Domain-Driven Design and Domain Modelling

Why is it important,
and why should you care?

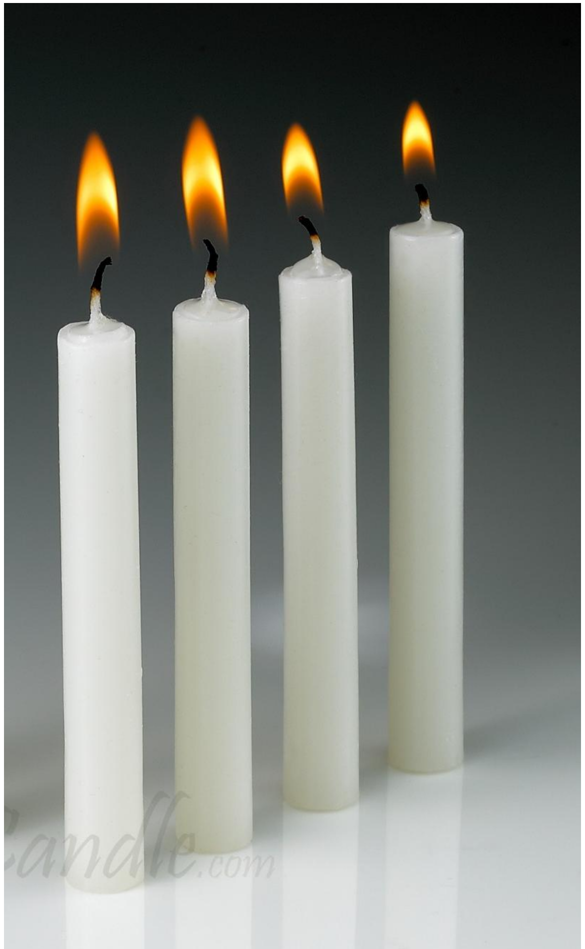
Part I

Communication & Feedback

Let's start with a comedy sketch (famous in UK)

Four candles?

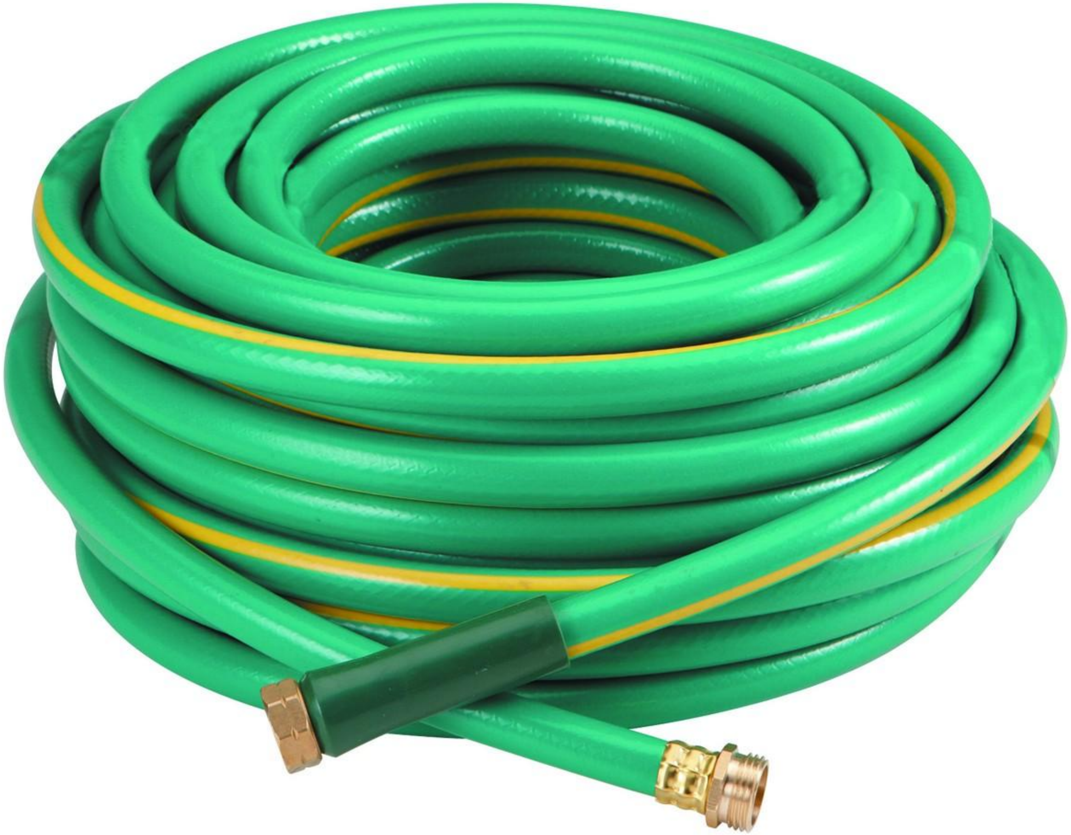
What he thought he heard



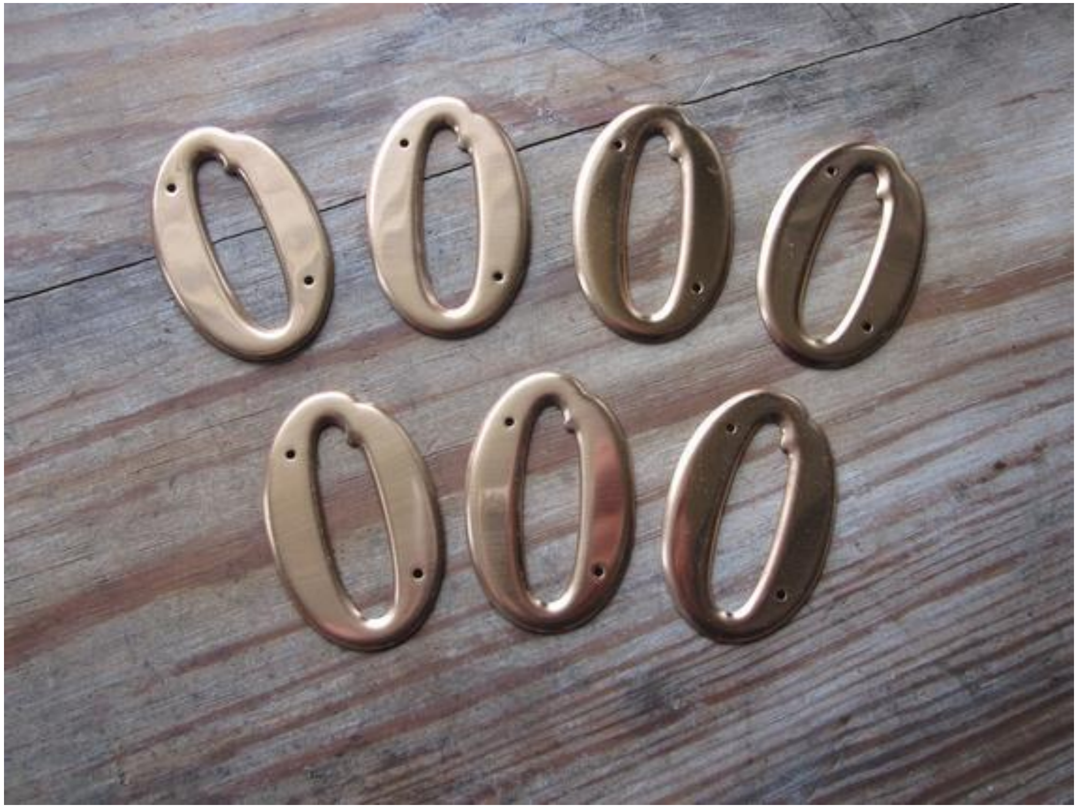
What was actually asked for

Some 'ose?

What he thought he heard



What was actually asked for



Some 'p's?
Ok, just like those 'o's

What he thought he heard

What was actually asked for

What's the problem?

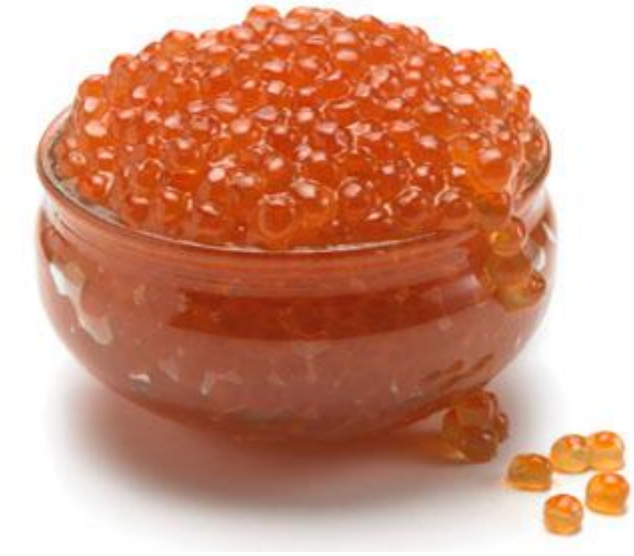
- Misunderstanding the requirement.
- Acting on the requirement without getting feedback first.

Most romantic comedies are based on the same premise.

Pro Tip: we don't want real life to be funny like this.

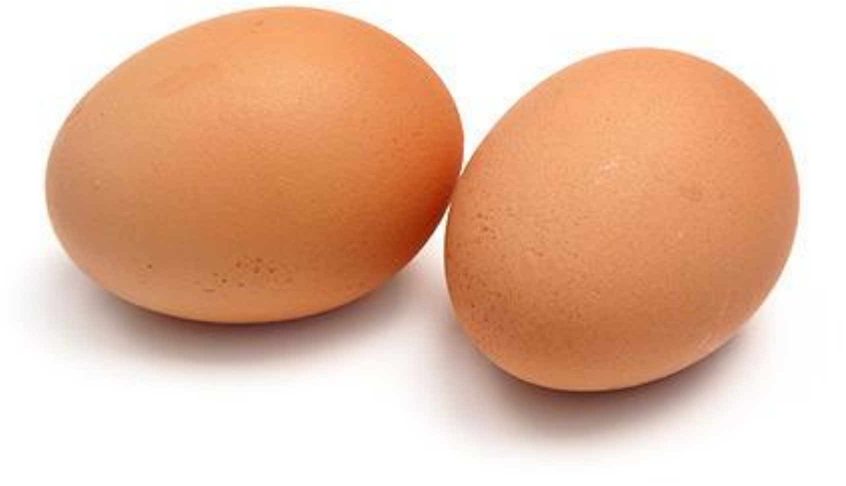
A café example

- Customer: "Can I have some eggs?"
- Waiter to chef: "Some eggs, please"
- Russian chef: "Here you go…"



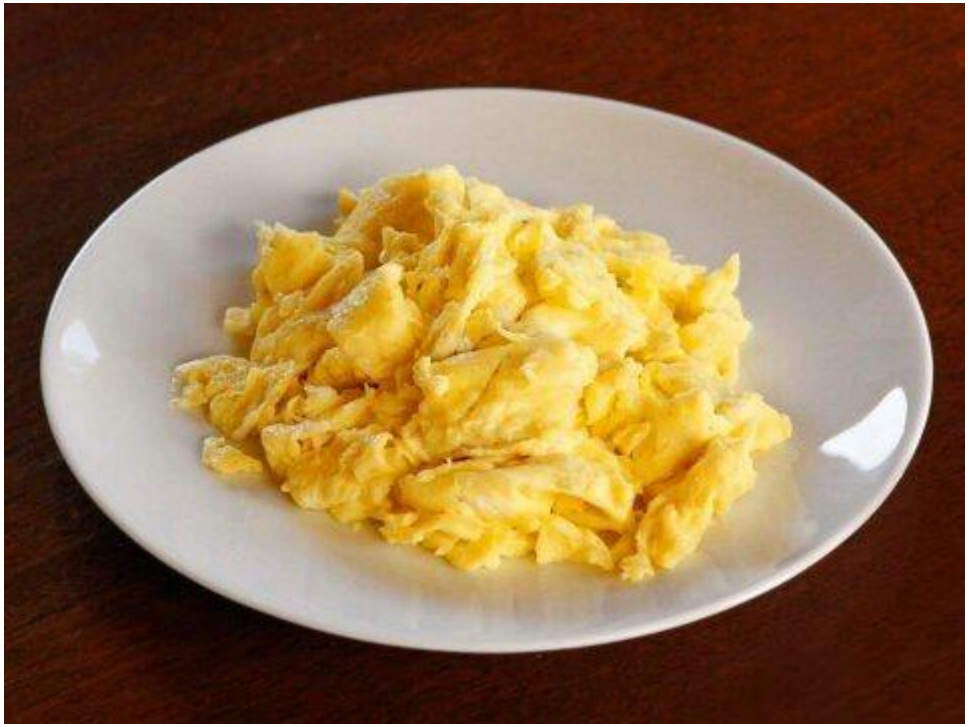
A café example

- Waiter to chef: "Not fish eggs, chicken eggs "
- Chef: "Ok, here you go…"



A café example

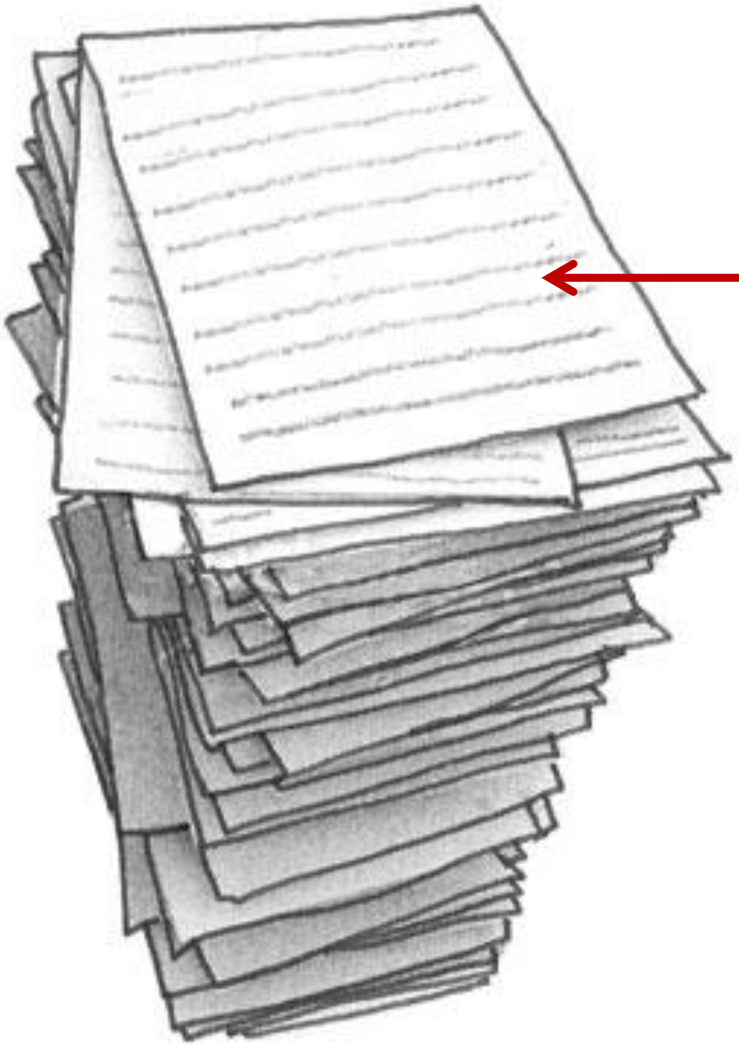
- Waiter to chef: " No, *cooked* chicken eggs"
- Chef: "Ok, this time I understand…"



A café example

- Waiter to customer: "Here are your eggs"
- Customers: "I wanted fried eggs" 😢

What's the solution?



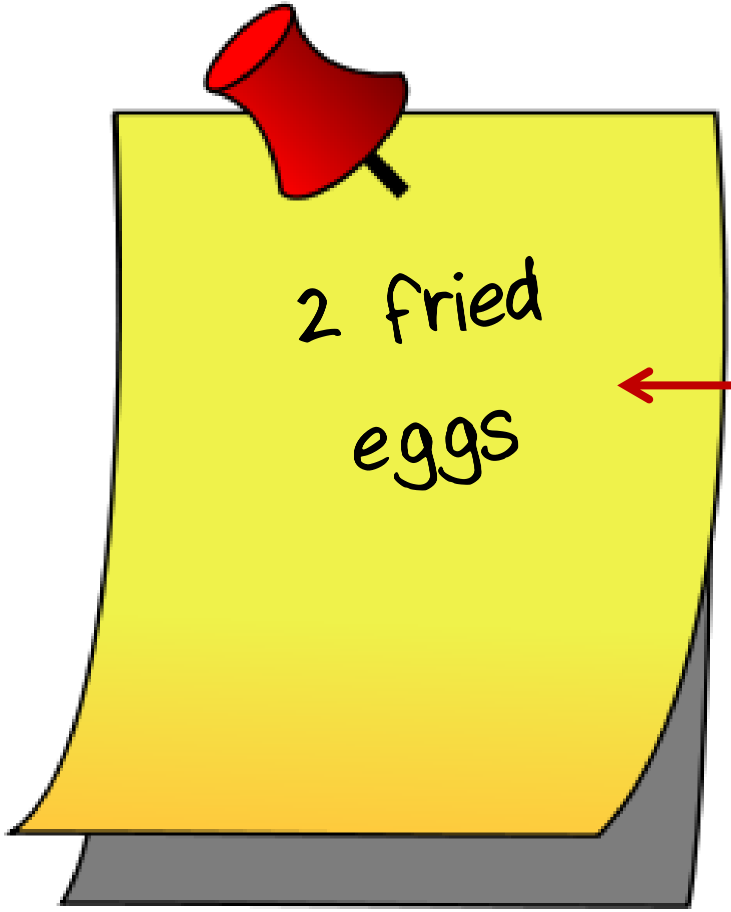
A 200 page spec on how to cook a fried egg

Who thinks this will work?

This is not the solution!

- We expect the chef to be a subject matter expert.
- A 200 page spec should not be needed!

