OBJECT ORIENTED JAVASCRIPT

1 2 3 4 5

ISP

ViewModel

```
const ViewModel = class extends ViewModelListener{
    static get(data){return new ViewModel(data);}
    static #subjects = new Set;
    static #inited = false;
    static notify(vm){
        this.#subjects.add(vm);
        if(this.#inited) return;
        this.#inited = true;
        const f =_=>{
            this.#subjects.forEach(vm=>{
               if(vm.#isUpdated.size){
                   vm.notify();
                   vm.#isUpdated.clear();
               }
            });
            requestAnimationFrame(f);
        };
        requestAnimationFrame(f);
    }
    styles = {}; attributes = {}; properties = {}; events = {};
    subKey = ""; parent = null;
    #isUpdated = new Set; #listeners = new Set;
    constructor(data, _=type(data, "object")){
        super();
        Object.entries(data).forEach(([cat, obj])=>{
            if("styles,attributes,properties".includes(cat)) {
                if (!obj || typeof obj != "object") throw `invalid object cat:${cat}, obj:${obj}`;
                this[cat] = Object.defineProperties({}, Object.entries(obj).reduce((r, [k, v])=>{
                    r[k] = {
                        enumerable:true,
                        get:_=>v,
                        set:newV=>{
                            v = newV;
                            this.add(new ViewModelValue(this.#subKey, cat, k, v));
                        }
                    };
                    return r;
                }, {}));
            }else{
                Object.defineProperties(this, {
                    [cat]: {
                        enumerable: true,
                        get:_=>obj,
                        set:newV=>{
                            obj = newV;
                            this.add(new ViewModelValue(this.#subKey, "root", cat, obj));
                        }
                    }
                });
                if(obj instanceof ViewModel){
                    obj.parent = this;
                    obj.subKey = cat;
                    obj.addListener(this);
                }
            }
        });
        ViewModel.notify(this);
        Object.seal(this);
    }
    viewmodelUpdated(updated){
        updated.forEach(v=>this.#isUpdated.add(v));
    }
    addListener(v, _=type(v, ViewModelListener)){
        this.#listeners.add(v);
    }
    removeListener(v, _=type(v, ViewModelListener)){
        this.#listeners.delete(v);
    }
    notify(){
        this.#listeners.forEach(v=>v.viewmodelUpdated(this.#isUpdated));
    }
};
```

. . . .

```
addListener(v, _=type(v, ViewModelListener)){
    this.#listeners.add(v);
}
removeListener(v, _=type(v, ViewModelListener)){
    this.#listeners.delete(v);
}
notify(){
    this.#listeners.forEach(v=>v.viewmodelUpdated(this.#isUpdated));
}
```

```
#isUpdated = new Set; #listeners = new Set;

addListener(v, _=type(v, ViewModelListener)){
    this.#listeners.add(v);
}
removeListener(v, _=type(v, ViewModelListener)){
    this.#listeners.delete(v);
}
notify(){
    this.#listeners.forEach(v=>v.viewmodelUpdated(this.#isUpdated));
}
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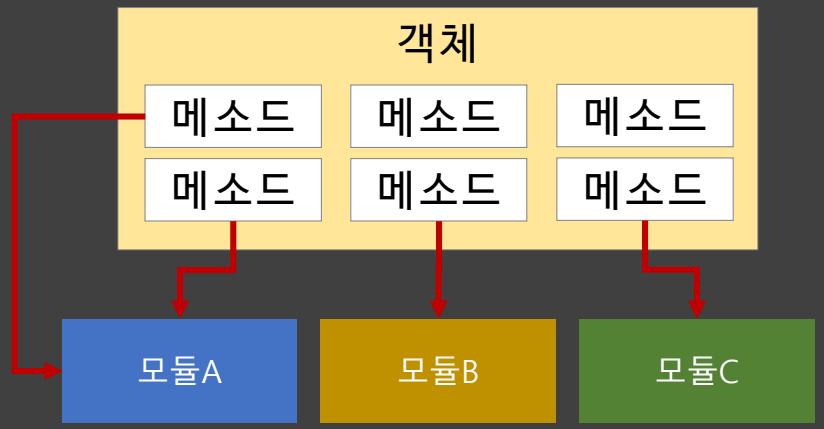
#isUpdated = new Set; #listeners = new Set;

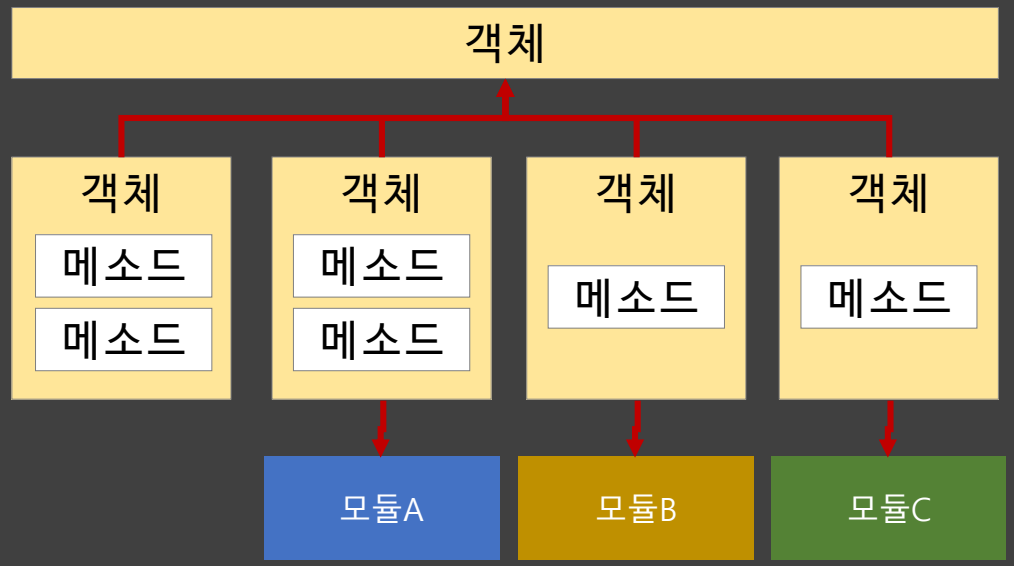
addListener(v, _=type(v, ViewModelListener)){
    this.#listeners.add(v);
}
removeListener(v, _=type(v, ViewModelListener)){
    this.#listeners.delete(v);
}
notify(){
    this.#listeners.forEach(v=>v.viewmodelUpdated(this.#isUpdated));
}
```

```
static #subjects = new Set;
static #inited = false;
static notify(vm){
    this.#subjects.add(vm);
    if(this.#inited) return;
    this.#inited = true;
    const f =_=>{
        this.#subjects.forEach(vm=>{
            if(vm.#isUpdated.size){
                vm.notify();
                vm.#isUpdated.clear();
            }
        });
        requestAnimationFrame(f);
    };
    requestAnimationFrame(f);
}
```

SOLID원칙

SRP Single Responsibility 단일책임
OCP Open Closed 개방폐쇄
LSP Liskov Substitusion 업캐스팅 안전
ISP Interface Segregation 인터페이스분리





```
const ViewModelSubject = class extends ViewModelListener{
    #info = new Set; #listeners = new Set;
    add(v, _=type(v, ViewModelValue)){this.#info.add(v);}
    clear(){this.#info.clear();}
    addListener(v, _=type(v, ViewModelListener)){
        this.#listeners.add(v);
        ViewModelSubject.watch(this);
    }
    removeListener(v, _=type(v, ViewModelListener)){
        this.#listeners.delete(v);
        if(!this.#listeners.size) ViewModelSubject.unwatch(this);
    }
    notify(){this.#listeners.forEach(v=>v.viewmodelUpdated(this.#info));}
};
```

```
#isUpdated = new Set; #listeners = new Set;

addListener(v, _=type(v, ViewModelListener)){
  this.#listeners.add(v);
}
removeListener(v, _=type(v, ViewModelListener)){
  this.#listeners.delete(v);
}
notify(){
  this.#listeners.forEach(
    v=>v.viewmodelUpdated(this.#isUpdated)
  );
}
```

```
const ViewModelSubject = class extends ViewModelListener{
    #info = new Set; #listeners = new Set;
    add(v, _=type(v, ViewModelValue)){this.#info.add(v);}
    clear(){this.#info.clear();}
    addListener(v, _=type(v, ViewModelListener)){
        this.#listeners.add(v);
        ViewModelSubject.watch(this);
    }
    removeListener(v, _=type(v, ViewModelListener)){
        this.#listeners.delete(v);
        if(!this.#listeners.size) ViewModelSubject.unwatch(this);
    }
    notify(){this.#listeners.forEach(v=>v.viewmodelUpdated(this.#info));}
};
```

```
#isUpdated = new Set; #listeners = new Set;

addListener(v, _=type(v, ViewModelListener)){
  this.#listeners.add(v);
}
removeListener(v, _=type(v, ViewModelListener)){
  this.#listeners.delete(v);
}
notify(){
  this.#listeners.forEach(
    v=>v.viewmodelUpdated(this.#isUpdated)
  );
}
```

```
static #subjects = new Set;
static #inited = false;
static notify(vm){
    this.#subjects.add(vm);
    if(this.#inited) return;
    this.#inited = true;
    const f =_=>{
        this.#subjects.forEach(vm=>{
           if(vm.#isUpdated.size){
               vm.notify();
               vm.#isUpdated.clear();
           }
        });
        requestAnimationFrame(f);
    };
    requestAnimationFrame(f);
}
```

