Analysis Patterns

Martin Fowler

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What we will cover

- Introduction
- Observation Patterns
- Accounting Patterns
- How to use Patterns
A pattern is an idea that has been useful in one practical context and will probably be useful in others.

[Fowler]

http://www.hillside.net/patterns

Define an object that encapsulates how a set of objects interact.


www.industriallogic.com/papers/learning.html
Analysis Patterns

David Hay
- Relational data models
- Not connected with patterns community, but still patterns

Martin Fowler
- OO conceptual models
- Healthcare, Accounting, Financial Trading, Planning

Notation

Each customer may have many orders
Each order has a single customer

A customer may be a corporate customer or an individual customer

Interface not implementation

Patterns in 3 tier architecture

- Visibility is from application to domain
- Domain carries shared services
- Applications do not see database
- Patterns used in domain tier

Observation Patterns

- Introduction
- Observation Patterns
- Accounting Patterns
- How to use Patterns
### Attributes of Person

<table>
<thead>
<tr>
<th>Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>height: Number</td>
</tr>
<tr>
<td>weight: Number</td>
</tr>
<tr>
<td>blood glucose level: Number</td>
</tr>
</tbody>
</table>

What are the problems with this model?

### Quantity

<table>
<thead>
<tr>
<th>Person</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>height: Quantity</td>
<td></td>
</tr>
<tr>
<td>weight: Quantity</td>
<td></td>
</tr>
<tr>
<td>blood glucose level: Quantity</td>
<td></td>
</tr>
</tbody>
</table>

- Define arithmetic operations for quantity
- Money is a kind of quantity
- Use Conversion Ratio to convert to other units

What if there are tens or hundreds of attributes?
When should we use this model?

- Martin Fowler is six feet tall

For each attribute of person, define an instance of phenomenon type
To record a value for a person create a measurement

When should we use this model?

- Martin Fowler is blood group O
- Martin Fowler is Male
**Knowledge and Operational Levels**

- **Operational**
  - regular day to day objects

- **Knowledge**
  - **Meta-Data**
  - **Objects that capture domain rules**

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### Range

**Range**

- upper: Magnitude
- lower: Magnitude
- isUpperInclusive: Boolean
- isLowerInclusive: Boolean

- includes (Magnitude): Boolean
- overlaps (Range): Boolean
- abuts (Range): Boolean

### Magnitude

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>=</td>
<td>&lt;</td>
</tr>
<tr>
<td>&gt;</td>
<td>&gt;=</td>
</tr>
</tbody>
</table>

- **Between 10 miles and 50 miles**
- **6m < x ≤ 15m**
Phenomenon with Range

Normal Heart Rate is 60-80 beats per minute

Assigning a phenomenon

new aMeasurement

phenomenon (phenomenon including aMeasurement)

includes (aMeasurement)

false

equals

equals

equals

equals

fastHeartRate

setPhenomenon(fastHeartRate)
Corporate Finance Problem

- Each month we get a large number of indicators (revenue, income, units sold...)
- Each indicator is given values for good, reasonable, poor, or bad
  - If revenue is over 105 million that is good, over 95 is reasonable, over 90 is poor and under 90 is bad.
- Indicators can be calculated based on other indicators
  - Revenue = income - costs
  - Income = units sold * average price

Measurement Protocol

- Source Protocols read from external systems
- Calculated Protocols are calculations
Calculated Measurement Protocol has formula and arguments:

- Revenue = Income - Costs
- Income = Number sold X Average Price
- Body Mass Index = weight / height^2

Creating a Measurement:

Factory method for measurements
Entries record history of changes to an account

Where might we use this model?

Transaction

I withdraw $100 from my checking account
The Willenhall Coal Company delivers 30 tons of coal to Bilston Gasworks

Why are transactions useful?
Posting Rule (simple)

- 5% of state tax is deducted from gross income

Individual Instance Method

- Income tax is deducted at
  - 15% for first $31,500
  - 28% to $80,750
  - 31% to $130,800
  - ...

- Each instance of posting rule has its own method
- Conceptual statement
Apply the graduated tax algorithm to the gross pay of Doug and Dinsdale Piranha to yield their net pay.
**Executing the network**

1. Get account (input account type)
2. Get unprocessed entries
3. For each entry
   - Execute posting rule
4. Post entry

**Procedural Approach**

1. Process Hours
2. Dollarize Straight Hours
3. Dollarize Excess Hours
4. Get straight hours account
5. Get unprocessed entries
6. [for all entries]
   - Multiply by rate
7. Post to straight dollars
Changing the Rules

Process Hours

Dollarize Straight Hours

Dollarize Excess Hours

Get straight hours account

Get unprocessed entries

Multiply by rate

Multiply by rate * 0.9

Post to straight dollars

Adding an effectivity time

Account Type

Output

Posting Rule

Effectivity: Date Range

Method

Employee Account

Employee

Add a date range for each posting rule instance
New Behavior

Implementing with singleton

State Tax PR
state: State
calculate()

CA Tax PR
state: State
calculate()

MA Tax PR
state: State
calculate()

NY Tax PR
state: State
calculate()

What are the strengths and weaknesses?
Strategy Pattern

What are the strengths and weaknesses?

Parameterized Method

What are the strengths and weaknesses?
Combining Implementations

- Combination of singleton and parameterized approaches

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Posting Rule Execution

- Eager firing
  - Fire when entry added to account
  - Find all posting rules looking at that account and fire them (etc, etc)

- Posting rule based
  - Have a coordinator which tells posting rules when to fire

- Account based based
  - Have a coordinator tell which accounts when to fire their outbound posting rules

- Backward Chained
  - When you ask an account for its balance
  - All input accounts must be asked for value (etc, etc)

Which would you choose?
Accounting Patterns

- Account
- Transaction
- Posting Rule
- Individual Instance Method
- Posting Rule Execution
- Posting Rules for Many Accounts
- Accounting Practice

How to use Patterns

- Introduction
- Observation Patterns
- Accounting Patterns
- How to use Patterns
Using Patterns

- Starting point for development
  > Inspiration to get things going
- Comparison for review
  > Why are we different to this pattern?
- Documentation of complex frameworks
  > Highlight the key patterns
- Informal standardization
- Mining from legacy systems
- Training
  > The next step after basic training

The why is at least as important as the what

Learning about Patterns

- Read the books
  > Use a book group
  > Discuss two chapters a week over lunch
- Take a training course
  > Training must emphasize using patterns
  > Instructors expertise is central
- Try using the patterns
  > You cannot understand a pattern till you have tried it
  > Trying a pattern and finding it does not fit is valuable
- Write some patterns

http://www.hillside.net/patterns
Books

- Fowler, M. Analysis Patterns, Addison-Wesley, Reading MA, 1997

http://www.hillside.net/patterns

Final Thoughts

- Patterns are relevant for all aspects of software engineering
  - and for Business Process Reengineering
- Analysis patterns can be used across traditional vertical business domains
- A model is not right or wrong, only more or less useful
- Patterns are a starting point, not a final destination
- Still learning about teaching, using, and discovering patterns