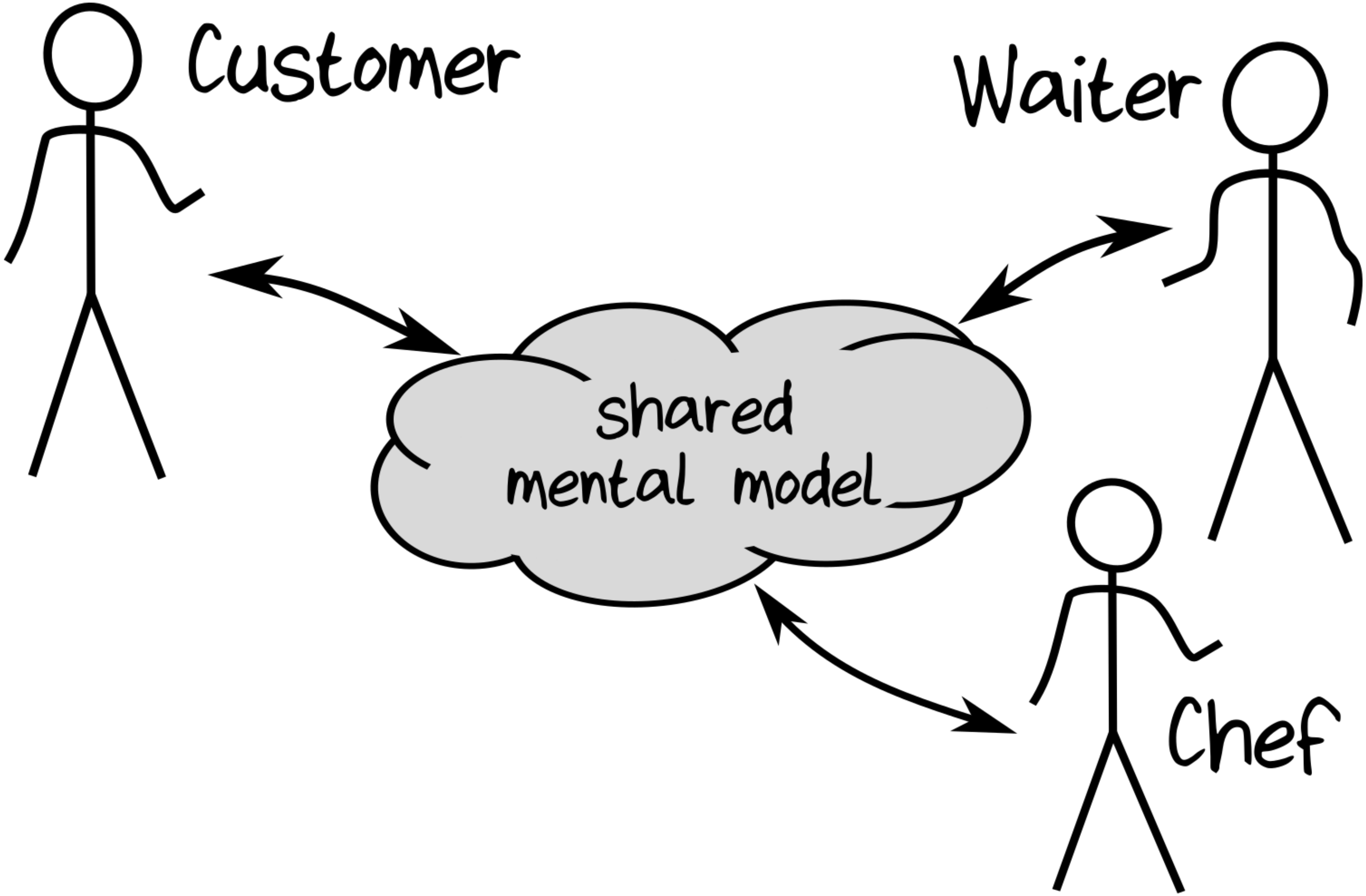
What happens in real life?



A 3 word spec

Why does this tiny spec work?

- Shared knowledge of the domain
  - *Everyone* is a "breakfast" subject matter expert!
- Shared vocabulary
  - Everyone knows what "fried eggs" means.


Customer
Waiter
shared
mental model
Chef

Food for thought

- Waiter still acts as translator from customer to chef
  - – But they all have the same mental model
- Should the waiter and chef have their own private jargon?
  - – If so, it's hard for the customer to participate

Food for thought

- Is this the most minimal spec?
  - What happens if you make eggs for yourself?
  - You don't write anything down!
- What if you visit often?
  - Can you ask for "the usual"?
  - If your colleague makes you tea, do they know how you like it?

The importance of feedback

- Fast feedback from the customer is important!
  - The customer can be unclear
  - The waiter can misunderstand
  - The chef can mess up
- What if we ordered 2000 eggs for delivery in 3 months time?
  - Do we wait for feedback then?
  - No! Get the customer to taste a sample ASAP! ("needs more salt")

How long must a spec be?

- Who here has a specialized hobby/interest?
- If I asked you to write an app for me, how big a spec would I need? Why?
- If I asked a non-expert to write the same app for me, how big a spec would I need? Why?
- Which of the two projects is more likely to succeed?

Part II

Efficiency vs. Effectiveness

People like to talk about efficiency a lot

This is an efficient light bulb!

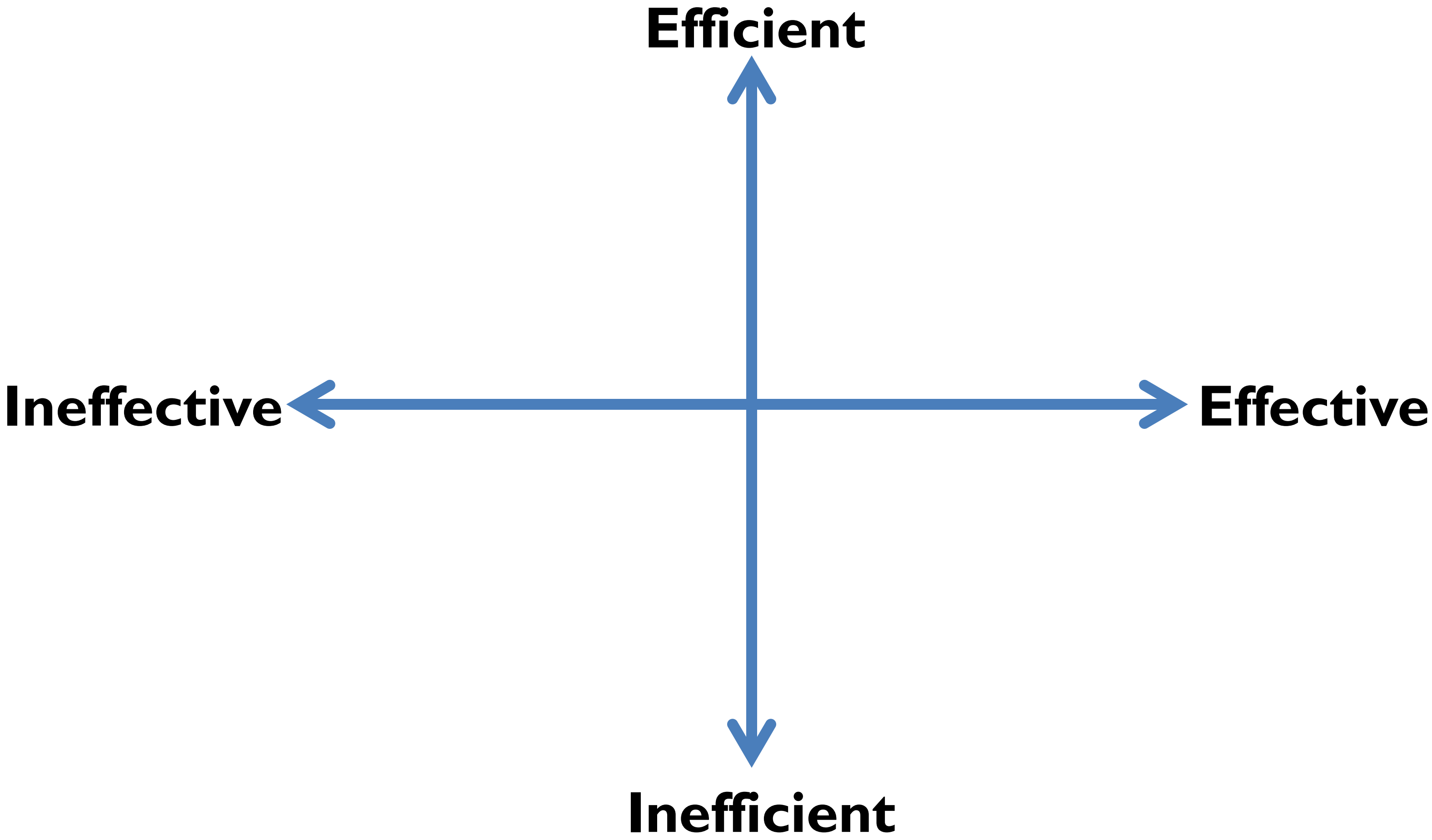
We should really focus on effectiveness

Effectiveness is about the direction, not the speed!

Better to go in the right direction slowly than the wrong direction quickly.

Effectiveness is about the direction, not the speed!

The "right" direction may change,
so check your compass bearing often!



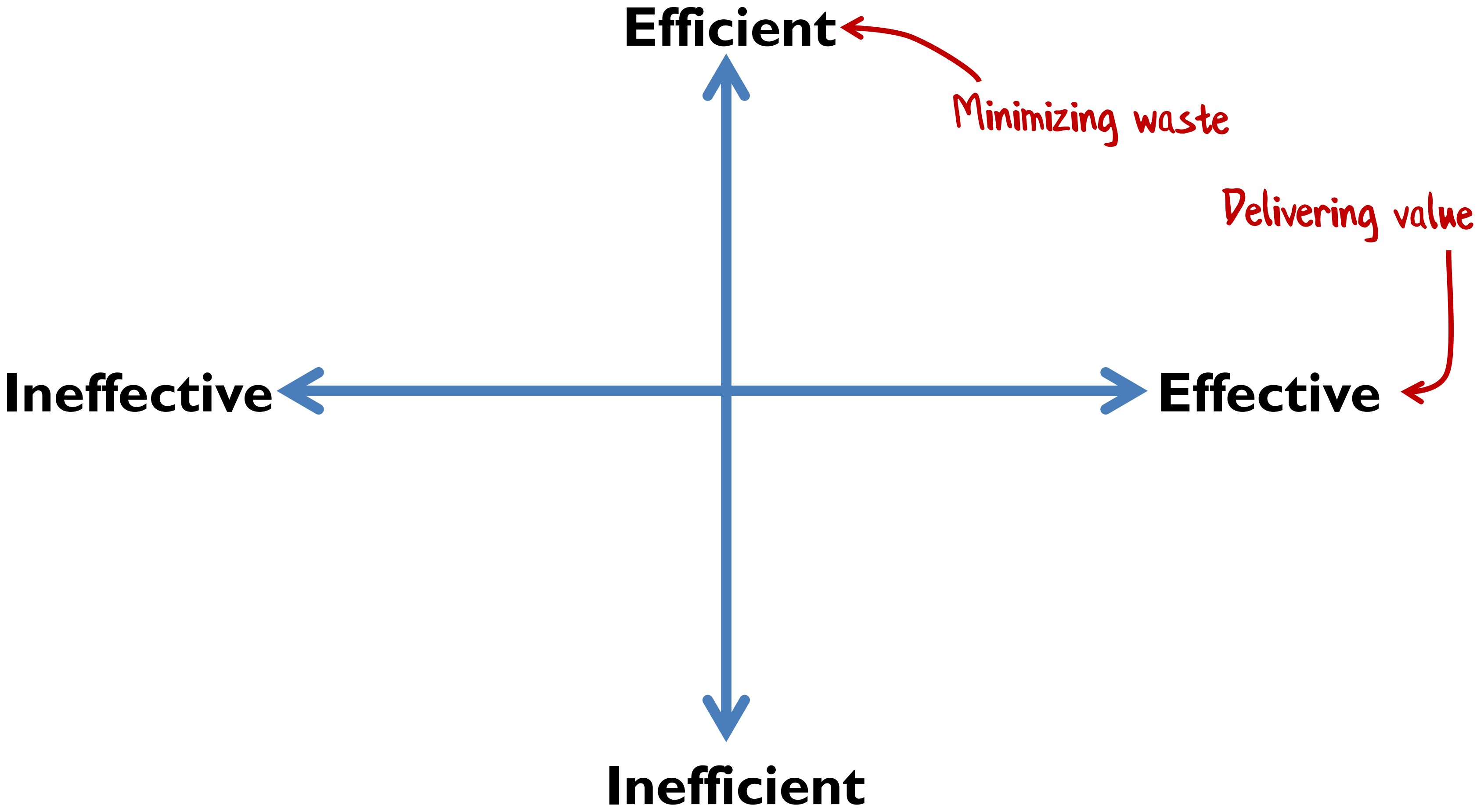
Efficient

Ineffective

Effective

Inefficient

A helpful and un-ironic four-quadrant diagram



Efficient

Minimizing waste

Delivering value

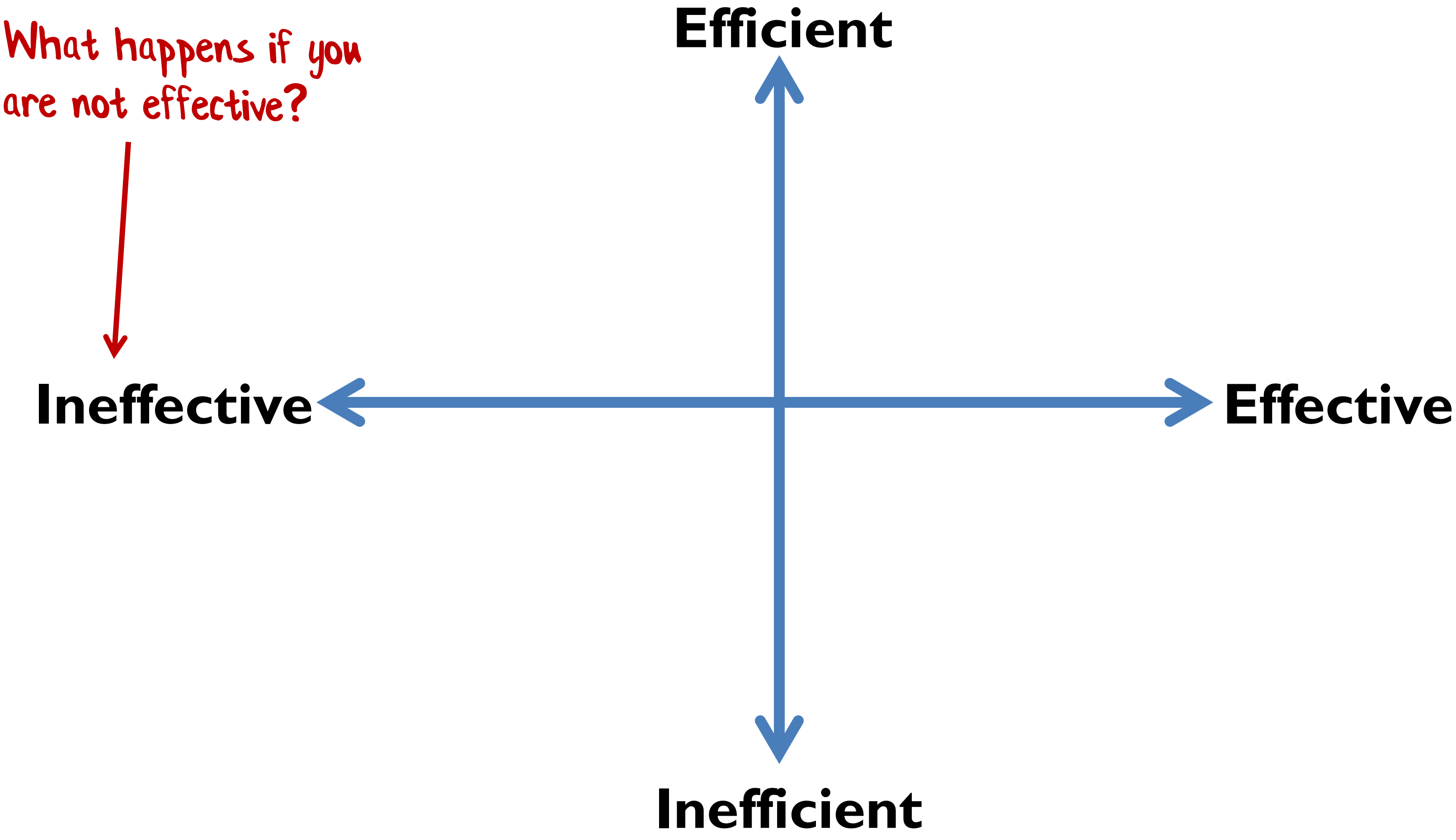
Ineffective

Effective

Inefficient

A helpful and un-ironic four-quadrant diagram

What happens if you are not effective?