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    if(this.#inited) return;
    this.#inited = true;
    const f =_=>{
        this.#subjects.forEach(vm=>{
           if(vm.#isUpdated.size){
               vm.notify();
               vm.#isUpdated.clear();
           }
        });
        requestAnimationFrame(f);
    };
    requestAnimationFrame(f);
}
```

```
static #subjects = new Set; static #inited = false;
static notify(){
    const f =_=>{
        this.#subjects.forEach(v=>{
            if(v.#info.size){
                v.notify();
                v.clear();
            }
        });
        if(this.#inited) requestAnimationFrame(f);
    };
    requestAnimationFrame(f);
}
```

```
static #subjects = new Set;
static #inited = false;
static notify(vm){
    this.#subjects.add(vm);
    if(this.#inited) return;
    this.#inited = true;
    const f =_=>{
        this.#subjects.forEach(vm=>{
           if(vm.#isUpdated.size){
               vm.notify();
               vm.#isUpdated.clear();
           }
        });
        requestAnimationFrame(f);
    };
    requestAnimationFrame(f);
}
```

```
static #subjects = new Set; static #inited = false;
static notify(){…}
static watch(vm, _=type(vm, ViewModelListener)){
    this.#subjects.add(vm);
    if(!this.#inited){
        this.#inited = true;
        this.notify();
    }
}
```

```
static #subjects = new Set;
static #inited = false;
static notify(vm){
    this.#subjects.add(vm);
    if(this.#inited) return;
    this.#inited = true;
    const f =_=>{
        this.#subjects.forEach(vm=>{
           if(vm.#isUpdated.size){
               vm.notify();
               vm.#isUpdated.clear();
           }
        });
        requestAnimationFrame(f);
    };
    requestAnimationFrame(f);
}
```

```
static #subjects = new Set; static #inited = false;
static notify(){…}
static watch(vm, _=type(vm, ViewModelListener)){
    this.#subjects.add(vm);
    if(!this.#inited){
        this.#inited = true;
        this.notify();
    }
}
static unwatch(vm, _=type(vm, ViewModelListener)){
    this.#subjects.delete(vm);
    if(!this.#subjects.size) this.#inited = false;
}
```

섬세한 권한 조정

```
const ViewModel = class extends ViewModelListener{
    static get(data){return new ViewModel(data);}
    styles = {}; attributes = {}; properties = {}; events = {};
    subKey = ""; parent = null;
```

```
const ViewModel = class extends ViewModelListener{
    static get(data){return new ViewModel(data);}
    styles = {}; attributes = {}; properties = {}; events = {};
    subKey = ""; parent = null;
```

```
const ViewModel = class extends ViewModelSubject{
    static get(data){return new ViewModel(data);}
    styles = {}; attributes = {}; properties = {}; events = {};
    #subKey = "";
    get subKey(){return this.#subKey;}
    #parent = null;
    get parent(){return this.#parent;}
    setParent(parent, subKey){
        this.#parent = type(parent, ViewModel);
        this.#subKey = subKey;
        this.addListener(parent);
    }
```

```
const ViewModel = class extends ViewModelListener{
    static get(data){return new ViewModel(data);}
    styles = {}; attributes = {}; properties = {}; events = {};
    subKey = ""; parent = null;
```

```
const ViewModel = class extends ViewModelSubject{
    static get(data){return new ViewModel(data);}
    styles = {}; attributes = {}; properties = {}; events = {};
    #subKey = "";
    get subKey(){return this.#subKey;}
    #parent = null;
    get parent(){return this.#parent;}
    setParent(parent, subKey){
        this.#parent = type(parent, ViewModel);
        this.#subKey = subKey;
        this.addListener(parent);
    }
```

```
constructor(data, _=type(data, "object")){
    super();
    Object.entries(data).forEach(([cat, obj])=>{
        if("styles,attributes,properties".includes(cat)) {
            if (!obj || typeof obj != "object") throw `invalid object cat:${cat}, obj:${obj}`;
            this[cat] = Object.defineProperties({}, Object.entries(obj).reduce((r, [k, v])=>{
                r[k] = {
                    enumerable:true,
                    get:_=>v,
                    set:newV=>{
                        v = newV;
                        this.add(new ViewModelValue(this.#subKey, cat, k, v));
                    }
                };
                return r;
            }, {}));
        }else{…}
    });
    Object.seal(this);
}
viewmodelUpdated(updated){updated.forEach(v=>this.add(v));}
```

```
constructor(data, _=type(data, "object")){
    super();
    Object.entries(data).forEach(([cat, obj])=>{
        if("styles,attributes,properties".includes(cat)) {…
        }else{
            Object.defineProperties(this, {
                [cat]: {
                    enumerable: true,
                    get: _ => obj,
                    set: newV => {
                        obj = newV;
                        this.add(new ViewModelValue(this.#subKey, "root", cat, obj));
                    }
                }
            });
            if(obj instanceof ViewModel) obj.setParent(this, cat);
        }
    });
    Object.seal(this);
}
viewmodelUpdated(updated){updated.forEach(v=>this.add(v));}
```

Visitor

```
const Scanner = class{
  scan(el, _ = type(el, HTMLElement)){
      const binder = new Binder;
      this.checkItem(binder, el);
      const stack = [el.firstElementChild];
      let target;
      while(target = stack.pop()){
          this.checkItem(binder, target);
          if(target.firstElementChild) stack.push(target.firstElementChild);
          if(target.nextElementSibling) stack.push(target.nextElementSibling);
      }
      return binder;
  }
  checkItem(binder, el){
      const vm = el.getAttribute("data-viewmodel");
      if(vm) binder.add(new BinderItem(el, vm));
  }
};
```

```
const Scanner = class{
  scan(el, _ = type(el, HTMLElement)){
      const binder = new Binder;
      this.checkItem(binder, el);
      const stack = [el.firstElementChild];
      let target;
      while(target = stack.pop()){
          this.checkItem(binder, target);
          if(target.firstElementChild) stack.push(target.firstElementChild);
          if(target.nextElementSibling) stack.push(target.nextElementSibling);
      }
      return binder;
  }
  checkItem(binder, el){
      const vm = el.getAttribute("data-viewmodel");
      if(vm) binder.add(new BinderItem(el, vm));
  }
};
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const Scanner = class{
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      while(target = stack.pop()){
          this.checkItem(binder, target);
          if(target.firstElementChild) stack.push(target.firstElementChild);
          if(target.nextElementSibling) stack.push(target.nextElementSibling);
      }
      return binder;
  }
  checkItem(binder, el){
      const vm = el.getAttribute("data-viewmodel");
      if(vm) binder.add(new BinderItem(el, vm));
  }
};
```

```
const Visitor = class {
    visit(action, target, _0=type(action, "function")) {
        throw "override"
    }
};
```

