

Scraph You Boilerplate

A Practical Design Pattern for Generic
Programming [3]

Duane Irvin

`duane@student.chalmers.se`

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DAT-315 — The computer scientist in society

CHALMERS UNIVERSITY OF TECHNOLOGY

```
export interface Company {  
  type: 'company'  
  departments: Department[]  
}
```

```
export interface Department {  
  type: 'department'  
  name: Name  
  manager: Manager  
  subunits: SubUnit[]  
}
```

```
export type Manager = Employee
```

```
export interface Employee {  
  type: 'employee'  
  person: Person  
  salary: Salary  
}
```

```
export interface Salary {  
  type: 'salary'  
  value: number  
}
```

```
export interface Department {  
  type: 'department'  
  name: Name  
  manager: Manager  
  subunits: SubUnit[]  
}
```

```
export interface SubUnit {  
  type: 'subunit'  
  unit: Employee | Department  
}
```

```
export const increase =  
  (k: number) =>  
    ({ departments, ...rest }: Company): Company => ({  
      ...rest,  
      departments: departments.map(increaseDepartment(k)),  
    })
```

```

const increaseDepartment =
  (k: number) =>
  ({ manager, subunits, ...rest }: Department): Department => ({
    ...rest,
    manager: increaseEmployee(k)(manager),
    subunits: subunits.map(({ unit, ...rest }) => {
      switch (unit.type) {
        case 'employee':
          return {
            ...rest,
            unit: increaseEmployee(k)(unit),
          }
        case 'department':
          return {
            ...rest,
            unit: increaseDepartment(k)(unit),
          }
        default:
          return switchFallback(unit)
      }
    })
  })

```

```
const increaseEmployee =  
  (k: number) =>  
  ({ salary, ...rest }: Employee): Employee => ({  
    ...rest,  
    salary: increaseSalary(k)(salary),  
  })
```

```
const increaseSalary =  
  (k: number) =>  
  ({ value, ...rest }: Salary): Salary => ({  
    ...rest,  
    value: value * (1 + k),  
  })
```

That's a lot of code! :(

```
export const increase =
  (k: number) =>
  ({ departments, ...rest }: Company): Company => ({
    ...rest,
    departments: departments.map(increaseDepartment(k)),
  })

const increaseDepartment =
  (k: number) =>
  ({ manager, subunits, ...rest }: Department): Department => ({
    ...rest,
    manager: increaseEmployee(k)(manager),
    subunits: subunits.map(({ unit, ...rest }) => {
      switch (unit.type) {
        case 'employee': {
          return {
            ...rest,
            unit: increaseEmployee(k)(unit),
          }
        }
        case 'department': {
          return {
            ...rest,
            unit: increaseDepartment(k)(unit),
          }
        }
        default: {
          return switchFallback(unit)
        }
      }
    }),
  })

const increaseEmployee =
  (k: number) =>
  ({ salary, ...rest }: Employee): Employee => ({
    ...rest,
    salary: increaseSalary(k)(salary),
  })

const increaseSalary =
  (k: number) =>
  ({ value, ...rest }: Salary): Salary => ({
    ...rest,
    value: value * (1 + k),
  })

const switchFallback = (fallback: never) => fallback
```


What if we could?

```
export const increase =  
  (k: number) =>  
  (company: Company): Company =>  
    everywhere({  
      data: company,  
      matcher: isSalary,  
      transformer: (salary) => ({  
        ...salary,  
        value: salary.value * (k + 1),  
      })),  
    })
```

Before

```
export const increase =
  (k: number) =>
    ({ departments, ...rest }: Company): Company => ({
      ...rest,
      departments: departments.map(increaseDepartment(k)),
    })

const increaseDepartment =
  (k: number) =>
    ({ manager, subunits, ...rest }: Department): Department => ({
      ...rest,
      manager: increaseEmployee(k)(manager),
      subunits: subunits.map(({ unit, ...rest }) => {
        switch (unit.type) {
          case 'employee':
            return {
              ...rest,
              unit: increaseEmployee(k)(unit),
            }
          case 'department':
            return {
              ...rest,
              unit: increaseDepartment(k)(unit),
            }
          default:
            return switchFallback(unit)
        }
      }),
    })

const increaseEmployee =
  (k: number) =>
    ({ salary, ...rest }: Employee): Employee => ({
      ...rest,
      salary: increaseSalary(k)(salary),
    })

const increaseSalary =
  (k: number) =>
    ({ value, ...rest }: Salary): Salary => ({
      ...rest,
      value: value * (1 + k),
    })

const switchFallback = (fallback: never) => fallback
```

After

```
export const increase =
  (k: number) =>
    (company: Company): Company =>
      everywhere({
        data: company,
        matcher: isSalary,
        transformer: (salary) => ({
          ...salary,
          value: salary.value * (k + 1),
        }),
      })
```

Before

```
export const bill = ({ departments }: Company): number =>
  departments.map(billDepartment).reduce((a, b) => a + b, 0)

const billDepartment = ({ manager, subunits }: Department): number =>
  billEmployee(manager) +
  subunits
    .map(({ unit }) => {
      switch (unit.type) {
        case 'employee':
          return billEmployee(unit)
        case 'department':
          return billDepartment(unit)
        default:
          switchFallback(unit)
          return 0
      }
    })
    .reduce((a, b) => a + b, 0)

const billEmployee = ({ salary }: Employee): number => billSalary(salary)

const billSalary = ({ value }: Salary): number => value

const switchFallback = (fallback: never) => fallback
```

After

```
export const bill = (data: unknown): number =>
  everything({
    data,
    matcher: isSalary,
    query: ({ value }) => value,
    reducer: (a, b) => a + b,
    zeroValue: 0,
  })
```

Before

```
bill :: Company -> Float
bill (Company ds) = sum $ map billDepartment ds

billDepartment :: Department -> Float
billDepartment (Department _ manager subunits) =
    billEmployee manager + sum (map billSubUnit subunits)

billSubUnit :: SubUnit -> Float
billSubUnit (EmployeeUnit employee) = billEmployee employee
billSubUnit (DepartmentUnit department) = billDepartment department

billEmployee :: Employee -> Float
billEmployee (Employee _ salary) = billSalary salary

billSalary :: Salary -> Float
billSalary (Salary value) = value
```

After

```
bill' :: Company -> Float
bill' = everything (+) (0 `mkQ` billSalary)

billSalary :: Salary -> Float
billSalary (Salary value) = value
```

Prior work

Traverse arbitrarily nested data structures:
A new approach to generic functional
programming. Hinze, R., 2000 [1]

Derivative work

Go beyond **show**, **map** and **reduce**:

“Scrap Your Boilerplate” Revolutions. Hinze, R.,
and Löh, 2006 [2]

References

- [1] HINZE, R.
A new approach to generic functional programming.
In *Proceedings of the 27th ACM SIGPLAN-SIGACT symposium on Principles of Programming Languages* (2000), pp. 119–132.
- [2] HINZE, R., AND LÖH, A.
“scrap your boilerplate” revolutions.
In *International Conference on Mathematics of Program Construction* (2006), Springer, pp. 180–208.
- [3] LÄMMEL, R., AND JONES, S. P.
Scrap your boilerplate: a practical design pattern for generic programming.
ACM SIGPLAN Notices 38, 3 (2003), 26–37.