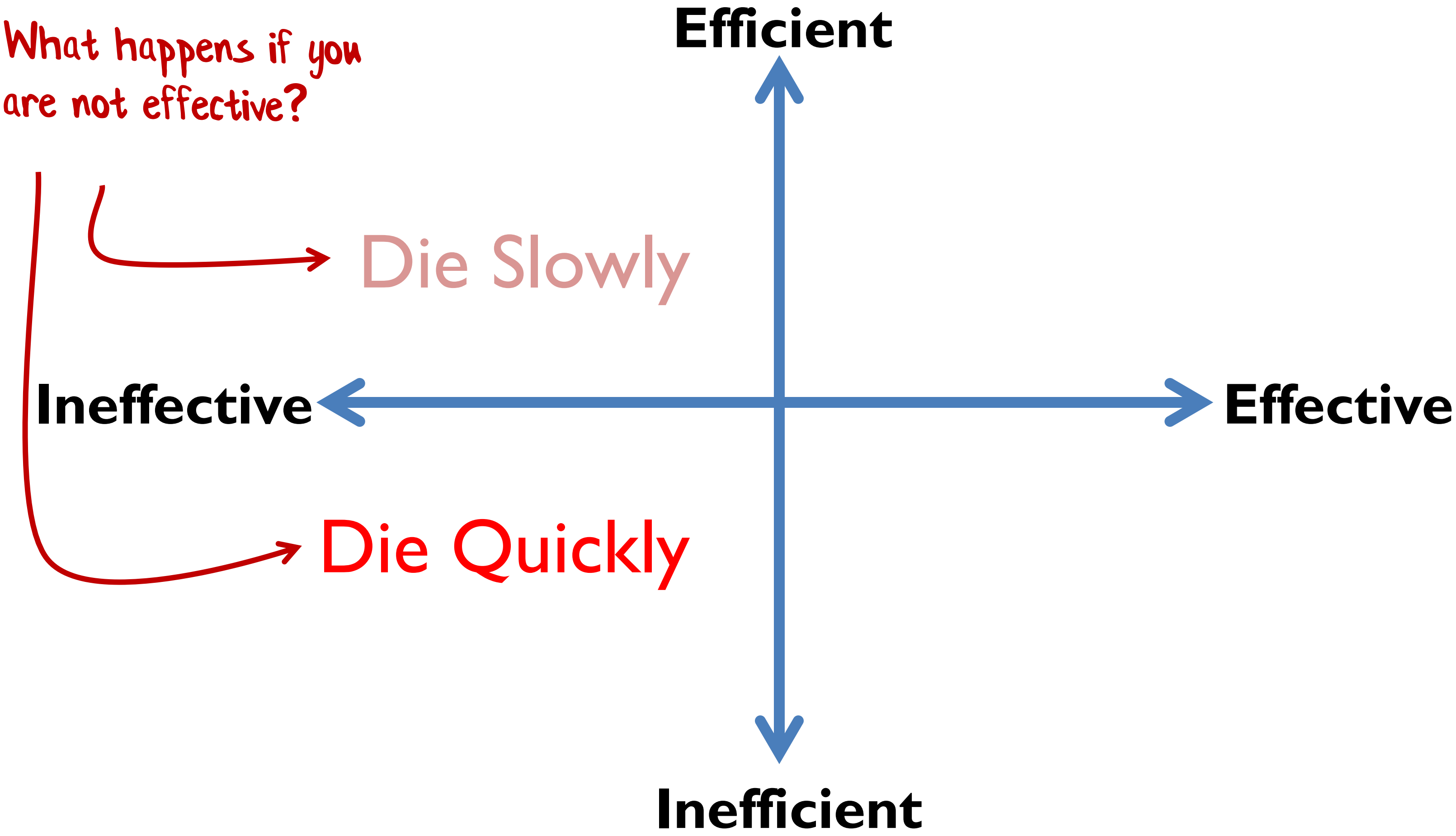
Efficient

Ineffective

Effective

Inefficient

A helpful and un-ironic four-quadrant diagram



What happens if you are not effective?

Efficient

Die Slowly

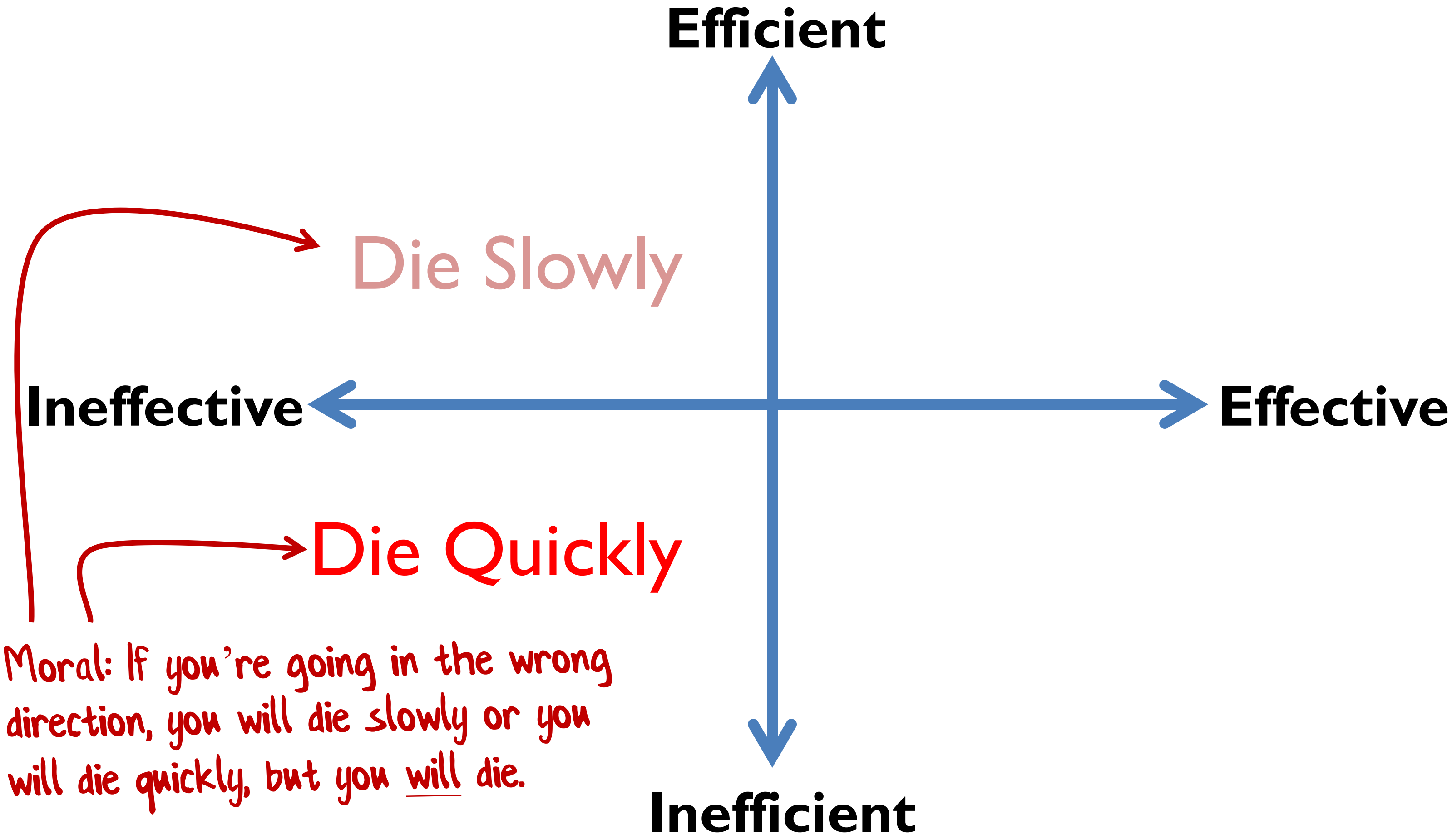
Ineffective

Effective

Die Quickly

Inefficient

A helpful and un-ironic four-quadrant diagram



Efficient

Ineffective

Effective

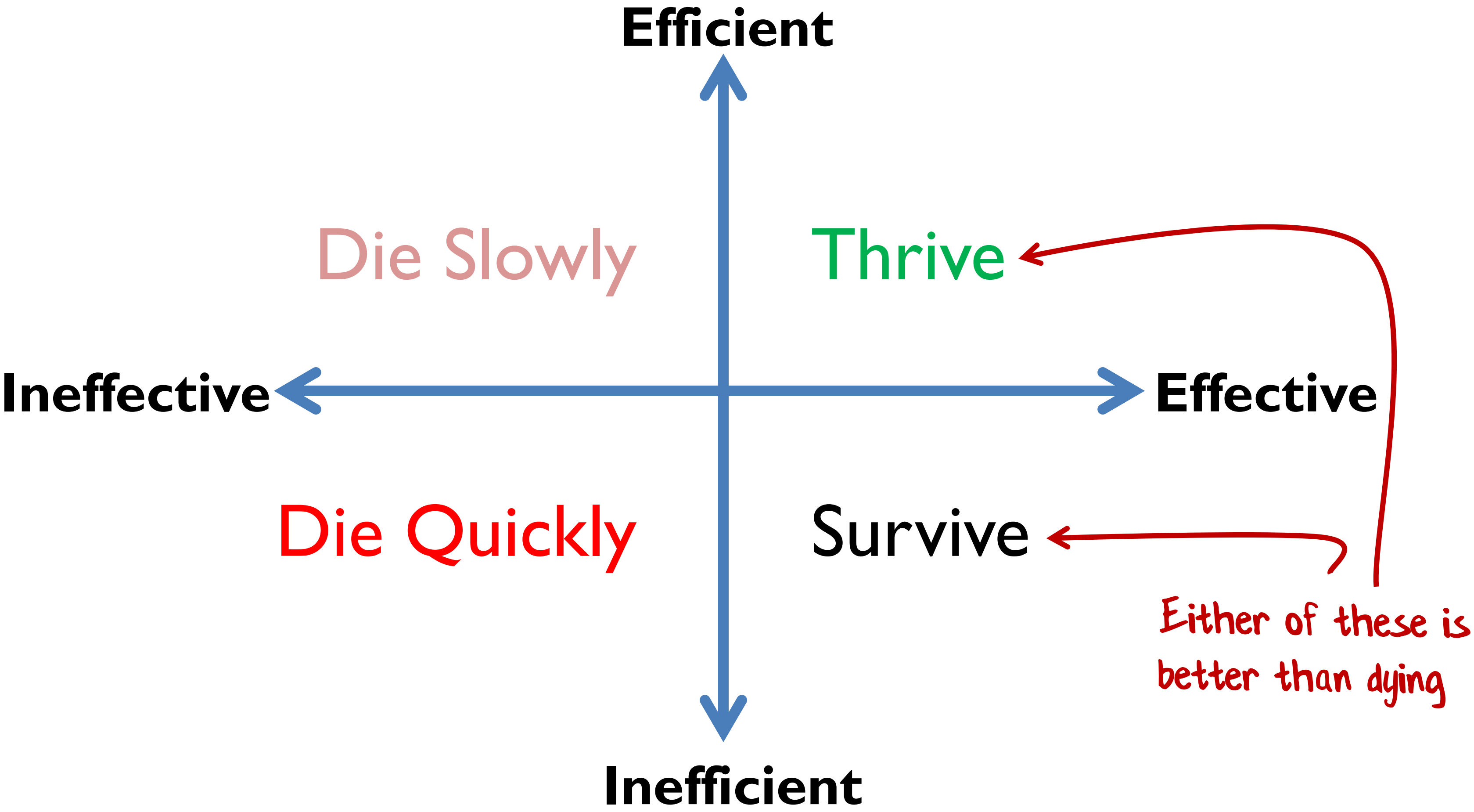
Inefficient

Die Slowly

Die Quickly

Moral: If you're going in the wrong direction, you will die slowly or you will die quickly, but you will die.

A helpful and un-ironic four-quadrant diagram



Efficient

Die Slowly

Thrive

Ineffective

Effective

Die Quickly

Survive

Either of these is better than dying

Inefficient

A helpful and un-ironic four-quadrant diagram

Efficiency is doing things right;
Effectiveness is doing the right things.

“The most serious mistakes are not being made as a result of wrong answers. The true dangerous thing is asking the wrong question.”

-- Peter Drucker.

Summary so far

- Strive for effectiveness over efficiency
  - Direction is more important than speed
- Communication is easiest with a shared mental model
  - And a shared vocabulary
- Fast feedback is important
  - Check your compass frequently

Part III

Domain Driven Design

What does all this have to do with software projects?

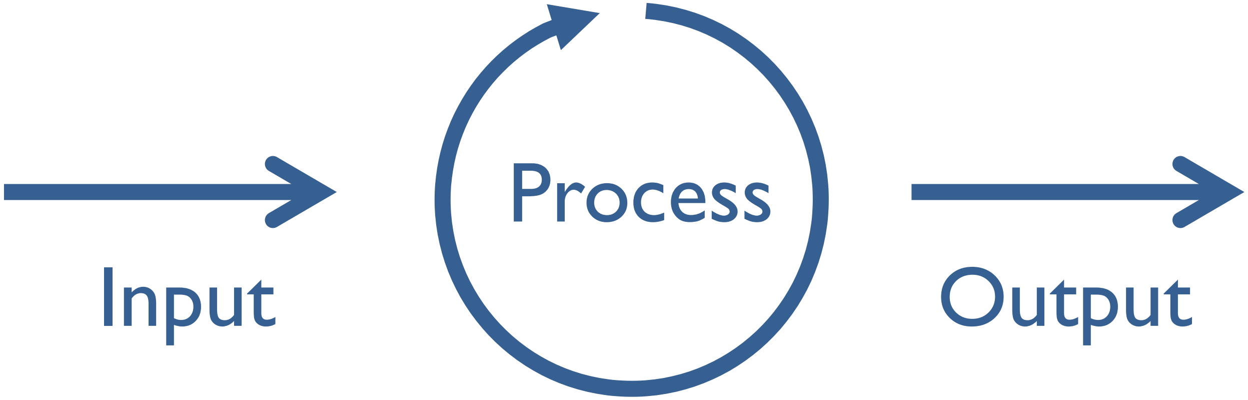
In my experience, most projects fail because:

- Misunderstanding requirements, or
- Going in the wrong direction, or
- Starting off in the right direction but veering off course

What's the ideal software development process?

- Build a shared mental model
  - Means a smaller spec
  - Less misunderstanding
- Have frequent feedback
  - Make sure you are going in the right direction
  - Course correction if goals change
- Value effectiveness over speed
  - No point going fast in the wrong direction