```
const Visitor = class {
    visit(action, target, _0=type(action, "function")) {
        throw "override"
    }
};

const DomVisitor = class extends Visitor{
    visit(action, target, _0=type(action, "function"), _1=type(target, HTMLElement)) {
        const stack = [];
        let curr = target.firstElementChild;
        do {
            action(curr);
            if (curr.firstElementChild) stack.push(curr.firstElementChild);
            if (curr.nextElementSibling) stack.push(curr.nextElementSibling);
        } while (curr = stack.pop());
    }
};
```

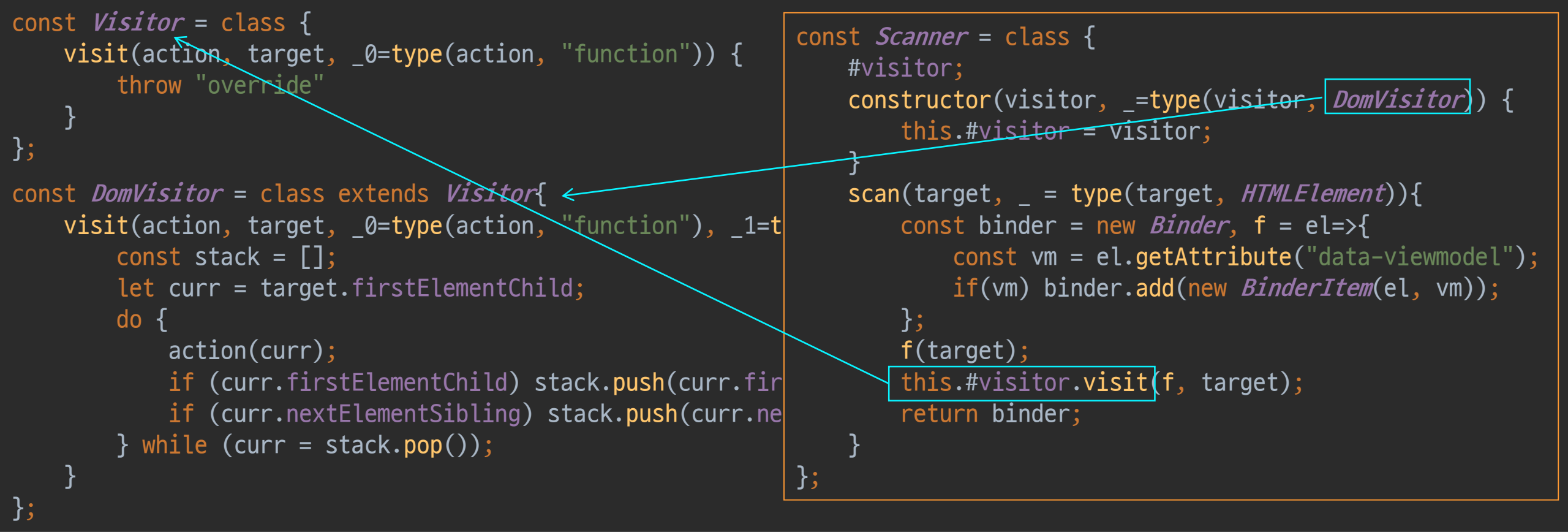
```
const Visitor = class {
    visit(action, target, _0=type(action, "function")) {
        throw "override"
    }
};

const DomVisitor = class extends Visitor{
    visit(action, target, _0=type(action, "function"), _1=type(target, HTMLElement)) {
        const stack = [];
        let curr = target.firstElementChild;
        do {
            action(curr);
            if (curr.firstElementChild) stack.push(curr.firstElementChild);
            if (curr.nextElementSibling) stack.push(curr.nextElementSibling);
        } while (curr = stack.pop());
    }
};
```

```
const Visitor = class {
    visit(action, target, _0=type(action, "function")) {
        throw "override"
    }
};
const DomVisitor = class extends Visitor{
    visit(action, target, _0=type(action, "function"), _1=t
        const stack = [];
        let curr = target.firstElementChild;
        do {
            action(curr);
            if (curr.firstElementChild) stack.push(curr.fir
            if (curr.nextElementSibling) stack.push(curr.ne
        } while (curr = stack.pop());
    }
};
```

```
const Scanner = class {
    #visitor;
    constructor(visitor, _=type(visitor, DomVisitor)) {
        this.#visitor = visitor;
    }
    scan(target, _ = type(target, HTMLElement)){
        const binder = new Binder, f = el=>{
            const vm = el.getAttribute("data-viewmodel");
            if(vm) binder.add(new BinderItem(el, vm));
        };
        f(target);
        this.#visitor.visit(f, target);
        return binder;
    }
};
```

추상계층 불일치


const Visitor = class {
visit(action, target, _0=type(action, "function")) {
throw "override"
}
};
const DomVisitor = class extends Visitor{
visit(action, target, _0=type(action, "function"), _1=t
const stack = [];
let curr = target.firstElementChild;
do {
action(curr);
if (curr.firstElementChild) stack.push(curr.fir
if (curr.nextElementSibling) stack.push(curr.ne
} while (curr = stack.pop());
}
};
const Scanner = class {
#visitor;
constructor(visitor, _=type(visitor, DomVisitor)) {
this.#visitor = visitor;
}
scan(target, _ = type(target, HTMLElement)){
const binder = new Binder, f = el=>{
const vm = el.getAttribute("data-viewmodel");
if(vm) binder.add(new BinderItem(el, vm));
};
f(target);
this.#visitor.visit(f, target);
return binder;
}
};

```
const Visitor = class {
    visit(action, target, _0=type(action, "function")) {
        throw "override"
    }
};
const DomVisitor = class extends Visitor{
    visit(action, target, _0=type(action, "function"), _1=t
        const stack = [];
        let curr = target.firstElementChild;
        do {
            action(curr);
            if (curr.firstElementChild) stack.push(curr.fir
            if (curr.nextElementSibling) stack.push(curr.ne
        } while (curr = stack.pop());
    }
};
```

```
const Scanner = class {
    #visitor;
    constructor(visitor, _=type(visitor, DomVisitor)) {
        this.#visitor = visitor;
    }
    scan(target, _ = type(target, HTMLElement)){
        const binder = new Binder, f = el=>{
            const vm = el.getAttribute("data-viewmodel");
            if(vm) binder.add(new BinderItem(el, vm));
        };
        f(target);
        this.#visitor.visit(f, target);
        return binder;
    }
};
```

```
const Scanner = class {
    #visitor;
    constructor(visitor, _ = type(visitor, Visitor)) {
        this.#visitor = visitor;
    }
    visit(f, target){this.#visitor.visit(f, target);}
    scan(target){throw "override"}
};
```

```
const Scanner = class {
    #visitor;
    constructor(visitor, _=type(visitor, DomVisitor)) {
        this.#visitor = visitor;
    }
    scan(target, _ = type(target, HTMLElement)){
        const binder = new Binder, f = el=>{
            const vm = el.getAttribute("data-viewmodel");
            if(vm) binder.add(new BinderItem(el, vm));
        };
        f(target);
        this.#visitor.visit(f, target);
        return binder;
    }
};
```

```
const Scanner = class {
    #visitor;
    constructor(visitor, _ = type(visitor, Visitor)) {
        this.#visitor = visitor;
    }
    visit(f, target){this.#visitor.visit(f, target);}
    scan(target){throw "override"}
};
const DomScanner = class extends Scanner{
    constructor(visitor, _=type(visitor, DomVisitor)) {
        super(visitor);
    }
    scan(target, _ = type(target, HTMLElement)){
        const binder = new Binder, f = el=>{
            const vm = el.getAttribute("data-viewmodel");
            if(vm) binder.add(new BinderItem(el, vm));
        };
        f(target);
        this.visit(f, target);
        return binder;
    }
};
```

```
const Scanner = class {
    #visitor;
    constructor(visitor, _=type(visitor, DomVisitor)) {
        this.#visitor = visitor;
    }
    scan(target, _ = type(target, HTMLElement)){
        const binder = new Binder, f = el=>{
            const vm = el.getAttribute("data-viewmodel");
            if(vm) binder.add(new BinderItem(el, vm));
        };
        f(target);
        this.#visitor.visit(f, target);
        return binder;
    }
};
```

```
const Scanner = class {
    #visitor;
    constructor(visitor, _ = type(visitor, Visitor)) {
        this.#visitor = visitor;
    }
    visit(f, target){this.#visitor.visit(f, target);}
    scan(target){throw "override"}
};
```

```
const Visitor = class {
    visit(action, target, _0=type(action, "function")) {
        throw "override"
    }
};
```

```
const DomScanner = class extends Scanner{
    constructor(visitor, _=type(visitor, DomVisitor)) {
        super(visitor);
    }
    scan(target, _ = type(target, HTMLElement)){
        const binder = new Binder, f = el=>{
            const vm = el.getAttribute("data-viewmodel");
            if(vm) binder.add(new BinderItem(el, vm));
        };
        f(target);
        this.visit(f, target);
        return binder;
    }
};
```

