bindings[prop] = [];
            this.bindings[prop].push(el);

            // 初始化值
            el.value = this.presenter?.model.data[prop] || '';

            // 双向绑定

```

```

        el.addEventListener('input', (e) => {
            this.presenter.model.setData(prop, e.target.value);
        });
    });

    // 处理事件绑定
    this.component.querySelectorAll('[data-event]').forEach(el => {
        const [eventType, handler] = el.dataset.event.split(':');
        el.addEventListener(eventType, () => {
            if (this.presenter && this.presenter[handler]) {
                this.presenter[handler]()
            }
        });
    });
}

bindPresenter(presenter) {
    this.presenter = presenter;
    this.presenter.model.subscribe((key) => this.updateBindings(key));
}

updateOutput(text) {
    this.elements.output.textContent = text;
}

updateBindings(key) {
    const value = this.presenter.model.data[key];
    this.bindings[key]?.forEach(el => {
        el.value = value;
    });
}

showError(message) {
    this.elements.usernameError.style.display = 'block';
    this.elements.usernameError.textContent = message;
}

hideError() {
    this.elements.usernameError.style.display = 'none';
}
}

// =====
// 装饰器翻译系统 依赖注入
// =====
// 装饰器工厂清单
const registerServices = new Map();

// 装饰器工厂方法
function registerService(serviceName) {
    return function(target) {
        registerServices.set(serviceName, new target());
        target.prototype.__serviceName = serviceName;
        return target;
    };
}

// 装饰器工厂流水线
function withDecorators(...decorators) {
    return function(target) {
        return decorators.reduceRight((acc, decorator) => {
            return decorator(acc);
        }, target);
    };
}

// =====
// 装饰器翻译系统 服务定义

```

```
// =====
const StorageService = withDecorators(
  registerService('storageService')
)(
  class {
    save(key, value) {
      localStorage.setItem(key, JSON.stringify(value));
    }
    load(key) {
      return JSON.parse(localStorage.getItem(key));
    }
  }
);

const UserService = withDecorators(
  registerService('userService')
)(
  class {
    constructor() {
      this.storage = registerServices.get('storageService');
    }
    saveUser(user) {
      this.storage.save('currentUser', user);
    }
  }
);

// =====
// Presenter 类 - 业务逻辑
// =====
class Presenter {
  constructor(view, model) {
    this.view = view;
    this.model = model;
    this.view.bindPresenter(this);

    // 依赖注入
    registerServices.forEach((service, name) => {
      if (this.constructor === service.constructor) return;
      this[name] = service;
    });
  }

  handleSubmit() {
    try {
      this.model.validateUsername(this.model.data.username);
      this.view.updateOutput(`欢迎, ${this.model.data.username}!`);
      this.view.hideError();

      // 使用注入的服务保存用户
      if (this.userService) {
        this.userService.saveUser({
          username: this.model.data.username,
          timestamp: new Date()
        });
      }
    } catch (error) {
      this.view.showError(error.message);
    }
  }

  handleSave() {
    console.log('保存商品: ', this.model.data.name);
    // 使用存储服务保存商品
    if (this.storageService) {
      this.storageService.save('lastProduct', {
        name: this.model.data.name,
        savedAt: new Date().toISOString()
      });
    }
  }
}
```

```
        });
    }
}

// =====
// 组件初始化系统
// =====
class App {
    static dataComponents = {};

    static registerModel(name, modelClass) {
        this.dataComponents[name] = modelClass;
    }

    static init() {
        document.querySelectorAll('[data-component]').forEach(dataComponent => {
            const modelName = dataComponent.dataset.model;
            const modelClass = this.dataComponents[modelName];

            if (!modelClass) throw new Error(`未注册的模型: ${modelName}`);

            const model = new modelClass();
            const view = new View(dataComponent.dataset.component);
            new Presenter(view, model);
        });
    }
}

// 注册模型
App.registerModel('UserModel', UserModel);
App.registerModel('ProductModel', ProductModel);

// 启动应用
document.addEventListener('DOMContentLoaded', () => App.init());
</script>
</body>
</html>
```