The software development process

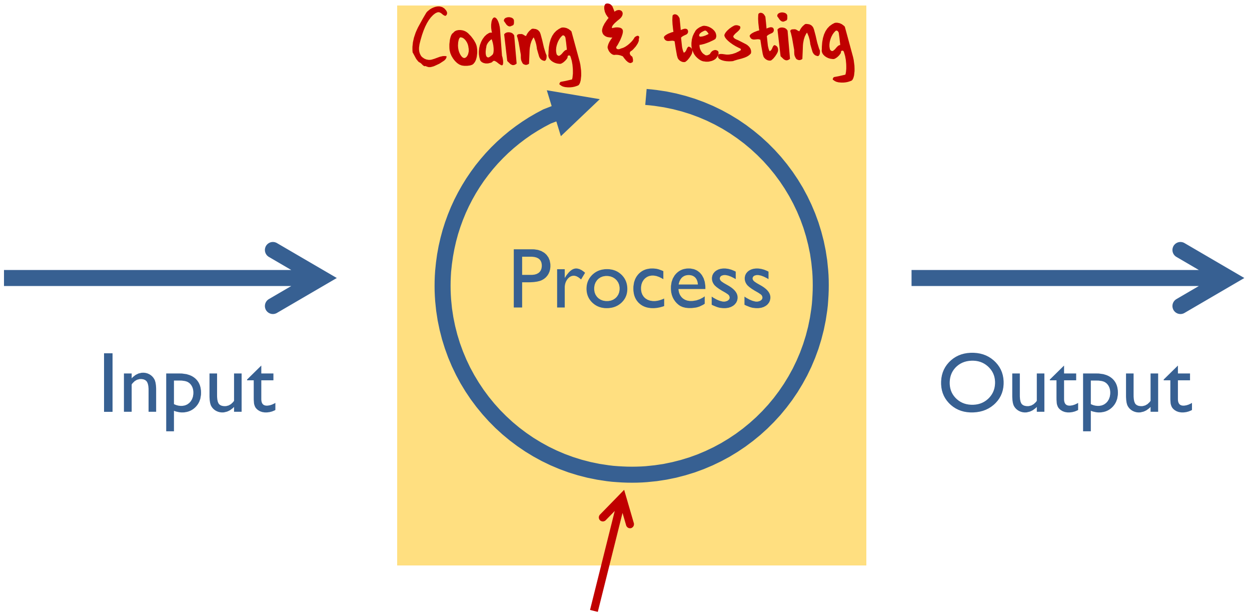


Input

Process

Output

The software development process



Coding & testing

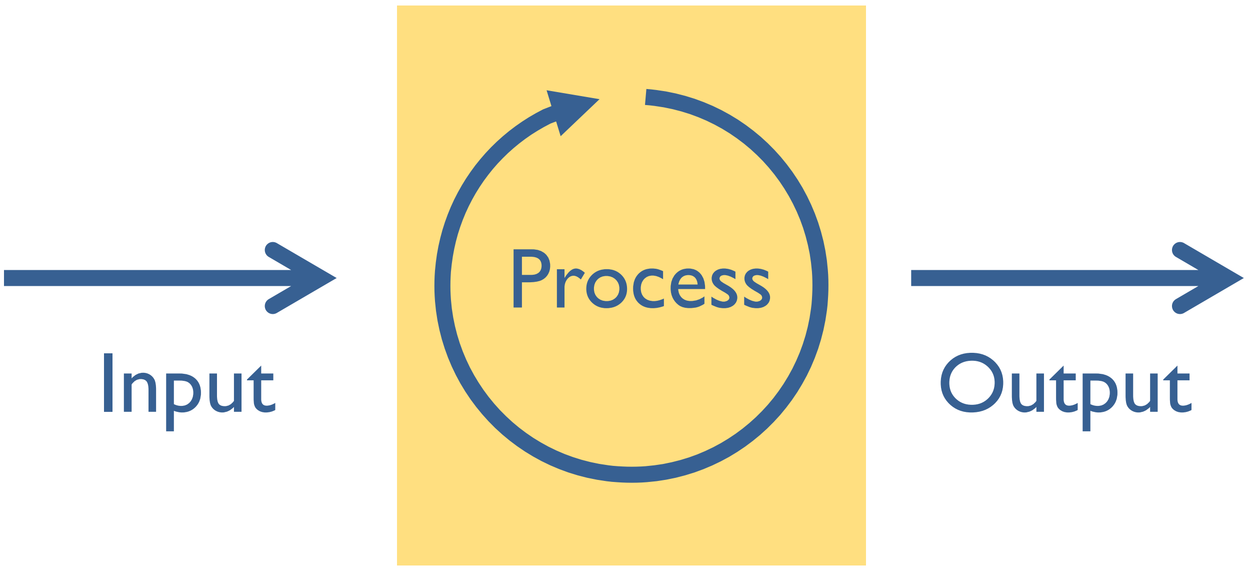
Input

Process

Output

Developers love to focus on this

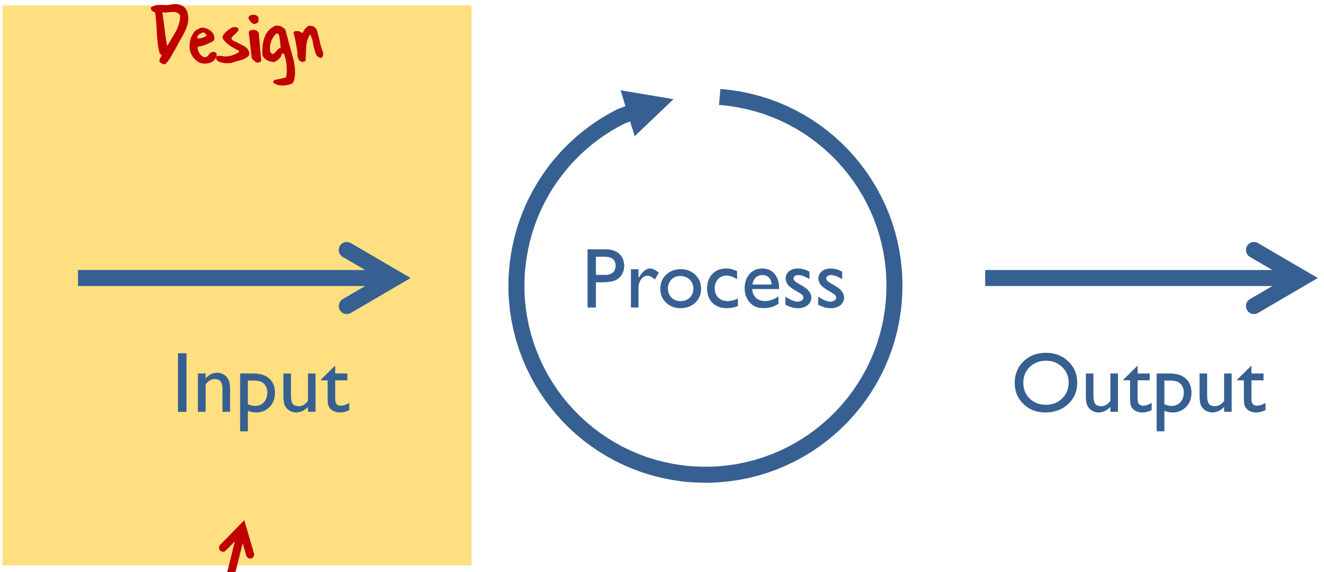
The software development process



Garbage in

Garbage out

The software development process



Design

Input

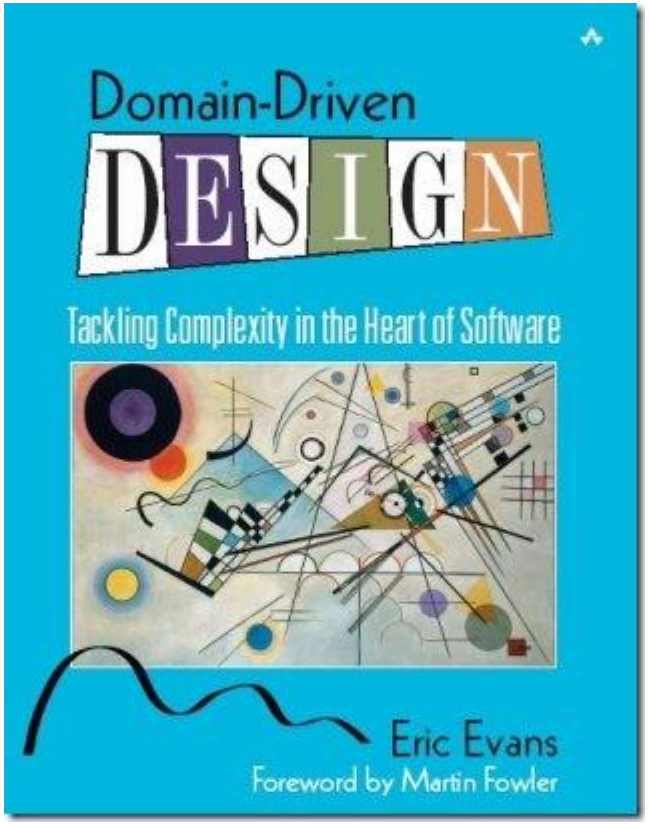
Process

Output

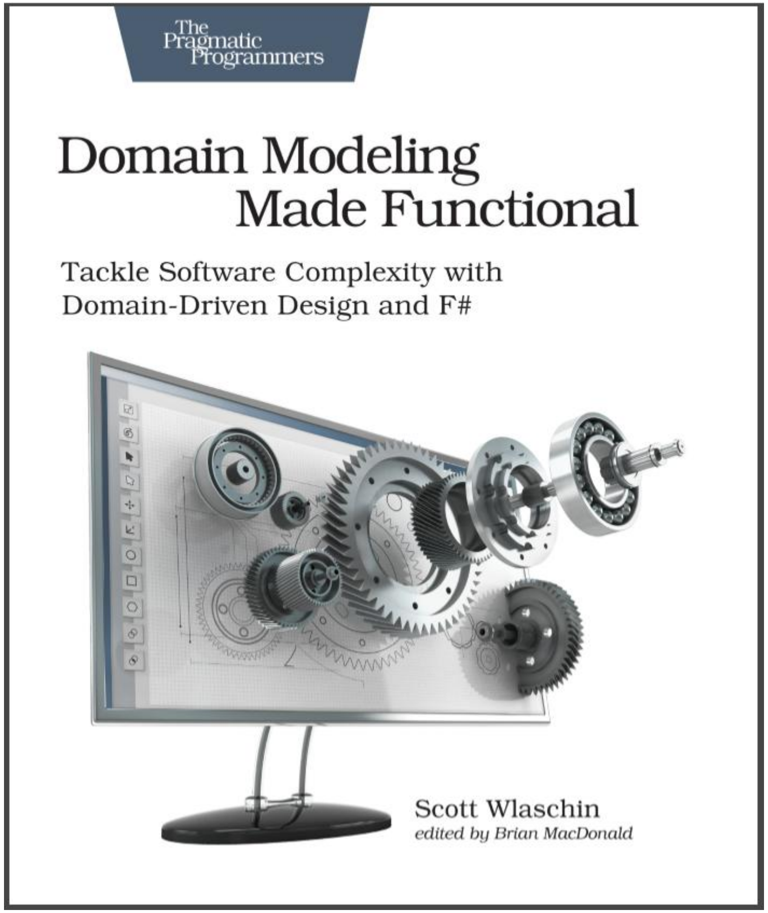
This workshop

(reduce) Garbage in

(reduced) Garbage out


Domain-Driven
DESIGN
Tackling Complexity in the Heart of Software
Eric Evans
Foreword by Martin Fowler

"Focus on the domain and domain logic rather than technology"
-- Eric Evans



The Pragmatic Programmers

Domain Modeling Made Functional

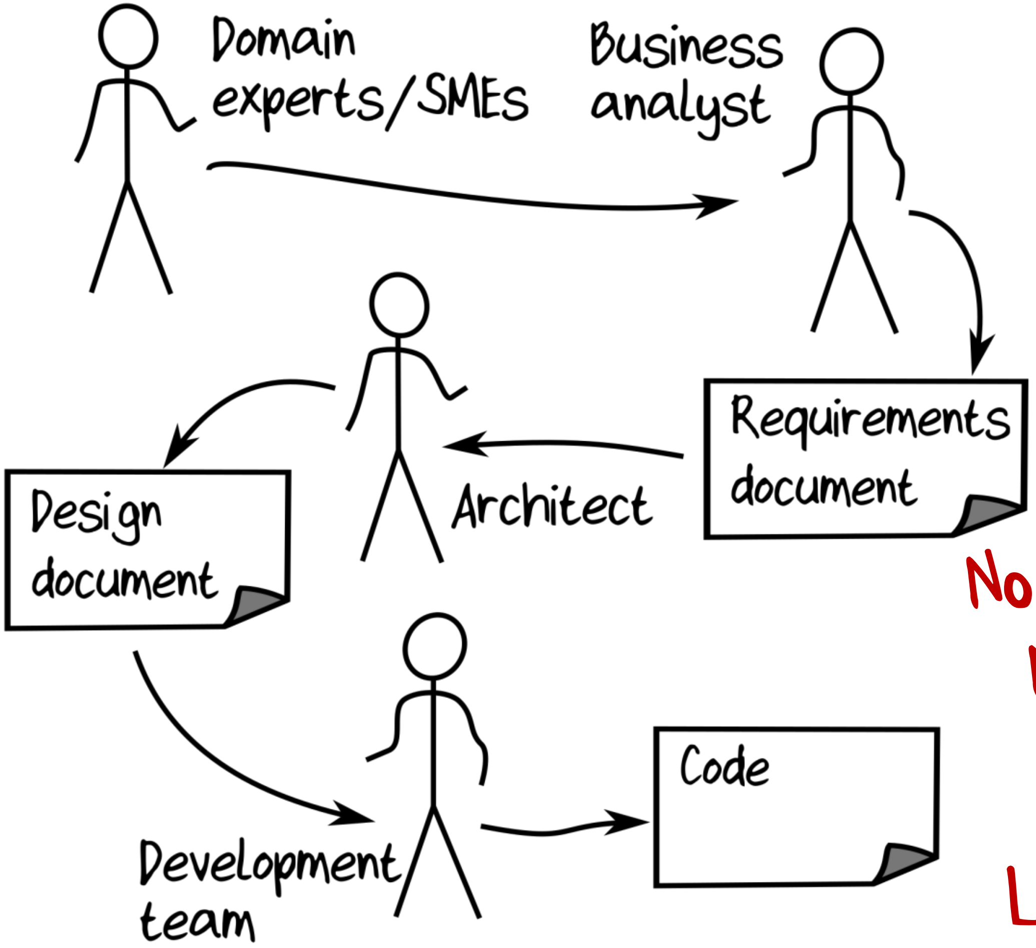
Tackle Software Complexity with Domain-Driven Design and F#

Scott Wlaschin
edited by Brian MacDonald

Or read the first 2 chapters of my book!

Why Domain-Driven Design?

Waterfall



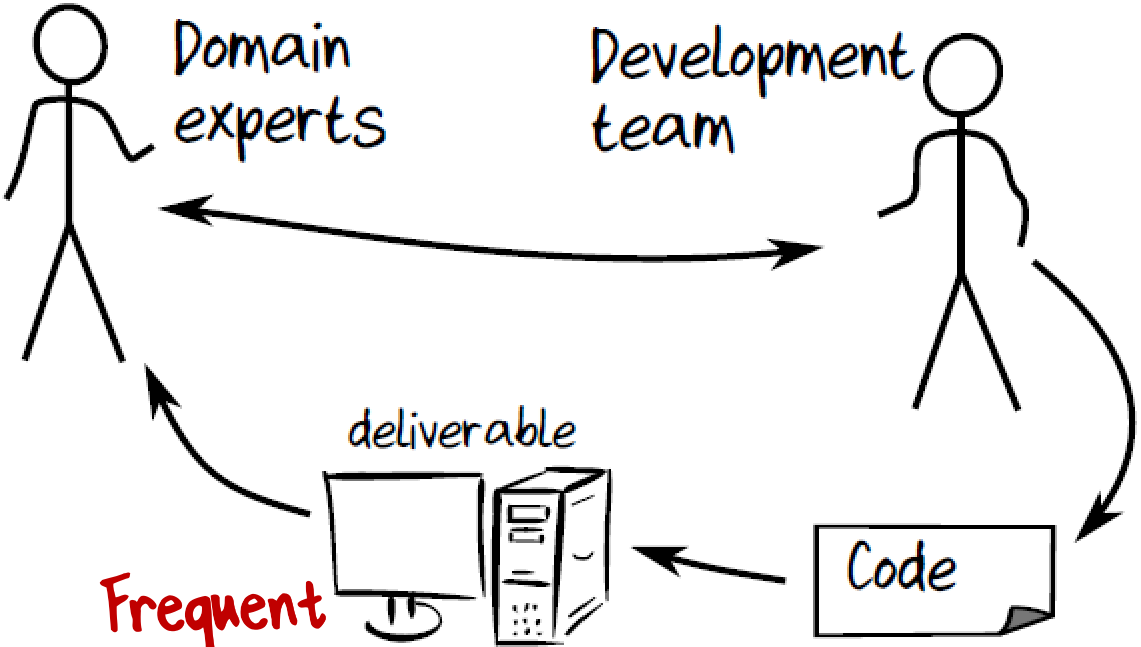
No shared model

No feedback

Like a bad children's game...

Warning: It's the developer's understanding of the domain that gets deployed!

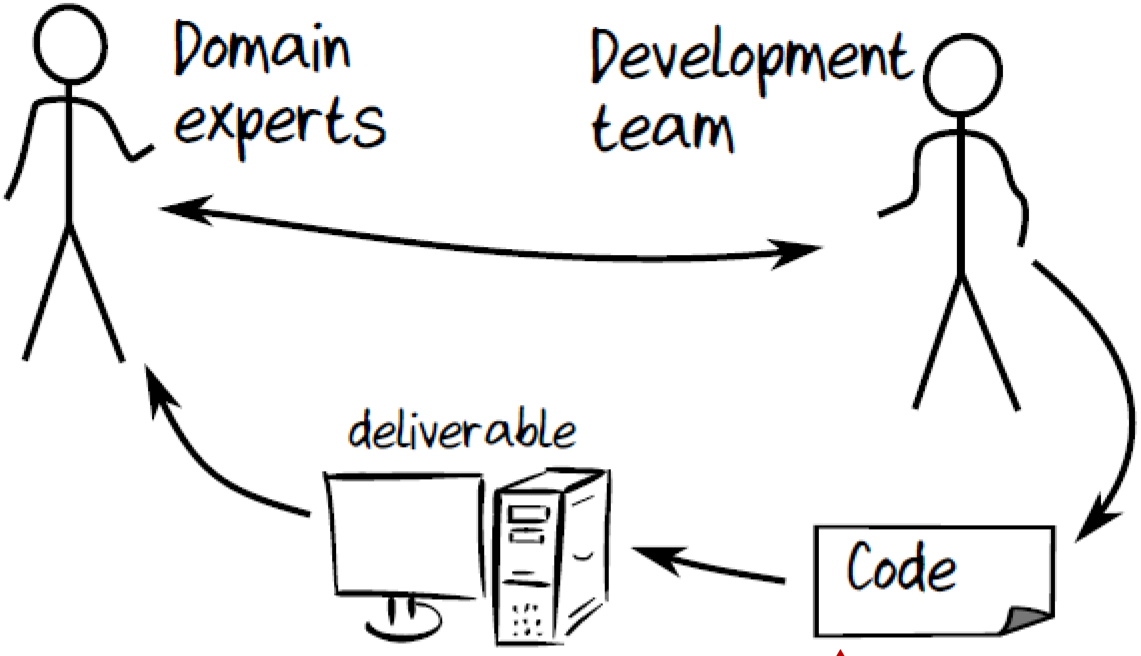
Agile



Frequent deliverables

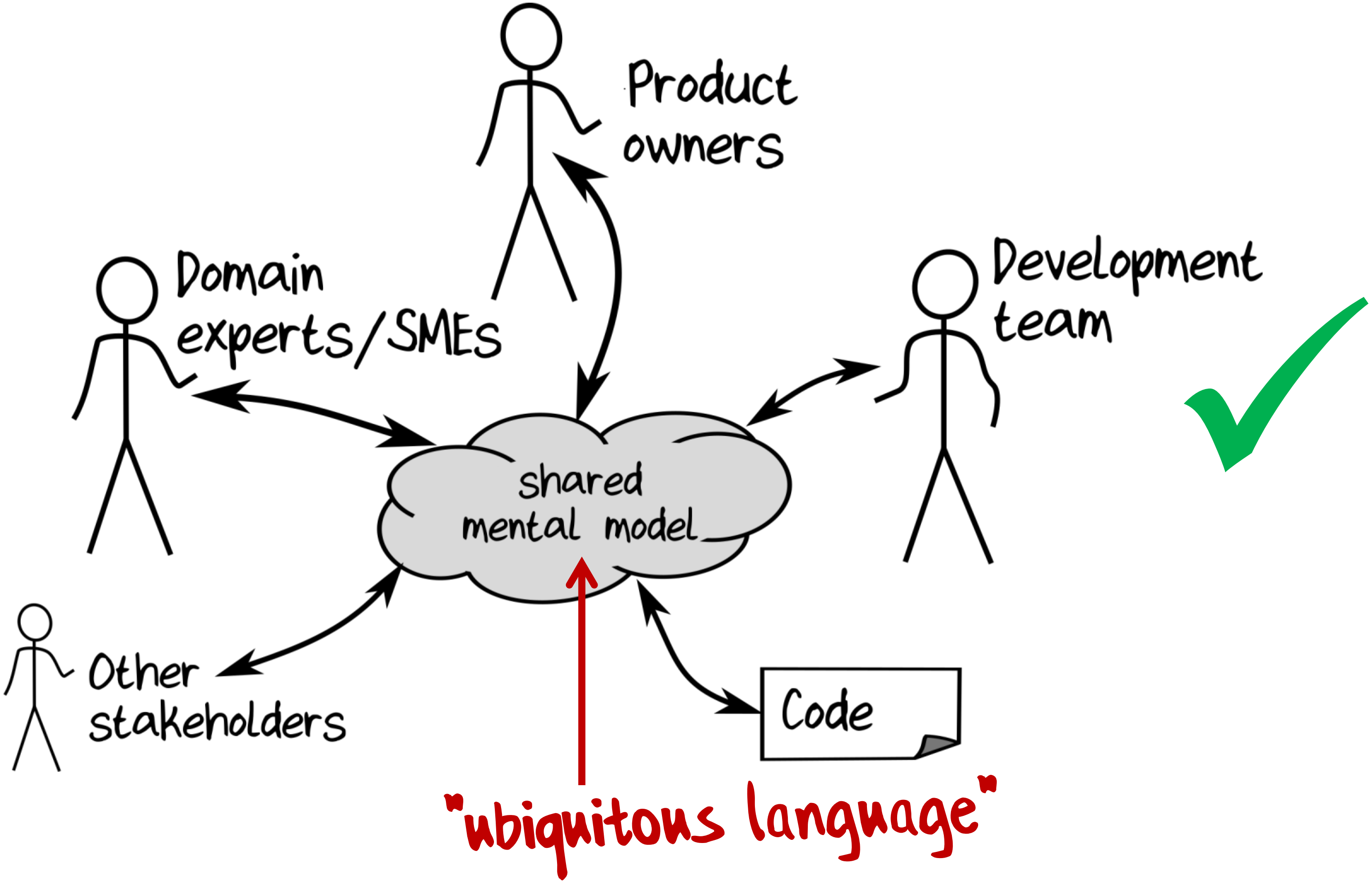
Focus on feedback is good...