```
const DomVisitor = class extends Visitor{
    visit(action, target, _0=type(action, "function"), _1=
        const stack = [];
        let curr = target.firstElementChild;
        do {
            action(curr);
            if (curr.firstElementChild) stack.push(curr.fi
            if (curr.nextElementSibling) stack.push(curr.n
        } while (curr = stack.pop());
    }
};
```

```
const scanner = new Scanner;
```

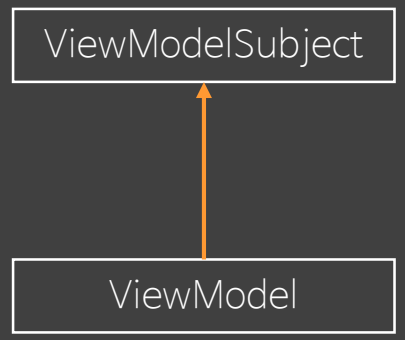
```
const scanner = new Scanner;
```

```
const scanner = new DomScanner(new DomVisitor);
```

설계 종합

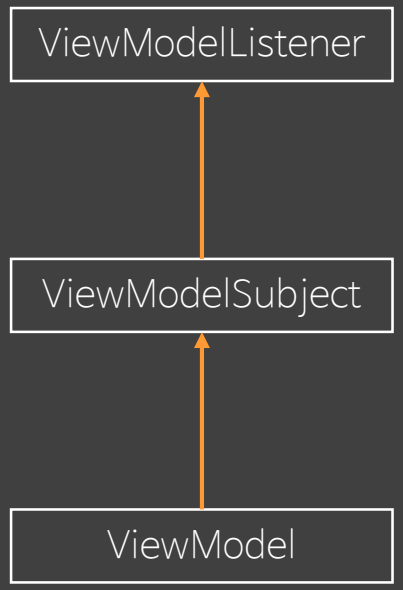
```
const ViewModel = class extends ViewModelSubject{
    static get(data){return new ViewModel(data);}
    styles = {}; attributes = {}; properties = {}; events = {};
    #subKey = "";
    get subKey(){return this.#subKey;}
    #parent = null;
    get parent(){return this.#parent;}
    setParent(parent, subKey){…}
    constructor(data, _=type(data, "object")){…}
    viewmodelUpdated(updated){updated.forEach(v=>this.add(v));}
};
```

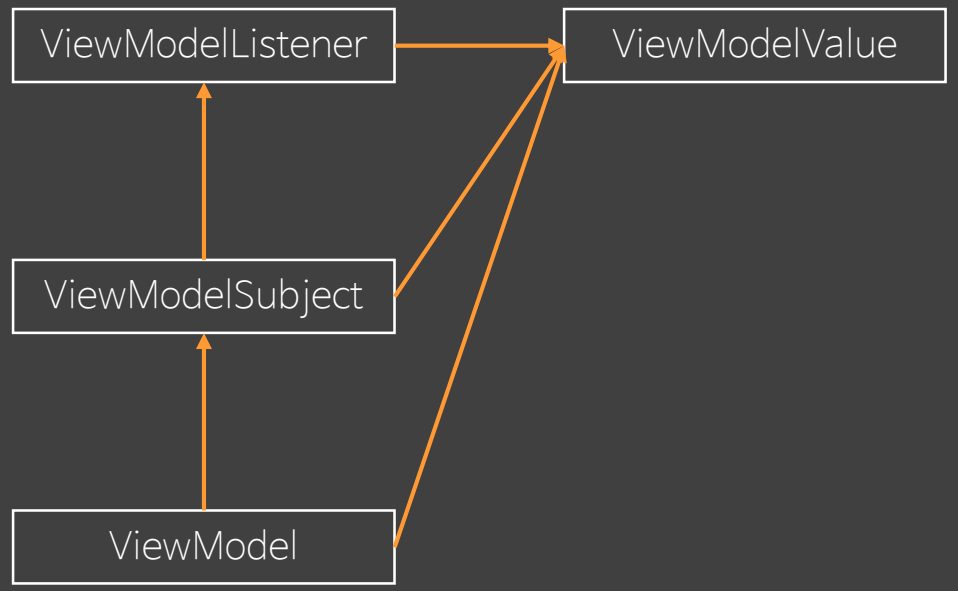
ViewModel



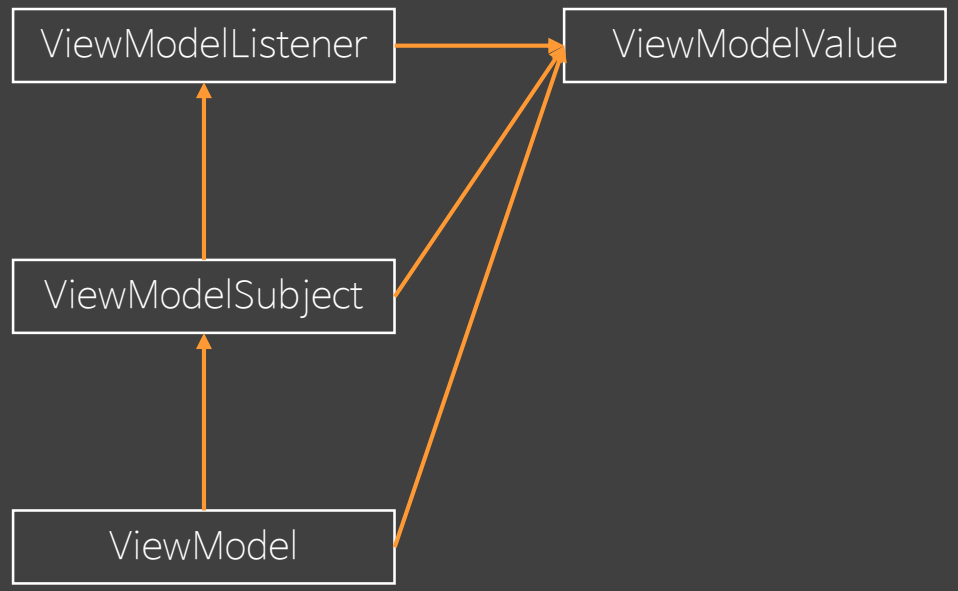

```
const ViewModelSubject = class extends ViewModelListener{
    static #subjects = new Set;
    static #inited = false;
    static notify(){…}
    static watch(vm, _=type(vm, ViewModelListener)){…}
    static unwatch(vm, _=type(vm, ViewModelListener)){…}
    #info = new Set; #listeners = new Set;
    add(v, _=type(v, ViewModelValue)){this.#info.add(v);}
    clear(){this.#info.clear();}
    addListener(v, _=type(v, ViewModelListener)){…}
    removeListener(v, _=type(v, ViewModelListener)){…}
    notify(){…}
};
```

```
const ViewModelListener = class{
    viewmodelUpdated(updated){throw "override";}
};
```





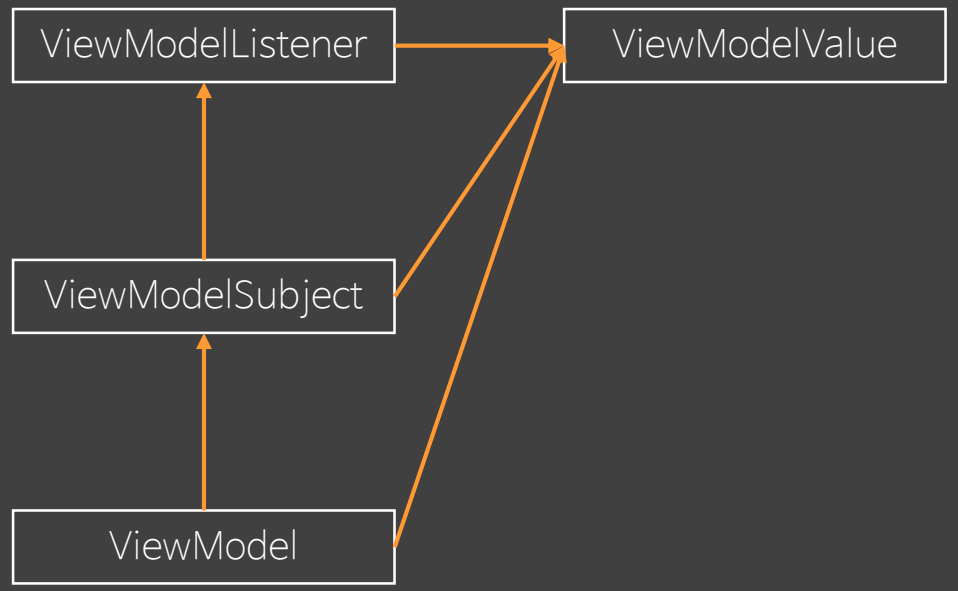

```
const ViewModelValue = class{
    subKey; cat; k; v;
    constructor(subKey, cat, k, v){
        this.subKey = subKey;
        this.cat = cat;
        this.k = k;
        this.v = v;
        Object.freeze(this);
    }
};
```

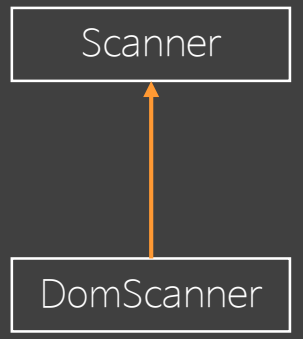



```
const Scanner = class {
    #visitor;
    constructor(visitor, _ = type(visitor, Visitor)){…}
    visit(f, target){…}
    scan(target) {…}
};
```

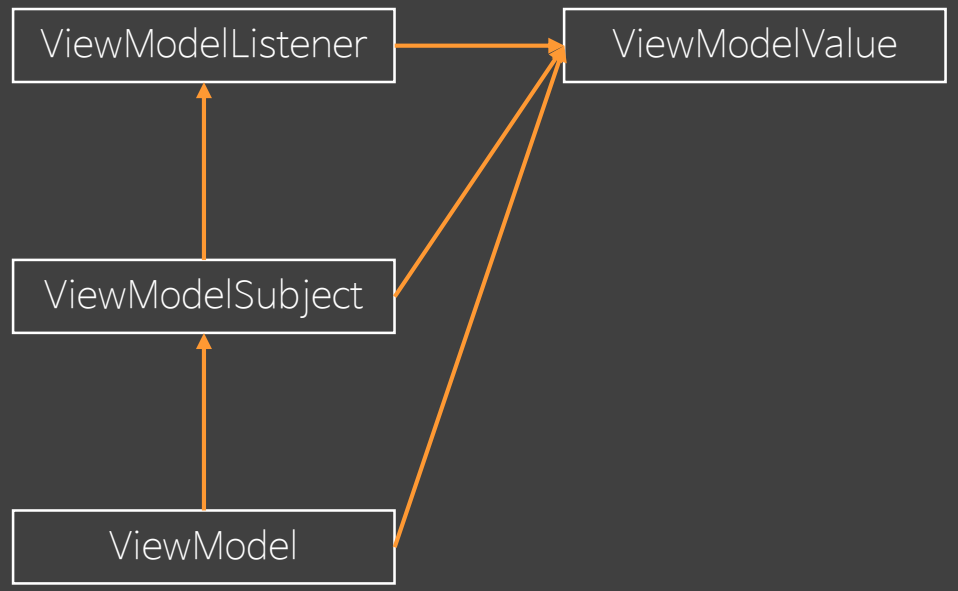
Scanner

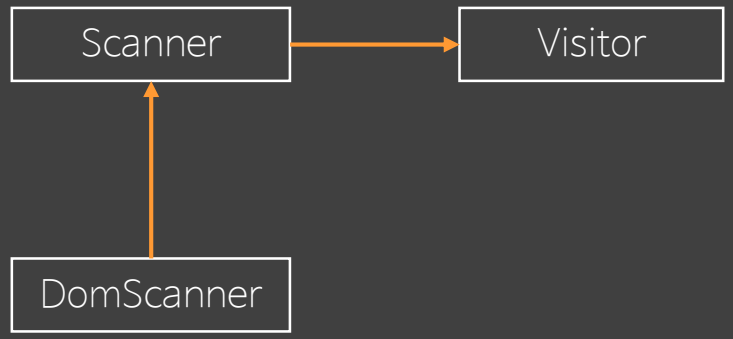
```
const DomVisitor = class extends Visitor{
    visit(action, target,