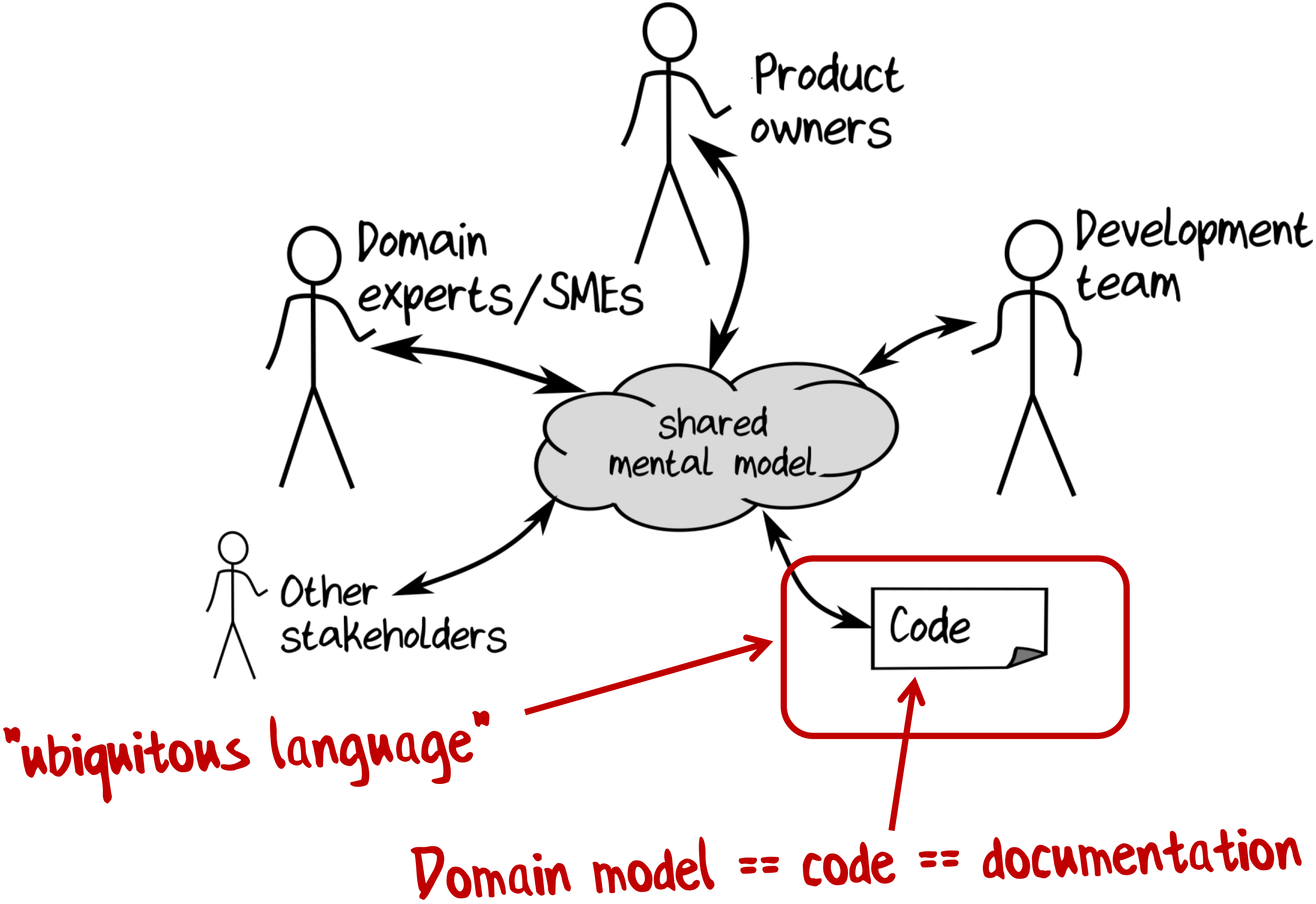
Agile



But code is still a "translation"

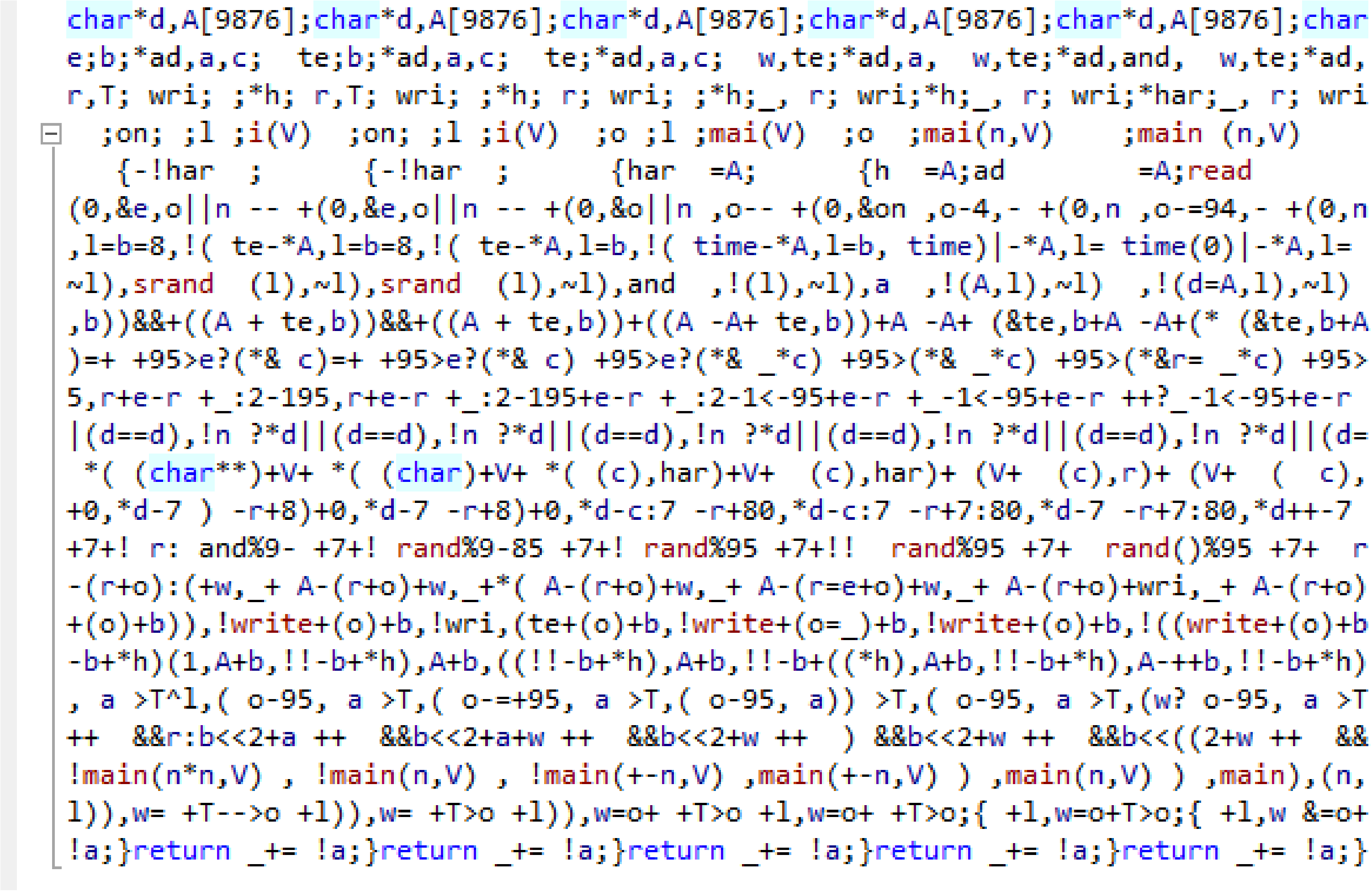
Domain-Driven Design




Product owners
Domain experts/SMEs
Development team
shared mental model
Other stakeholders
Code
"ubiquitous language"
Domain model == code == documentation

Can you really make code represent the domain?

What some source code looks like



```
char*d,A[9876];char*d,A[9876];char*d,A[9876];char*d,A[9876];char*d,A[9876];char
e;b;*ad,a,c;  te;b;*ad,a,c;  te;*ad,a,c;  w,te;*ad,a,  w,te;*ad,and,  w,te;*ad,
r,T; wri; ;*h; r,T; wri; ;*h; r; wri; ;*h;_, r; wri;*h;_, r; wri;*har;_, r; wri
  ;on; ;l ;i(V)  ;on; ;l ;i(V)  ;o ;l ;mai(V)  ;o  ;mai(n,V)    ;main (n,V)
   {-!har  ;       {-!har  ;       {har  =A;       {h  =A;ad        =A;read
(0,&e,o||n -- +(0,&e,o||n -- +(0,&o||n ,o-- +(0,&on ,o-4,- +(0,n ,o-=94,- +(0,n
,l=b=8,!( te-*A,l=b=8,!( te-*A,l=b,!( time-*A,l=b, time)|-*A,l= time(0)|-*A,l=
~l),srand  (l),~l),srand  (l),~l),and  ,!(l),~l),a  ,!(A,l),~l)  ,!(d=A,l),~l)
,b))&&+((A + te,b))&&+((A + te,b))+((A -A+ te,b))+A -A+ (&te,b+A -A+(* (&te,b+A
)=+ +95>e?(*& c)=+ +95>e?(*& c) +95>e?(*& _*c) +95>(*& _*c) +95>(*&r= _*c) +95>
5,r+e-r +_:2-195,r+e-r +_:2-195+e-r +_:2-1<-95+e-r +_-1<-95+e-r ++?_-1<-95+e-r
|(d==d),!n ?*d||(d==d),!n ?*d||(d==d),!n ?*d||(d==d),!n ?*d||(d==d),!n ?*d||(d=
 *( (char**)+V+ *( (char)+V+ *( (c),har)+V+  (c),har)+ (V+  (c),r)+ (V+  (  c),
+0,*d-7 ) -r+8)+0,*d-7 -r+8)+0,*d-c:7 -r+80,*d-c:7 -r+7:80,*d-7 -r+7:80,*d++-7
+7+! r: and%9- +7+! rand%9-85 +7+! rand%95 +7+!!  rand%95 +7+  rand()%95 +7+  r
-(r+o):(+w,_+ A-(r+o)+w,_+*( A-(r+o)+w,_+ A-(r=e+o)+w,_+ A-(r+o)+wri,_+ A-(r+o)
+(o)+b)),!write+(o)+b,!wri,(te+(o)+b,!write+(o=_)+b,!write+(o)+b,!((write+(o)+b
-b+*h)(1,A+b,!!-b+*h),A+b,((!!-b+*h),A+b,!!-b+((*h),A+b,!!-b+*h),A-++b,!!-b+*h)
, a >T^l,( o-95, a >T,( o-=+95, a >T,( o-95, a)) >T,( o-95, a >T,(w? o-95, a >T
++  &&r:b<<2+a ++  &&b<<2+a+w ++  &&b<<2+w ++  ) &&b<<2+w ++  &&b<<((2+w ++  &&
!main(n*n,V) , !main(n,V) , !main(+-n,V) ,main(+-n,V) ) ,main(n,V) ) ,main),(n,
l)),w= +T-->o +l)),w= +T>o +l)),w=o+ +T>o +l,w=o+ +T>o;{ +l,w=o+T>o;{ +l,w &=o+
!a;}return _+= !a;}return _+= !a;}return _+= !a;}return _+= !a;}return _+= !a;}
```

What DDD source code
should look like

```
module CardGame =

  type Suit = Club | Diamond | Spade | Heart

  type Rank = Two | Three | Four | Five | Six | Seven | Eight
              | Nine | Ten | Jack | Queen | King

  type Card = Suit * Rank

  type Hand = Card list
  type Deck = Card list

  type Player = {Name:string; Hand:Hand}
  type Game = {Deck:Deck; Players: Player list}

  type Deal = Deck -> (Deck * Card)

  type PickupCard = (Hand * Card) -> Hand
```

Shared language

```
module CardGame =
```

'|' means a choice -- pick one from the list

```
    type Suit = Club | Diamond | Spade | Heart

    type Rank = Two | Three | Four | Five | Six | Seven | Eight
                | Nine | Ten | Jack | Queen | King

    type Card = Suit * Rank
```

* means a pair. Choose one from each type

```
    type Hand = Card list
    type Deck = Card list
```

list type is built in

```
    type Player = {Name:string; Hand:Hand}
    type Game = {Deck:Deck; Players: Player list}

    type Deal = Deck -> (Deck * Card)

    type PickupCard = (Hand * Card) -> Hand
```

X -> Y means a workflow

- input of X
- output of Y

Do you think this is a reasonable amount of code to write for this domain?

```
module CardGame =

    type Suit = Club | Diamond | Spade | Heart

    type Rank = Two | Three | Four | Five | Six | Seven | Eight
                | Nine | Ten | Jack | Queen | King

    type Card = Suit * Rank

    type Hand = Card list
    type Deck = Card list

    type Player = {Name:string; Hand:Hand}
    type Game = {Deck:Deck; Players: Player list}

    type Deal = Deck –› (Deck * Card)

    type PickupCard = (Hand * Card) –› Hand
```

Do you think a non-programmer could understand this?

```
module CardGame =

    type Suit = Club | Diamond | Spade | Heart

    type Rank = Two | Three | Four | Five | Six | Seven | Eight
                | Nine | Ten | Jack | Queen | King | Ace

    type Card = Suit * Rank

    type Hand = Card list
    type Deck = Card list

    type Player = {Name:string; Hand:Hand}
    type Game = {Deck:Deck; Players: Player list}

    type Deal = Deck -> (Deck * Card)

    type PickupCard = (Hand * Card) -> Hand
```

Anyone spot the mistake?

```
module CardGame =

    type Suit = Club | Diamond | Spade | Heart

    type Rank = Two | Three | Four | Five | Six | Seven | Eight
                | Nine | Ten | Jack | Queen | King | Ace

    type Card = Suit * Rank

    type Hand = Card list
    type Deck = Card list
    type Deal = Deck –› (Deck * Card)
```

Improving the domain

```
module CardGame =

    type Suit = Club | Diamond | Spade | Heart

    type Rank = Two | Three | Four | Five | Six | Seven | Eight
                    | Nine | Ten | Jack | Queen | King | Ace

    type Card = Suit * Rank

    type Hand = Card list
    type Deck = Card list
    type Deal = ShuffledDeck –› (ShuffledDeck * Card)
    type ShuffledDeck = Card list
    type Shuffle = Deck –› ShuffledDeck
```

Improving the domain

```
module CardGame =

    type Suit = Club | Diamond | Spade | Heart

    type Rank = Two | Three | Four | Five | Six | Seven | Eight
                | Nine | Ten | Jack | Queen | King | Ace

    type Card = Suit * Rank

    type Hand = Card list
    type Deck = Card list

    type Player = {Name:string; Hand:Hand}
    type Game = {Deck:Deck; Players: Player list}

    type Deal = Deck -> (Deck * Card)

    type PickupCard = (Hand * Card) -> Hand
```

"persistence ignorance"

Domain-driven not database-driven

```
module CardGame =

    type Suit = Club | Diamond | Spade | Heart

    type Rank = Two | Three | Four | Five | Six | Seven | Eight
                | Nine | Ten | Jack | Queen | King | Ace

    type Card = Suit * Rank

    type Hand = Card list
    type Deck = Card list

    type Player = {Name:string; Hand:Hand}
    type Game = {Deck:Deck; Players: Player list}

    type Deal = Deck –› (Deck * Card)

    type PickupCard = (Hand * Card) –› Hand
```

"The design is the code, and the code is the design."

This is not pseudocode – this is executable code!