      _0=type(action, "function"),
      _1=type(target, HTMLElement)) {…}
};
```



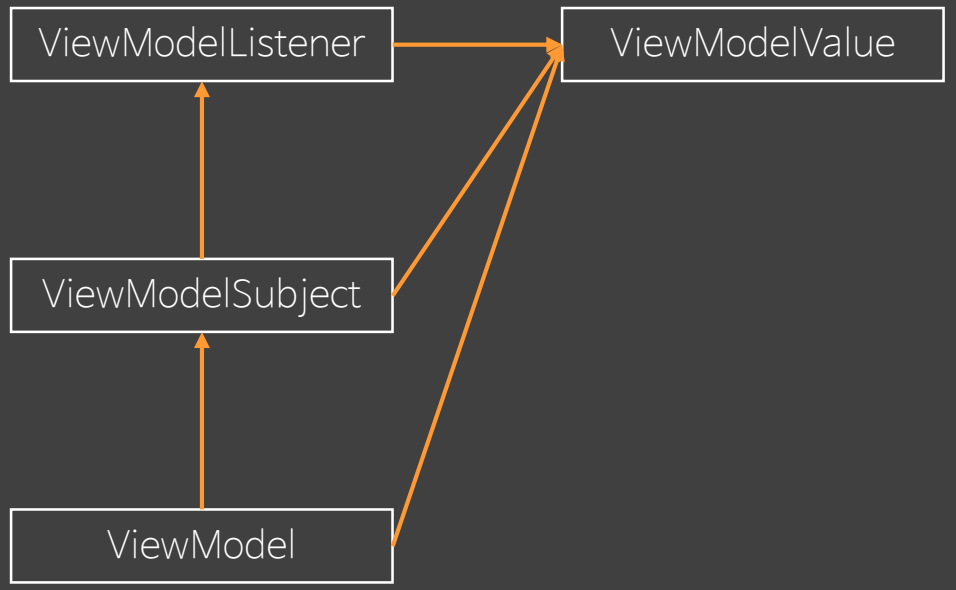


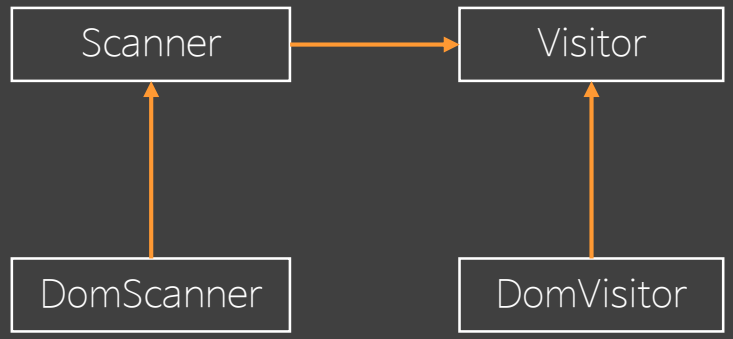
```
const Visitor = class {
    visit(action, target, _0=type(action, "function")) {
        throw "override"
    }
};
```

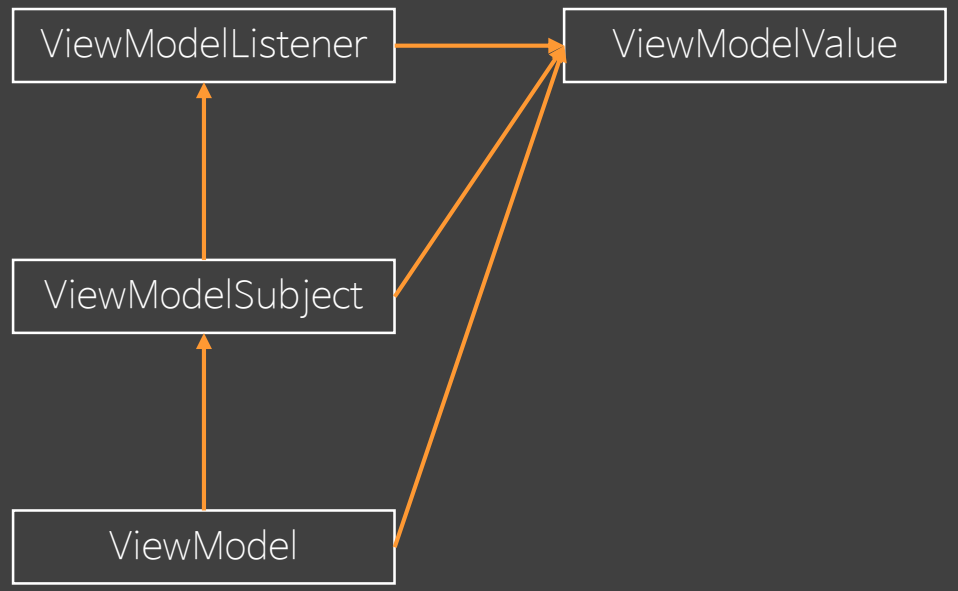




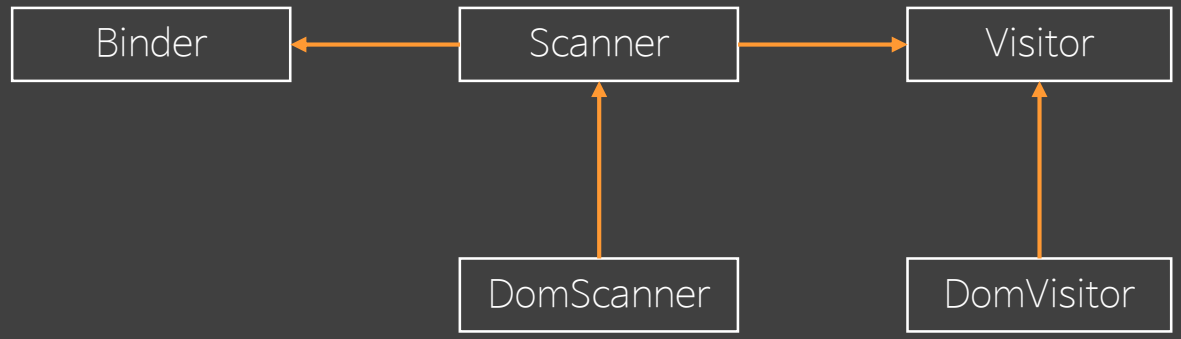
```
const DomVisitor = class extends Visitor{
    visit(action, target,
      _0=type(action, "function"),
      _1=type(target, HTMLElement)) {…}
};
```

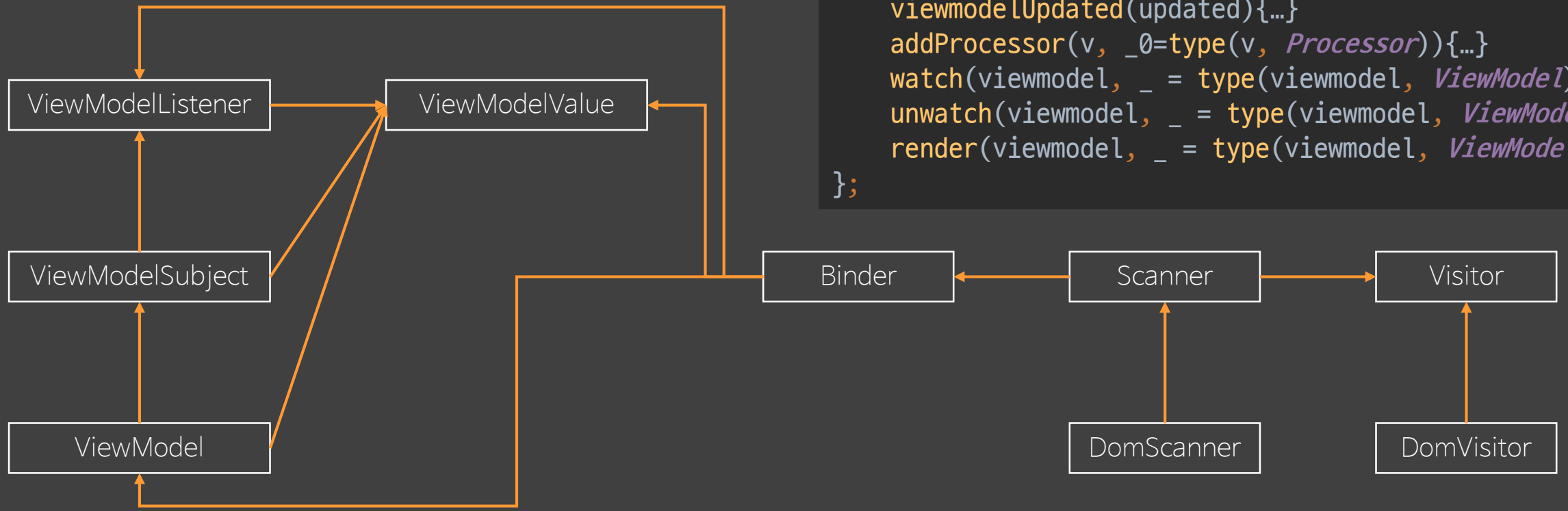






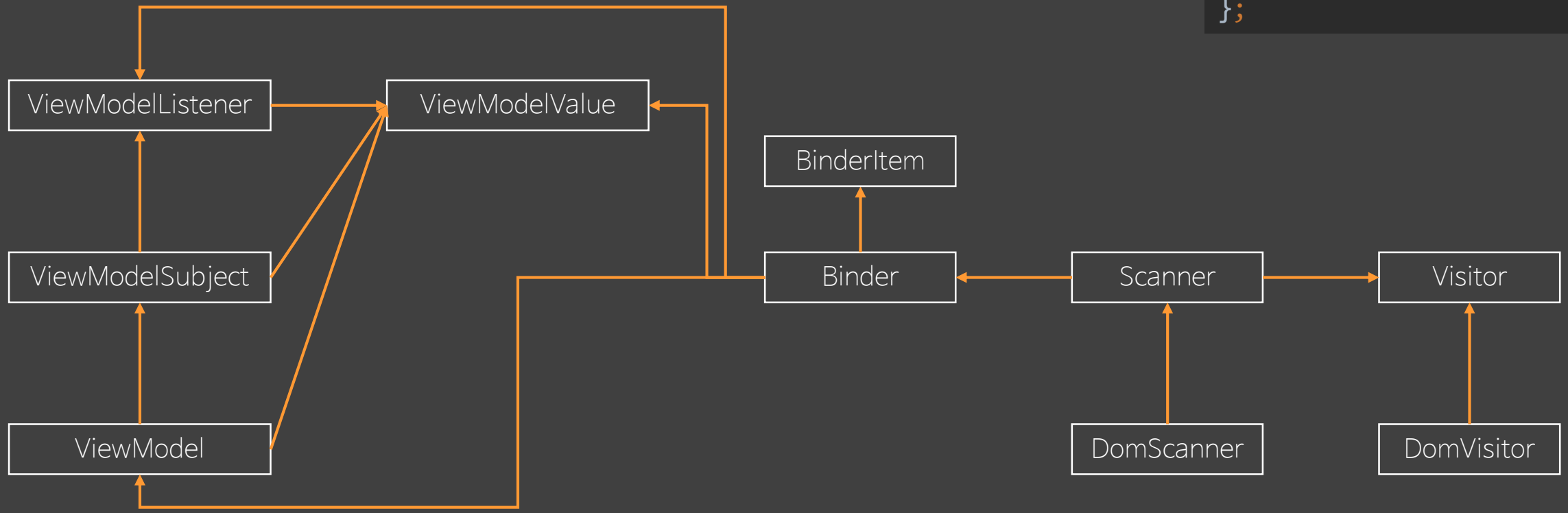

```
const Binder = class extends ViewModelListener{
    #items = new Set; #processors = {};
    add(v, _ = type(v, BinderItem)){this.#items.add(v);}
    viewmodelUpdated(updated){…}
    addProcessor(v, _0=type(v, Processor)){…}
    watch(viewmodel, _ = type(viewmodel, ViewModel)){…}
    unwatch(viewmodel, _ = type(viewmodel, ViewModel)){…}
    render(viewmodel, _ = type(viewmodel, ViewModel)){…}
};
```



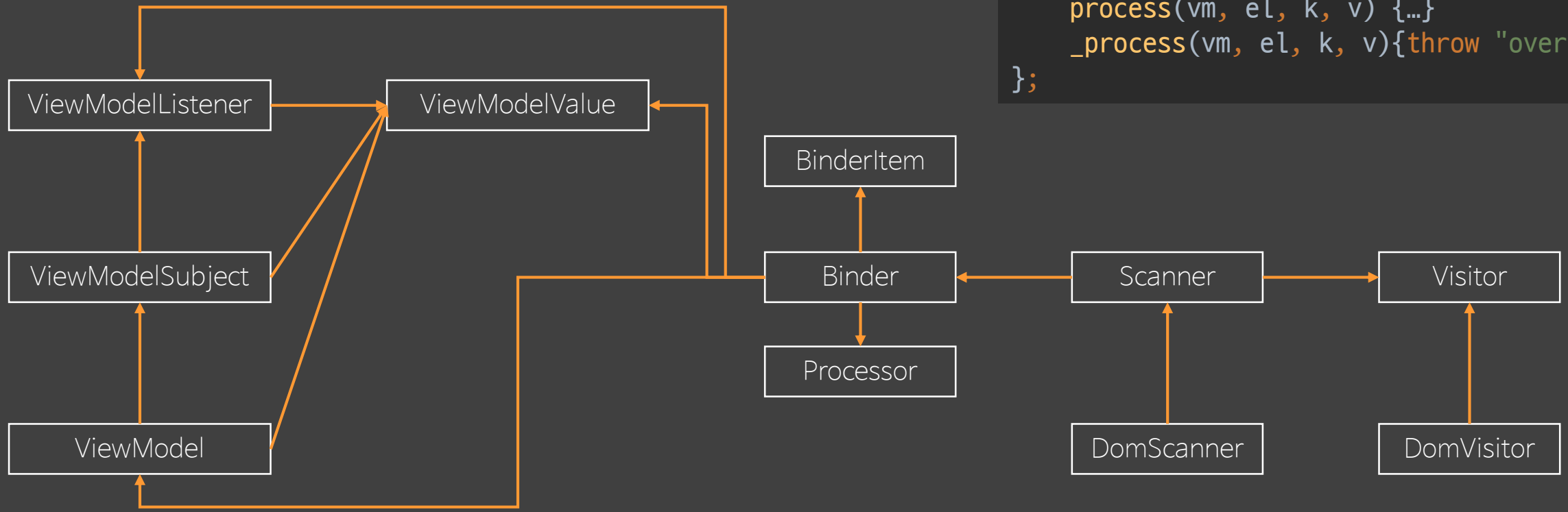



```
const Binder = class extends ViewModelListener{
    #items = new Set; #processors = {};
    add(v, _ = type(v, BinderItem)){this.#items.add(v);}
    viewmodelUpdated(updated){…}
    addProcessor(v, _0=type(v, Processor)){…}
    watch(viewmodel, _ = type(viewmodel, ViewModel)){…}
    unwatch(viewmodel, _ = type(viewmodel, ViewModel)){…}
    render(viewmodel, _ = type(viewmodel, ViewModel)){…}
};
```

```
const BinderItem = class{
  el; viewmodel;
  constructor(el, viewmodel){…}
};
```

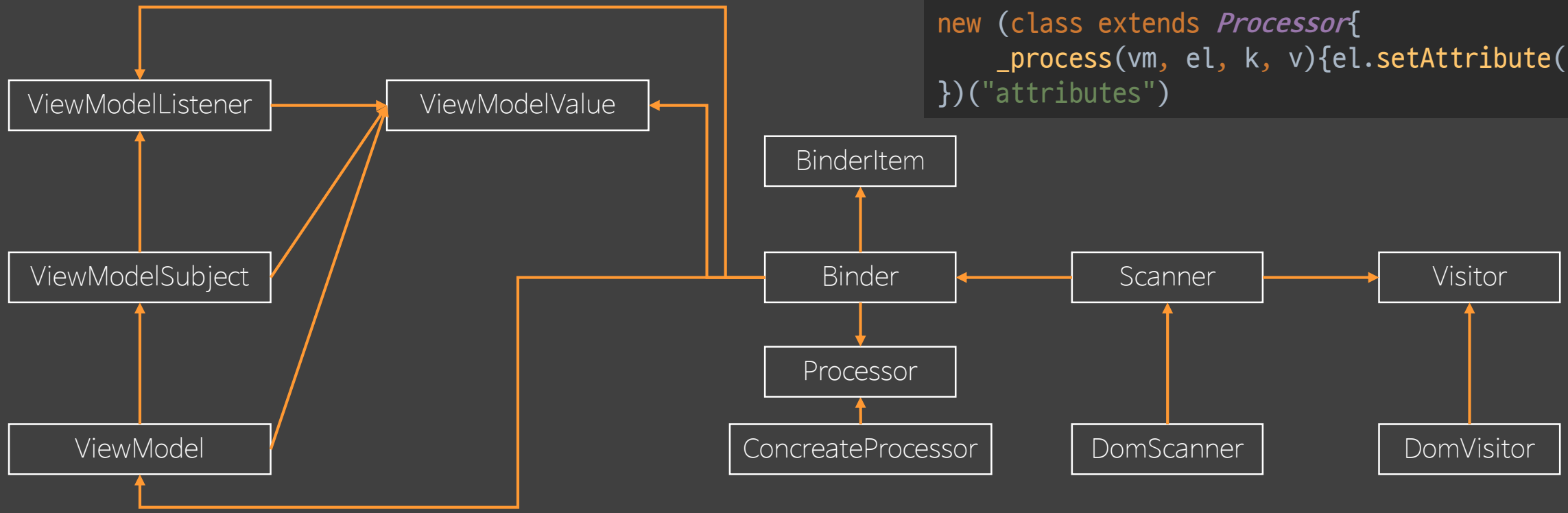


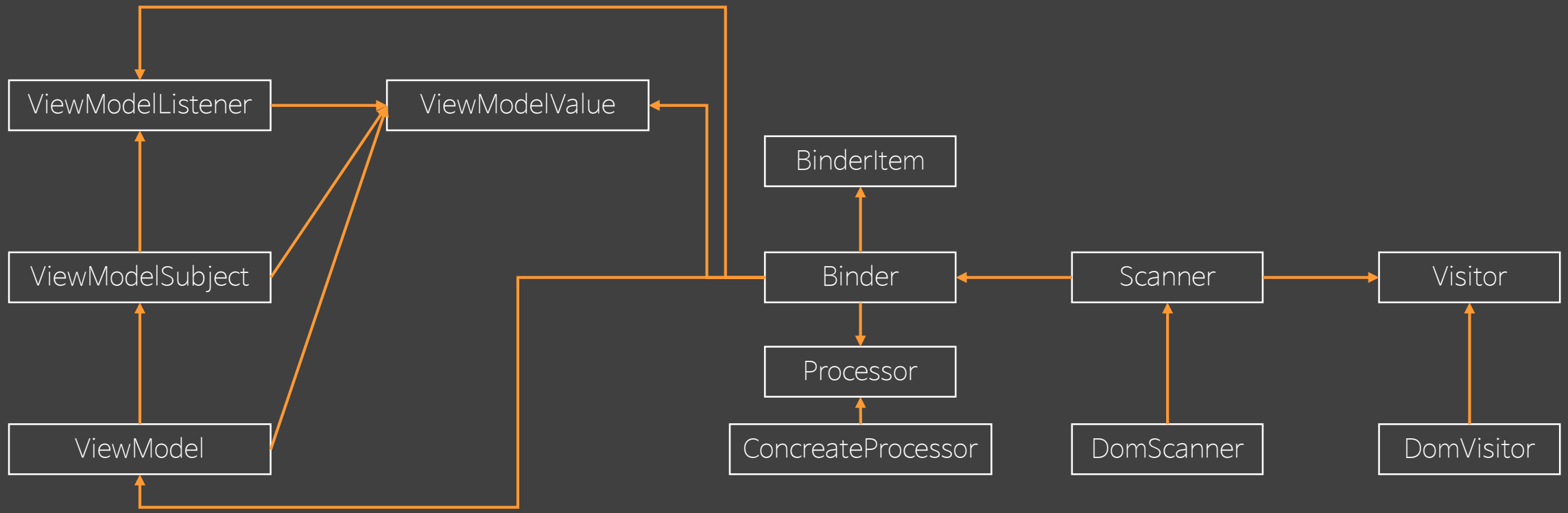
```
const Processor = class{
    cat;
    constructor(cat){…}
    process(vm, el, k, v) {…}
    _process(vm, el, k, v){throw "override";}
};
```

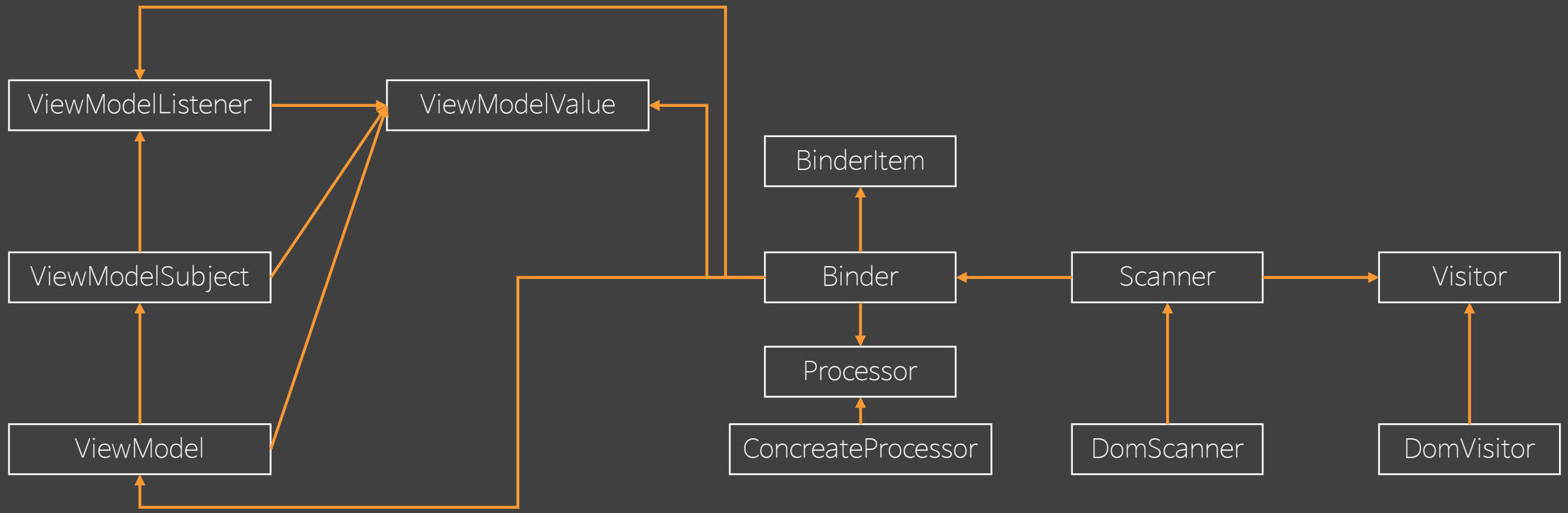