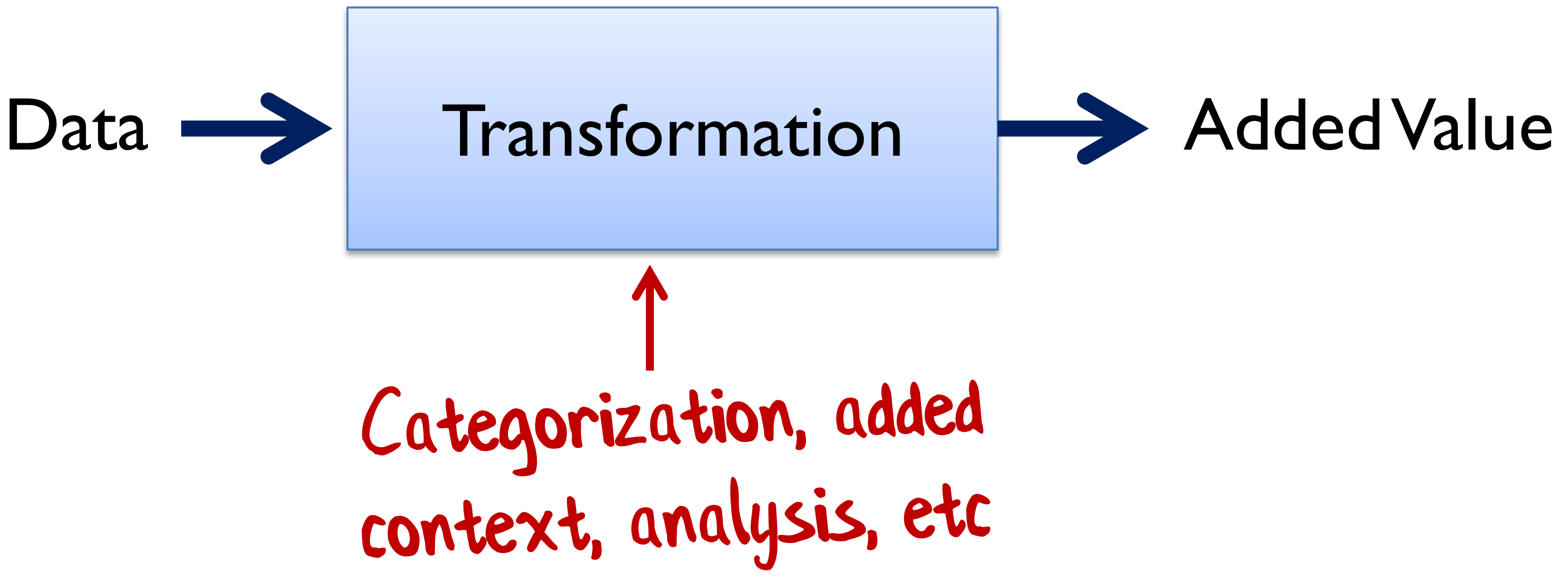
Part IV

The DDD approach
to understanding the domain

Introducing "business events"

Data transformation

- A business doesn’t just *have data, it transforms it somehow*
  - The value of the business is created in this process of transformation
- Data that is sitting there unused is not contributing anything



Data

Transformation

Added Value

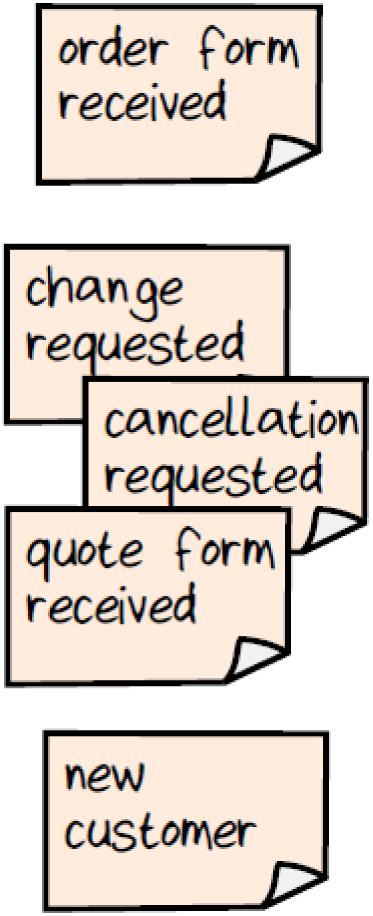
Categorization, added context, analysis, etc

P.S. This looks awfully like a function...

Events

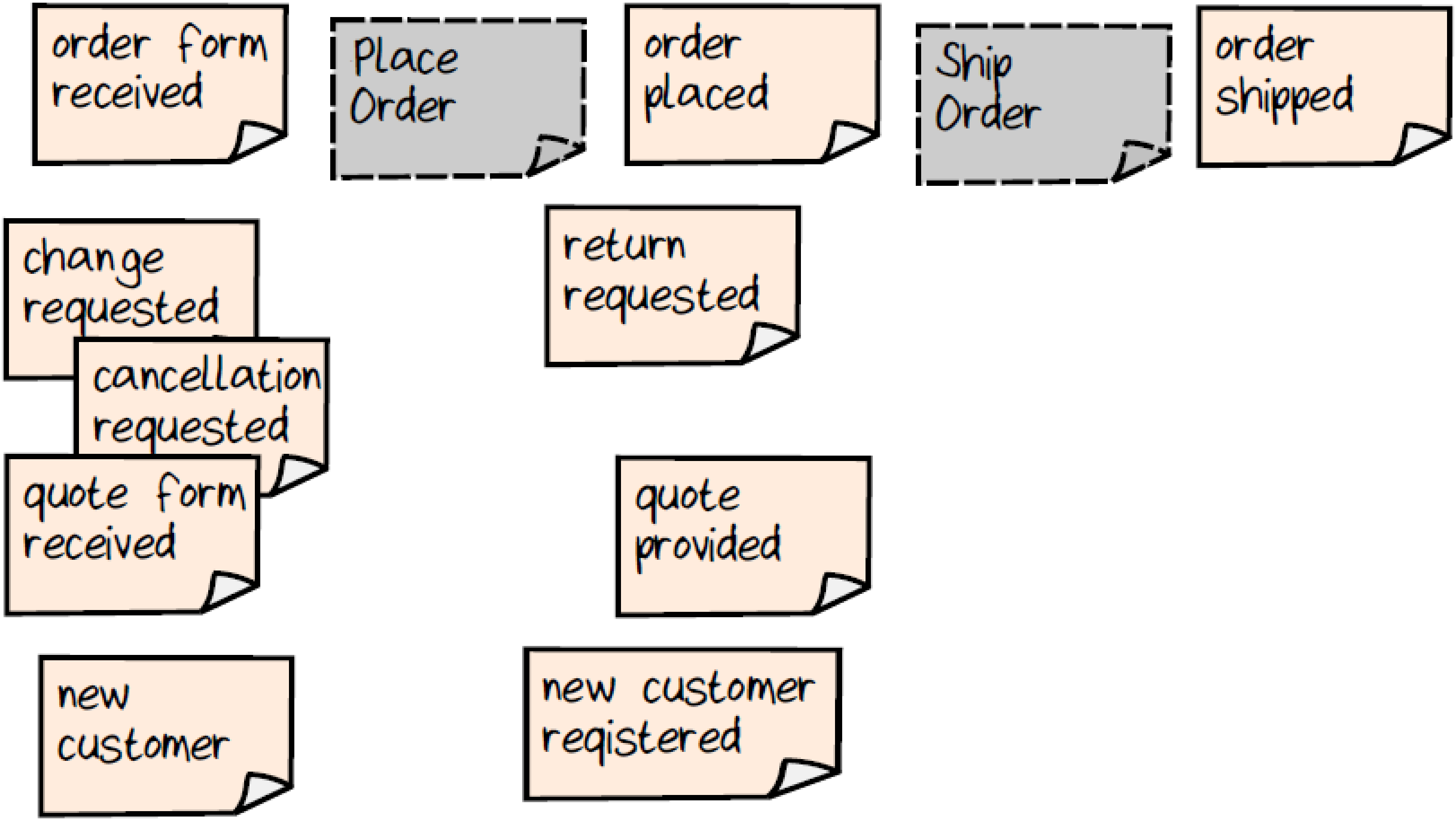
- What causes an employee or process to start working with that data and adding value?
  - An **event**!
- Examples of events:
  - New information arrives ("news")
  - Context changes
  - Customer asks for analysis

Finding the events with Event Storming

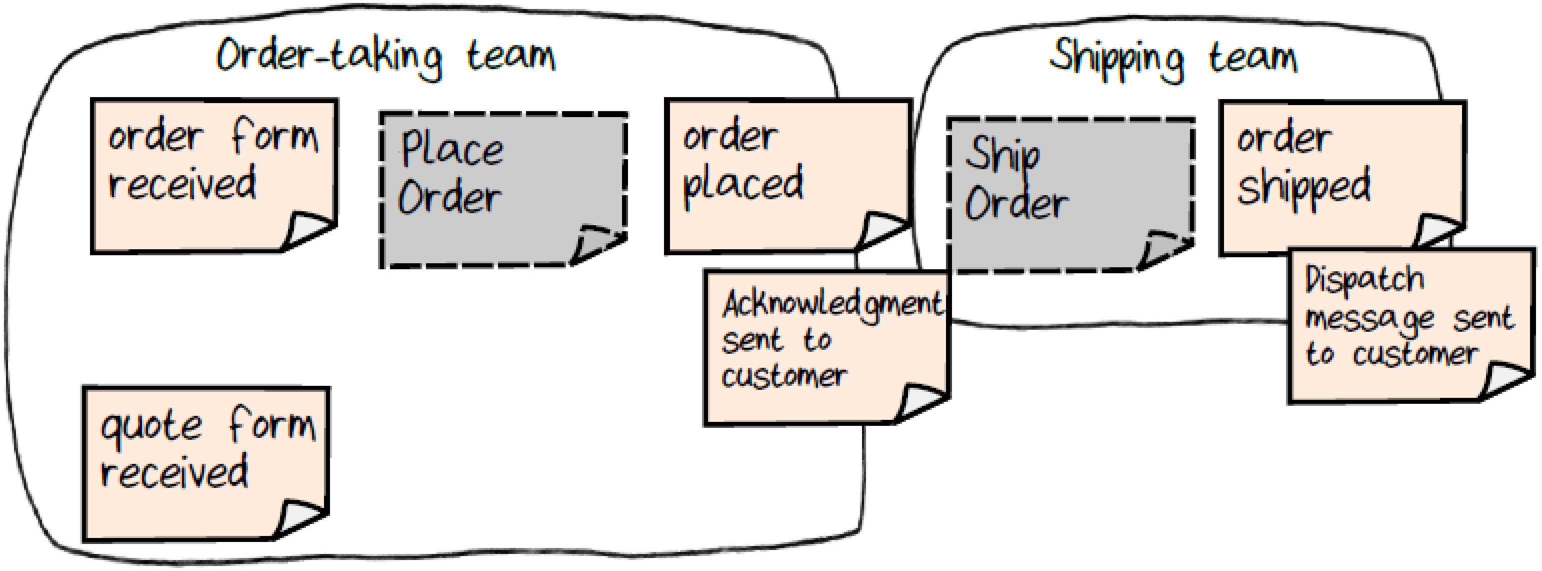


Order processing example

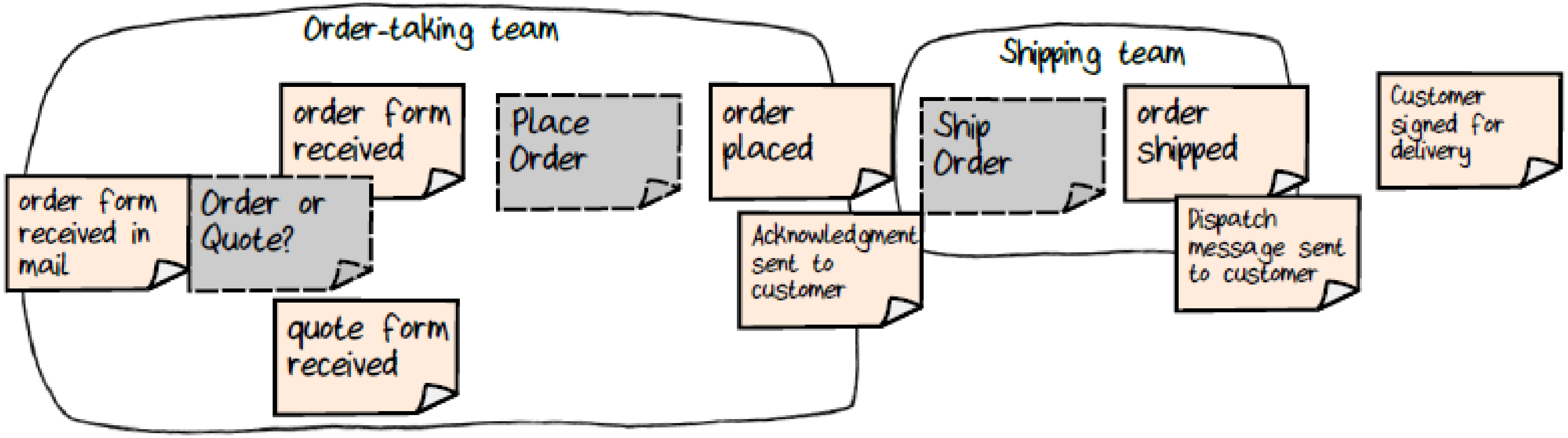
Finding the events with Event Storming



Then group the events

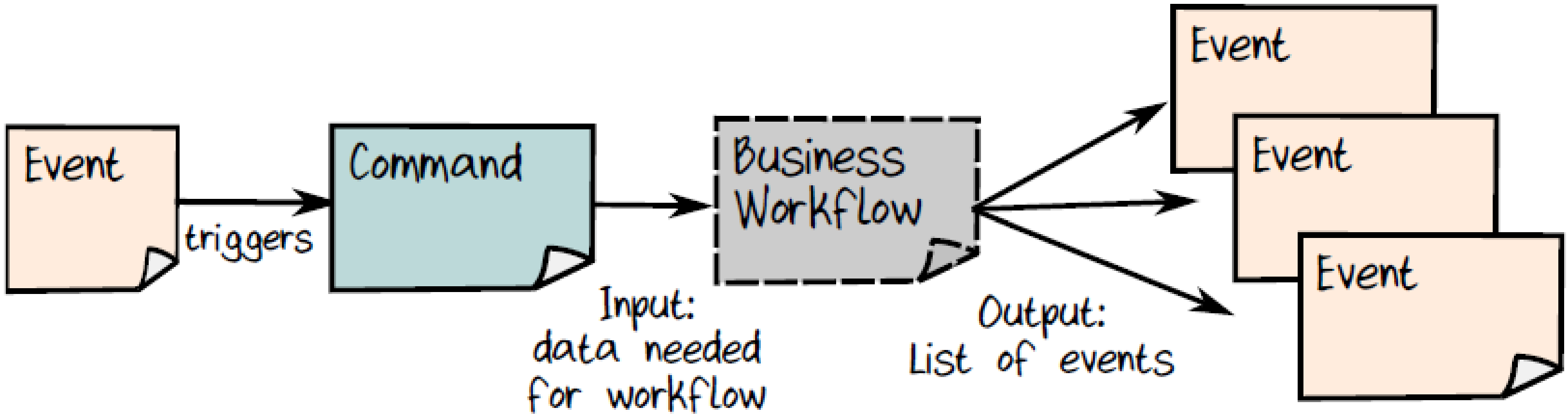


And extend to the edges



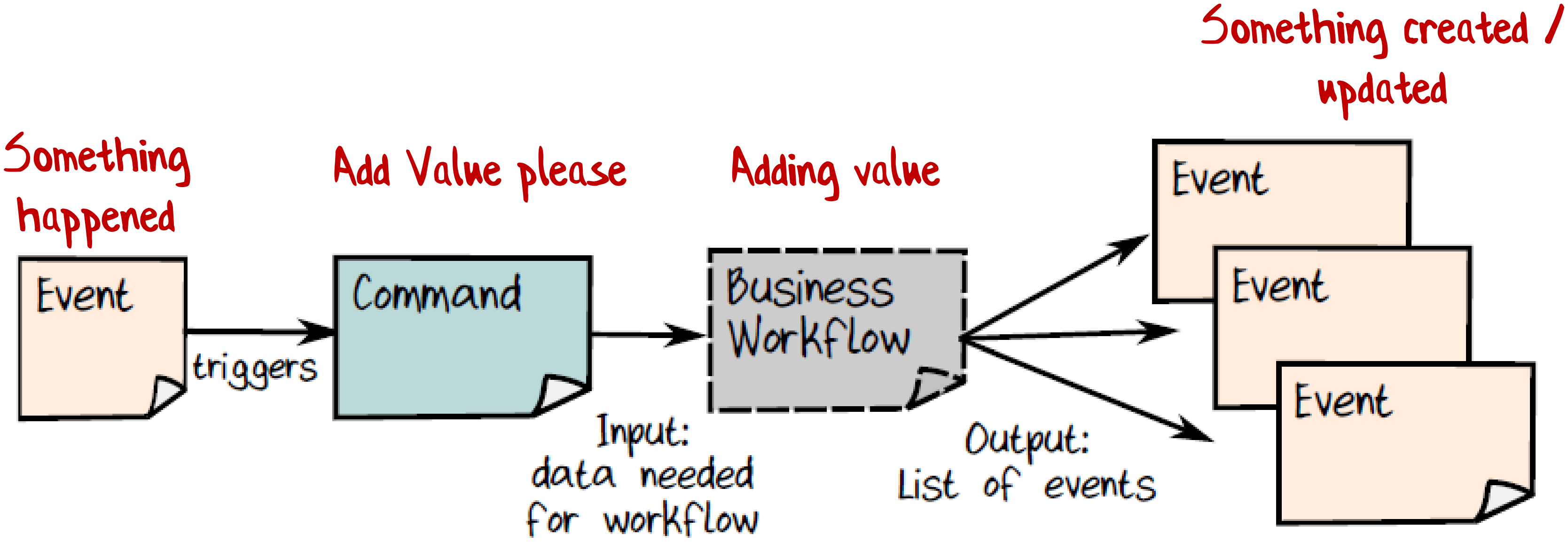
Introducing "workflows"