```
new (class extends Processor{
    _process(vm, el, k, v){el.style[k] = v;}
})("styles")
```

```
new (class extends Processor{
    _process(vm, el, k, v){el.setAttribute(k, v);}
})("attributes")
```




ViewModelListener
ViewModelValue
BinderItem
ViewModelSubject
Binder
Scanner
Visitor
Processor
ViewModel
ConcreateProcessor
DomScanner
DomVisitor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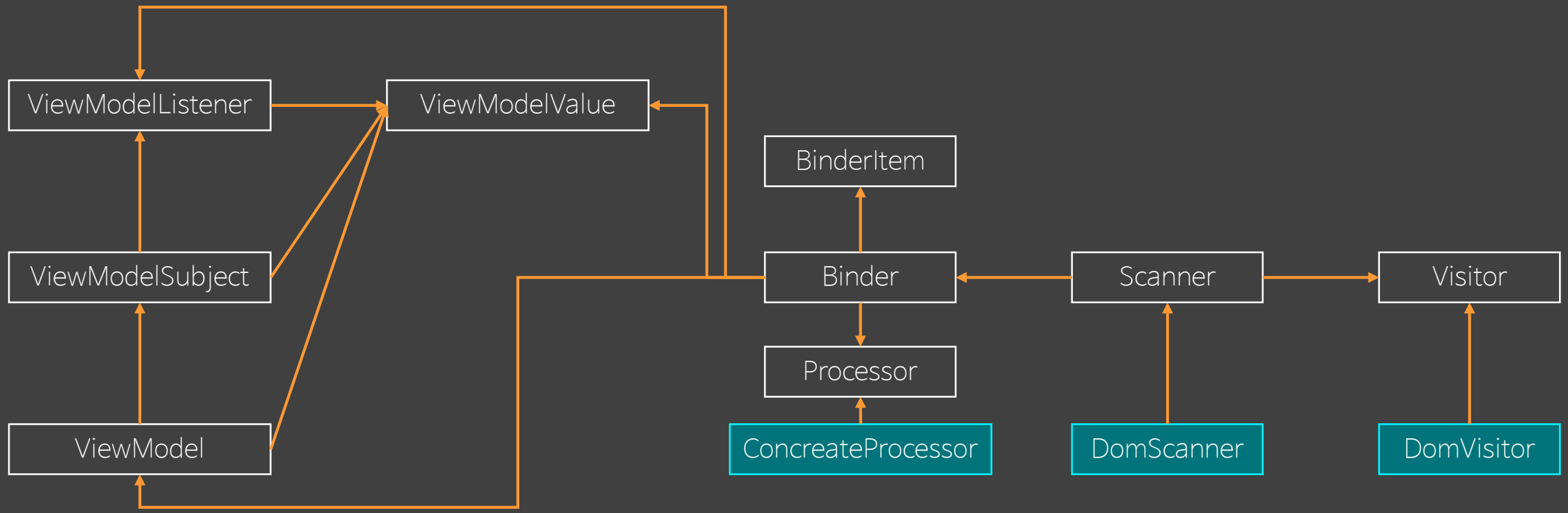
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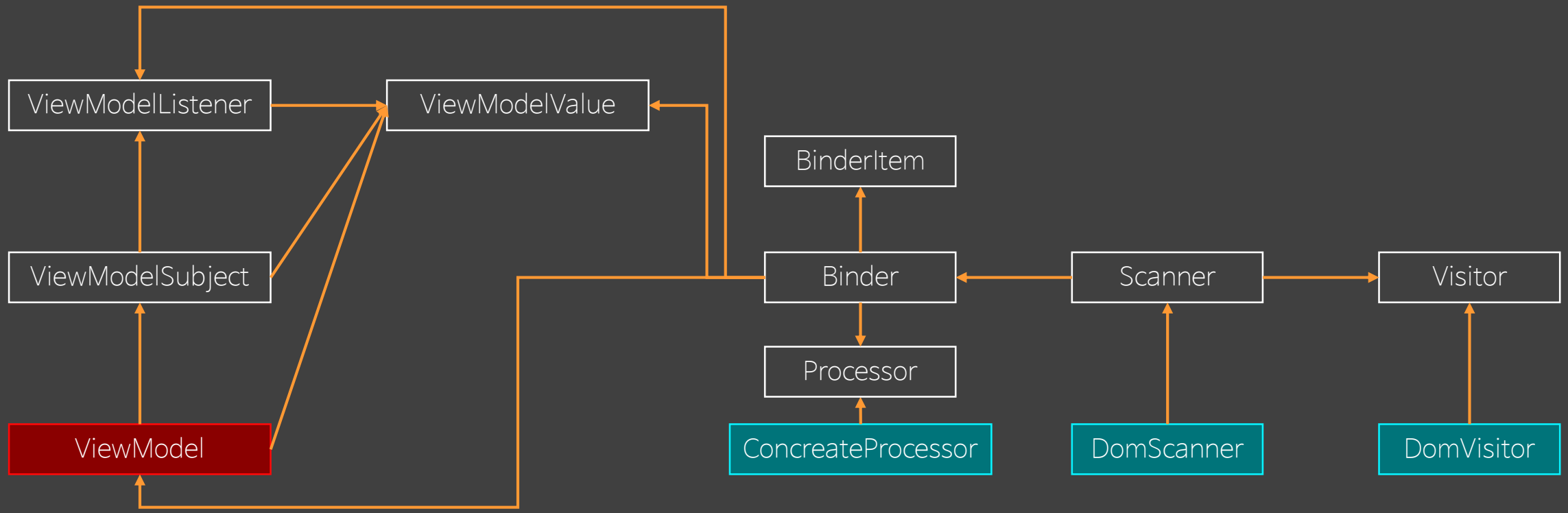
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