Events, commands, workflows



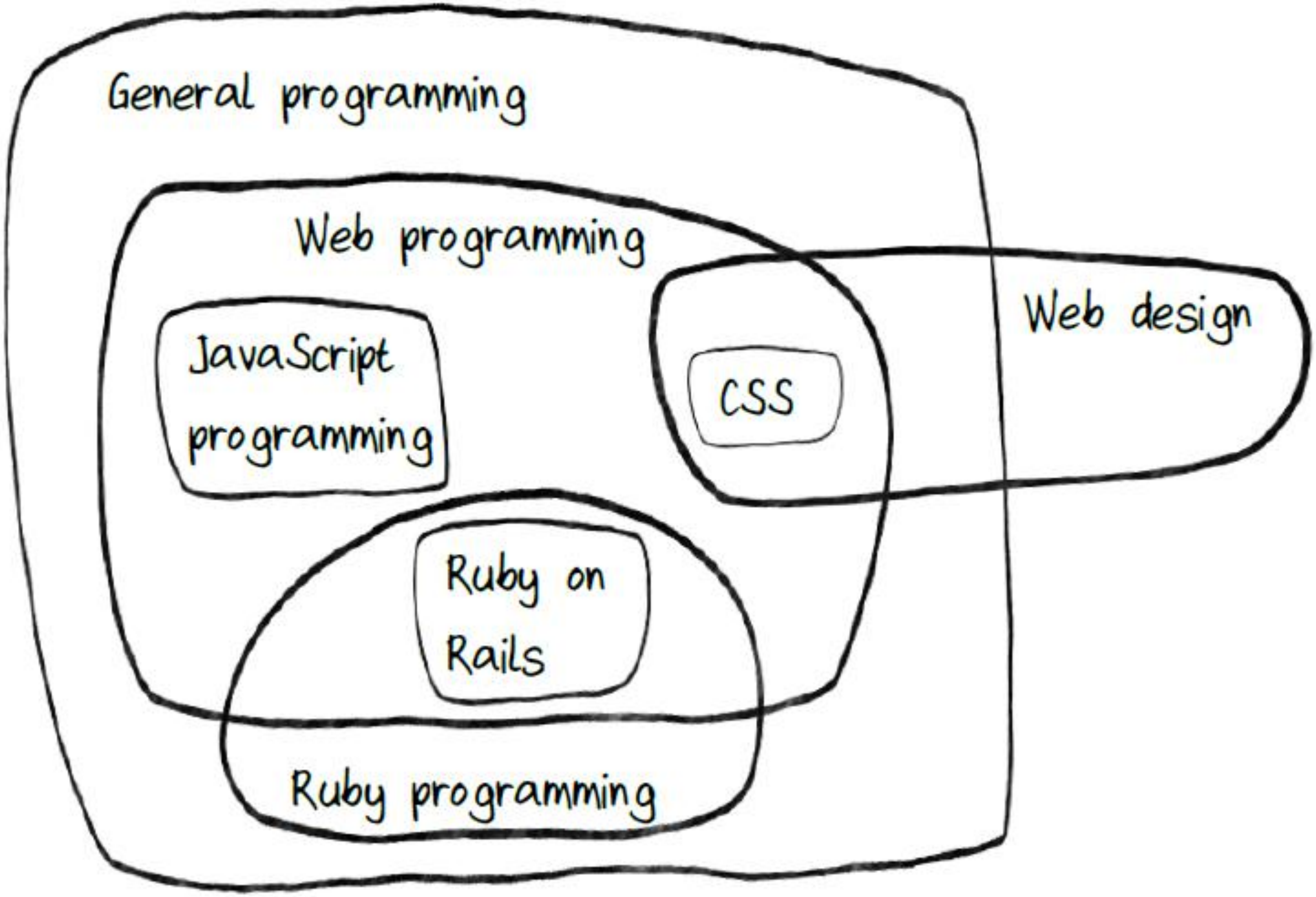
These are the units of work for
specs, coding, & delivery

Events, commands, workflows

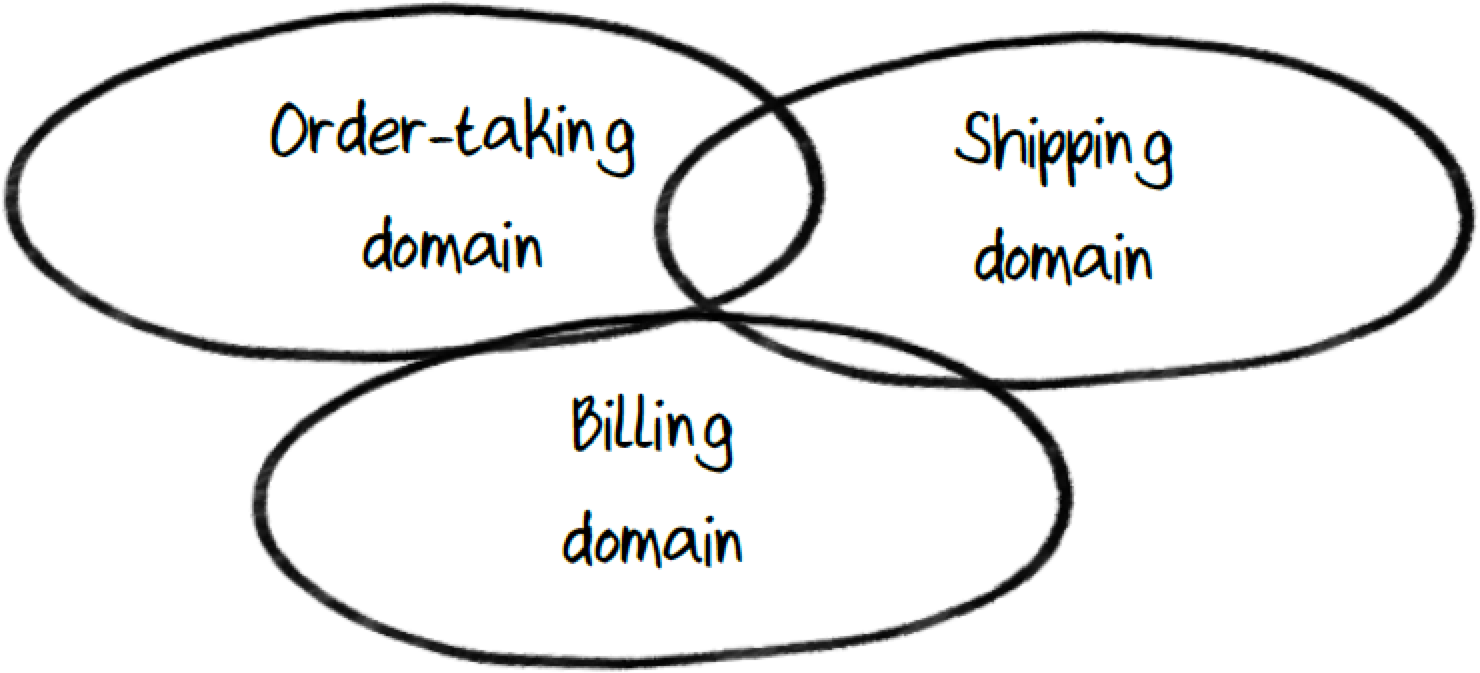


Introducing "subdomains"

What is a subdomain?



What is a subdomain?

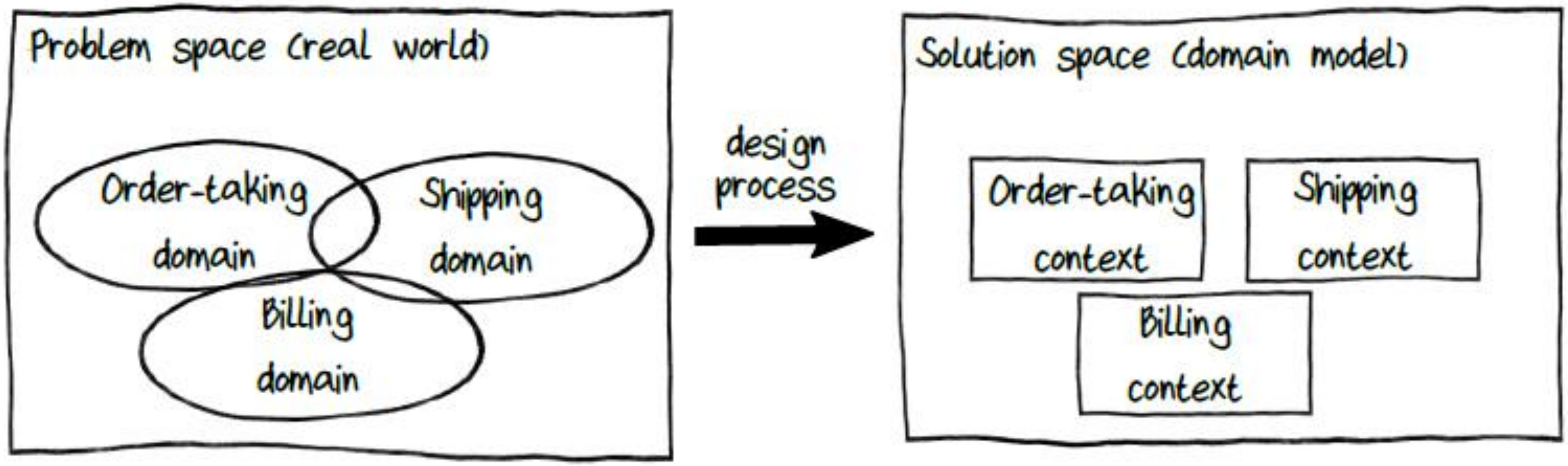


Introducing "bounded contexts"

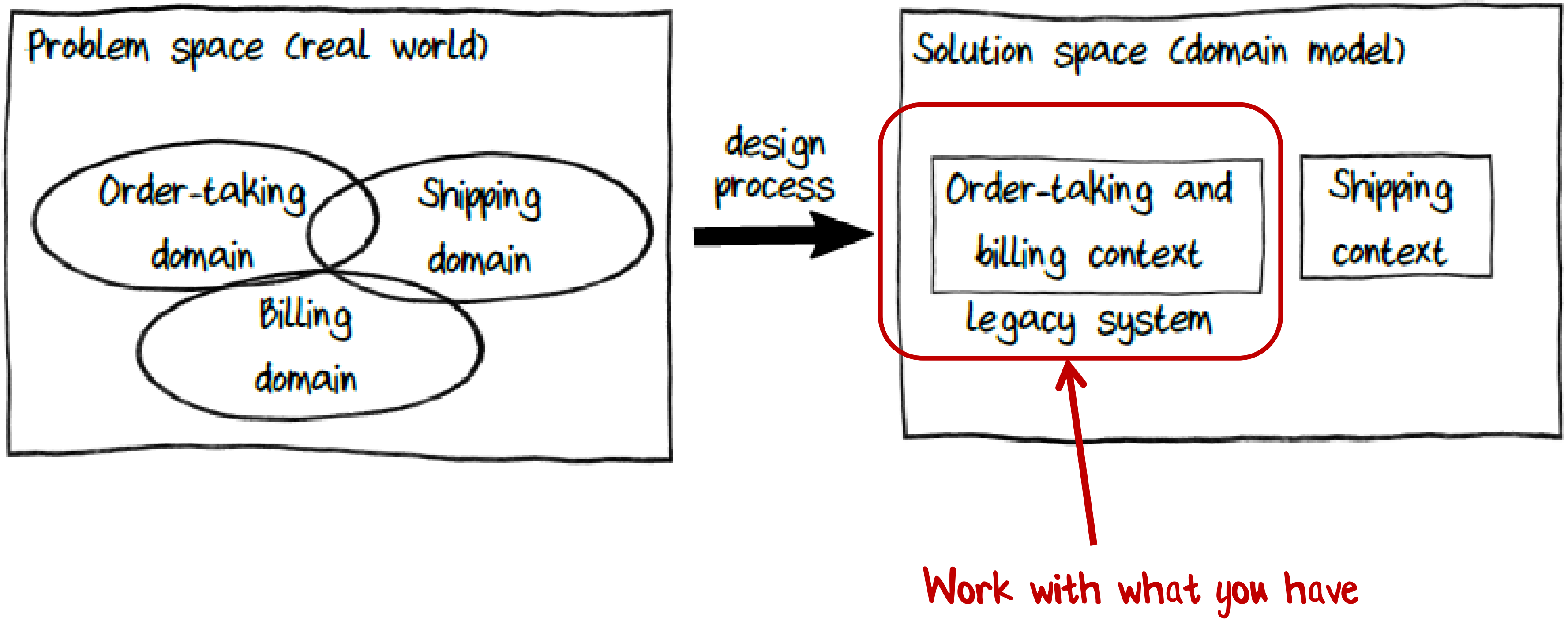
"Problem space" vs. "Solution space"

- The solution is a *model* of the problem domain
  - Only contains aspects of the domain that are relevant!
- A "Subdomain" is in the problem space
- A "Bounded context" is in the solution space

"Problem space" vs. "Solution space"



"Problem space" vs. "Solution space"



Why "Bounded Context"?

- Focus on what is important
  - being aware of the context
  - being aware of the boundaries.
- "*Context*"
  - Specialized knowledge and common language
  - Information taken out of context is confusing or unusable
- "*Bounded*"
  - We want to reduce coupling
  - Contexts must evolve independently!

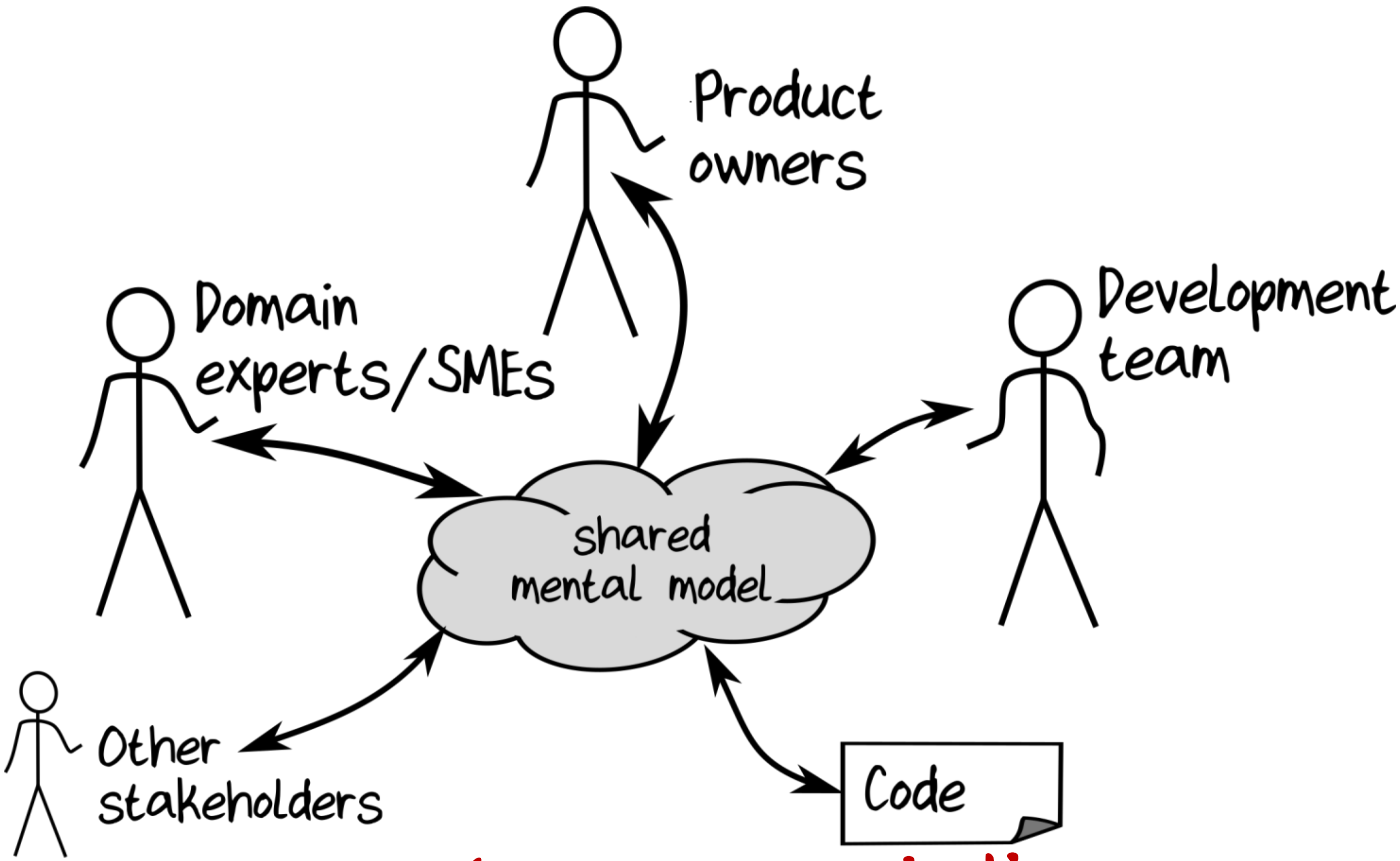
How to get the contexts right

- Listen to the domain experts!
  - Pay attention to existing team and department boundaries
- Don’t forget the “bounded” part of a bounded context
  - Watch out for scope creep when setting boundaries
- Design for autonomy
  - If two groups contribute to the same bounded context, they might end up pulling the design in different directions as it evolves (a three legged race!)
  - Better to have separate bounded contexts that can evolve independently than one mega-context that tries to make everyone happy

Introducing "ubiquitous language"

Ubiquitous Language

- The Ubiquitous Language is a set of concepts and vocabulary associated with the domain and is shared by
  - Domain experts
  - Product owners
  - Development team
  - The source code
- The "everywhere language"



Shared communication can be hard!

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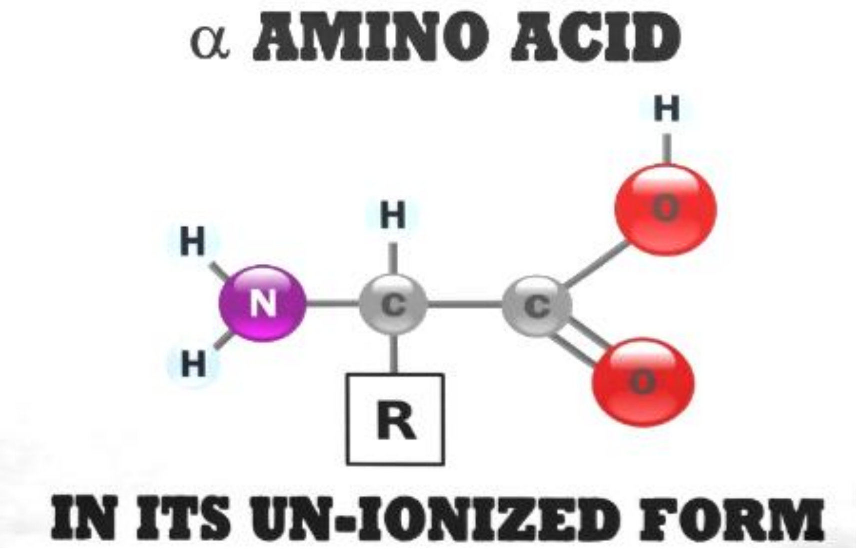
BETTER
MEDICAL
SCHOOLS
GIFT PACKAGES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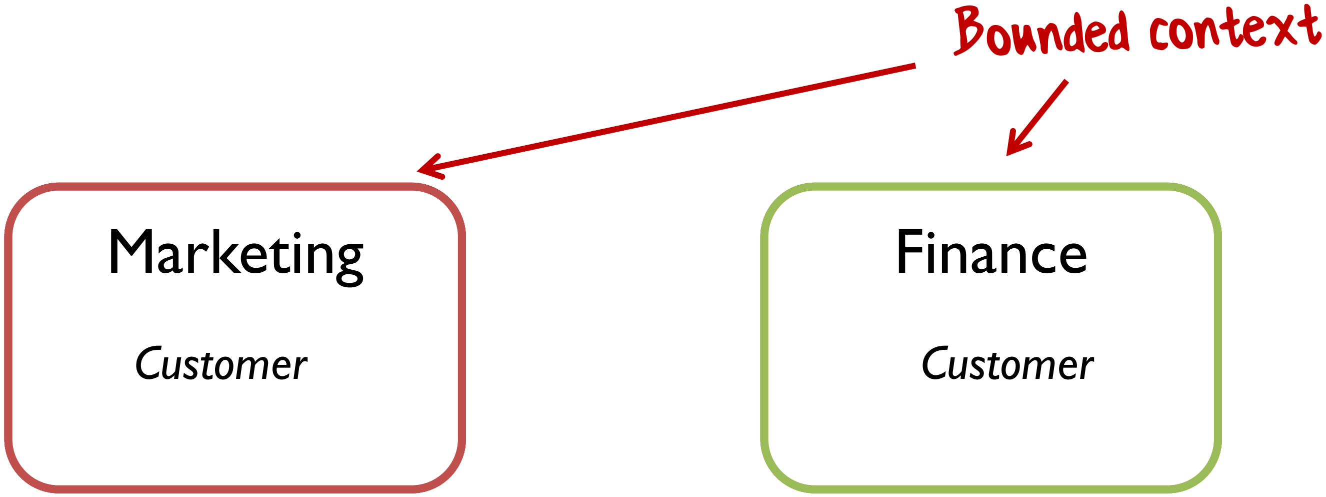


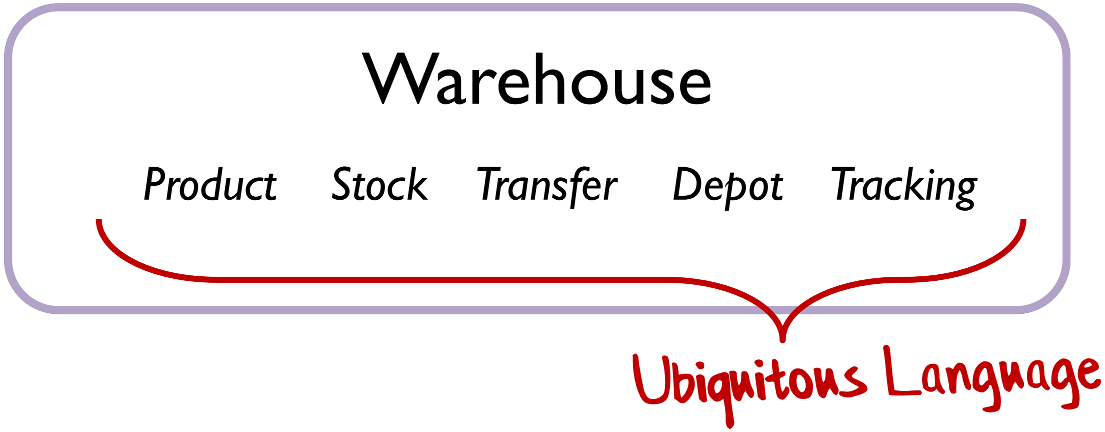
Bounded context

Marketing

Customer

Finance

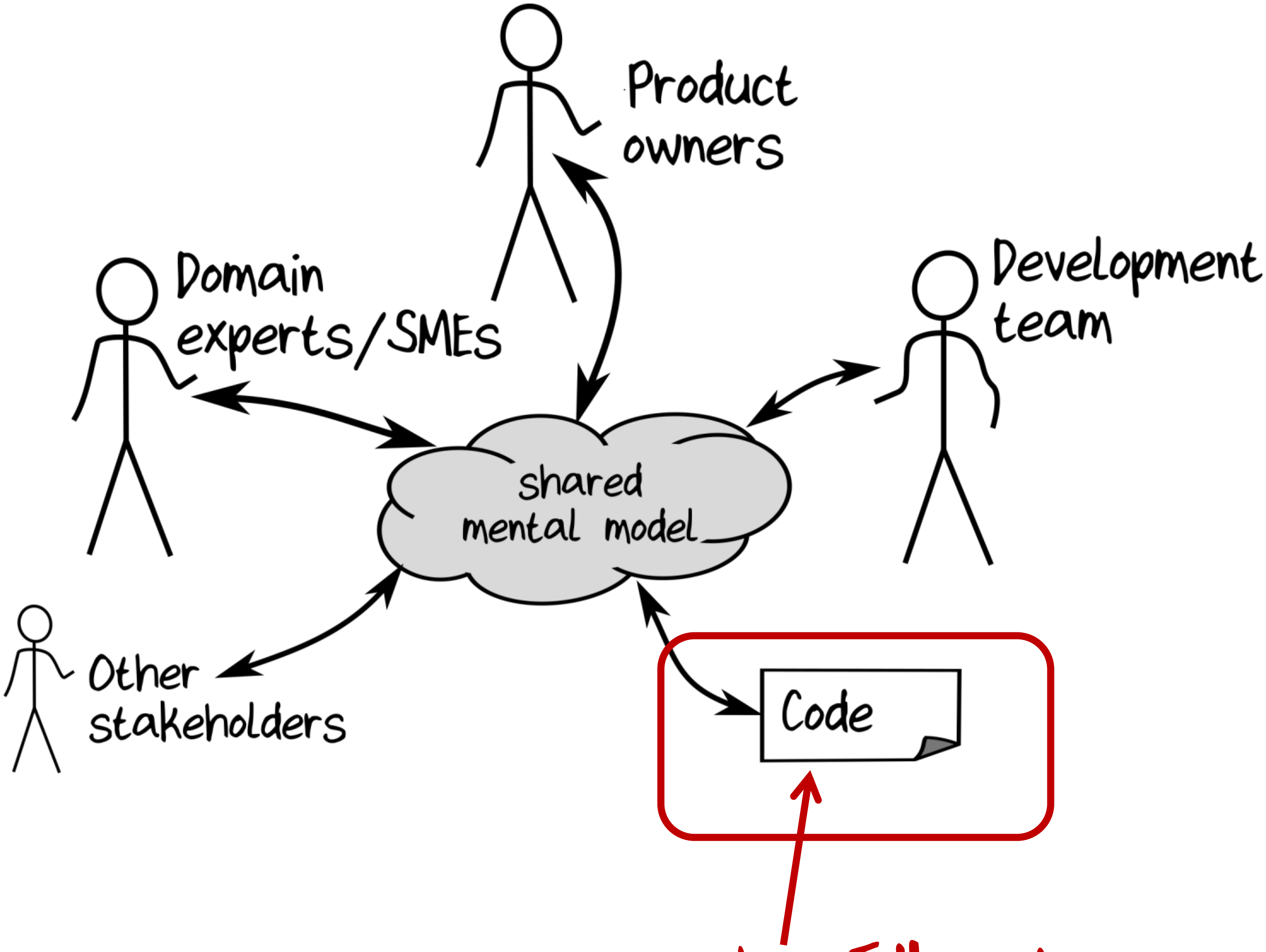
Customer



Warehouse

Product *Stock* *Transfer* *Depot* *Tracking*

Ubiquitous Language



Domain model in F# code

Bounded context

```
module CardGame =
```

Ubiquitous language

```
  type Suit = Club | Diamond | Spade | Heart

  type Rank = Two | Three | Four | Five | Six | Seven | Eight
              | Nine | Ten | Jack | Queen | King

  type Card = Suit * Rank

  type Hand = Card list
  type Deck = Card list

  type Player = {Name:string; Hand:Hand}
  type Game = {Deck:Deck; Players: Player list}
```

Workflow

```
  type Deal = Deck -> (Deck * Card)

  type PickupCard = (Hand * Card) -> Hand
```

Summary of DDD concepts

- Domain Model
  - A set of **simplifications** that represent those aspects of a domain that are **relevant** to a particular problem.
  - The domain model is part of the **solution space**
- Bounded context
  - A subsystem in the domain model
  - Is autonomous and has explicit boundaries.

Summary of DDD concepts

- Ubiquitous Language
  - Concepts and vocabulary associated with the domain
  - Shared by both the team members and the source code.

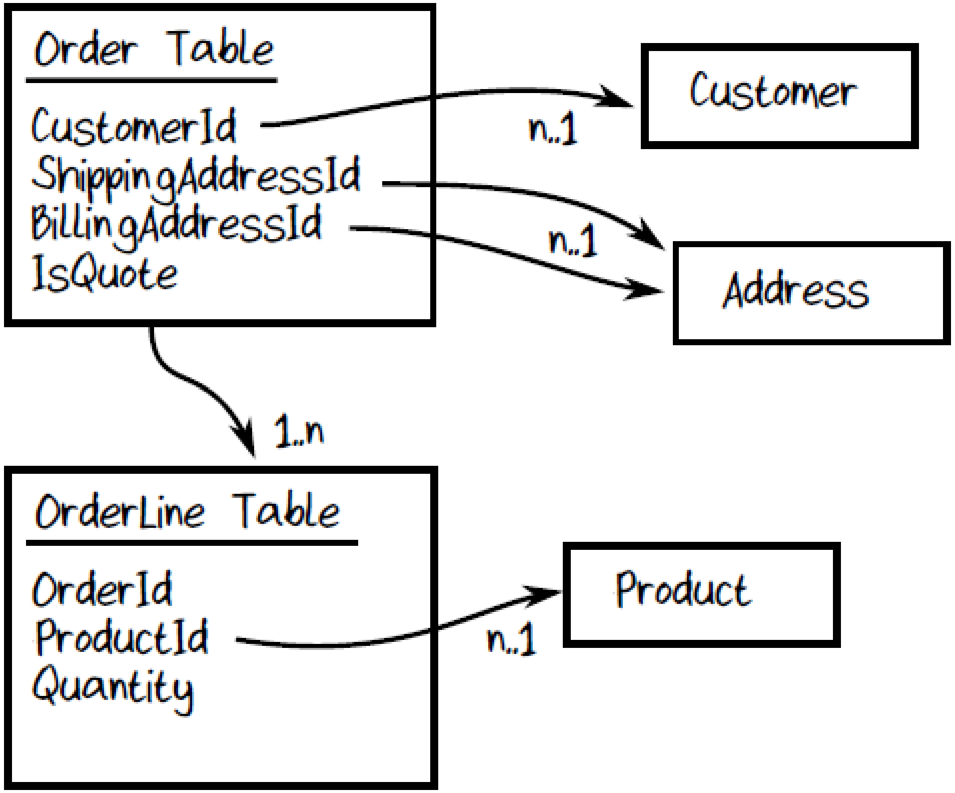
Summary of DDD concepts

- Domain Event
  - A record of something that happened in the system.
  - An event often triggers additional activity.
- Command
  - A request for some process to happen
  - Triggered by a person or another event.
  - If the command succeeds, the state of the system changes and one or more Domain Events are recorded.

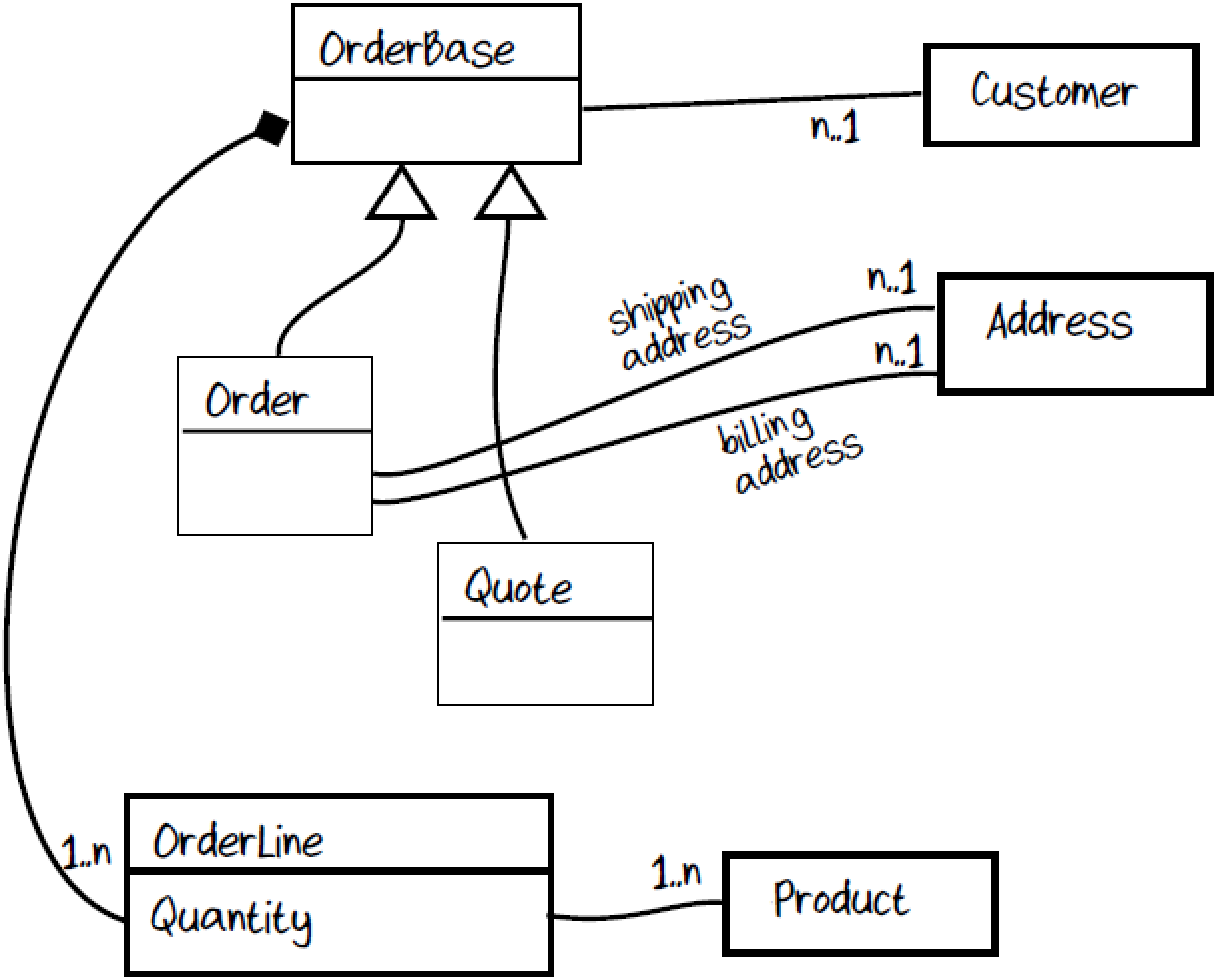
Part V

Getting started with domain modelling

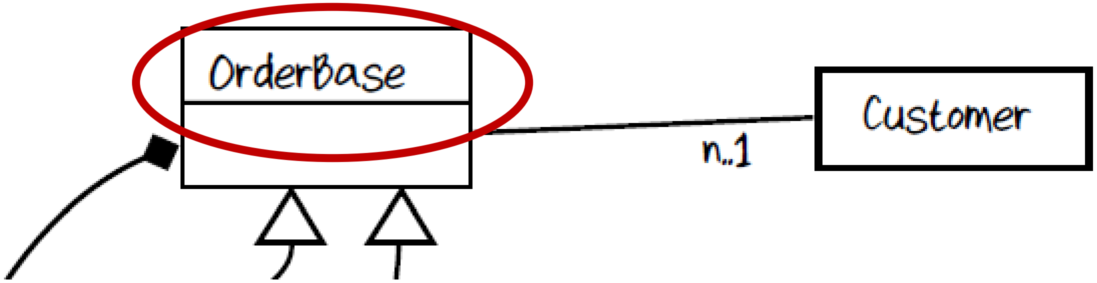
It's not database modelling!



It's not OO modelling!



It's not OO modelling!



Pro tip: If you have a "base", "factory", "manager", or "helper" class then you're doing it wrong!

A domain expert or SME wouldn’t know what you meant by these words.

My recommended way of domain modelling

Start with an event and workflow

```
Bounded context: Order-Taking

Workflow: "Place order"
triggered by:
  "Order form received" event
primary input:
  An order form
other input:
  Product catalog
output events:
  "Order Placed" event
side-effects:
  An acknowledgment is sent to the customer,
  along with the placed order
```

Document the data with AND

```
data Order =
  CustomerInfo
  AND ShippingAddress
  AND BillingAddress
  AND list of OrderLines
  AND AmountToBill

data OrderLine =
  Product
  AND Quantity
  AND Price

data CustomerInfo = ??? // don't know yet
data BillingAddress = ??? // don't know yet
```

Never use primitive types in a domain model

```
data Customer = string AND string

data OrderLine = int AND int
```

✗

Important! "int" and "float" are not domain concepts

```
data Customer = FirstName AND LastName

data OrderLine = ProductId AND Quantity
```

✓

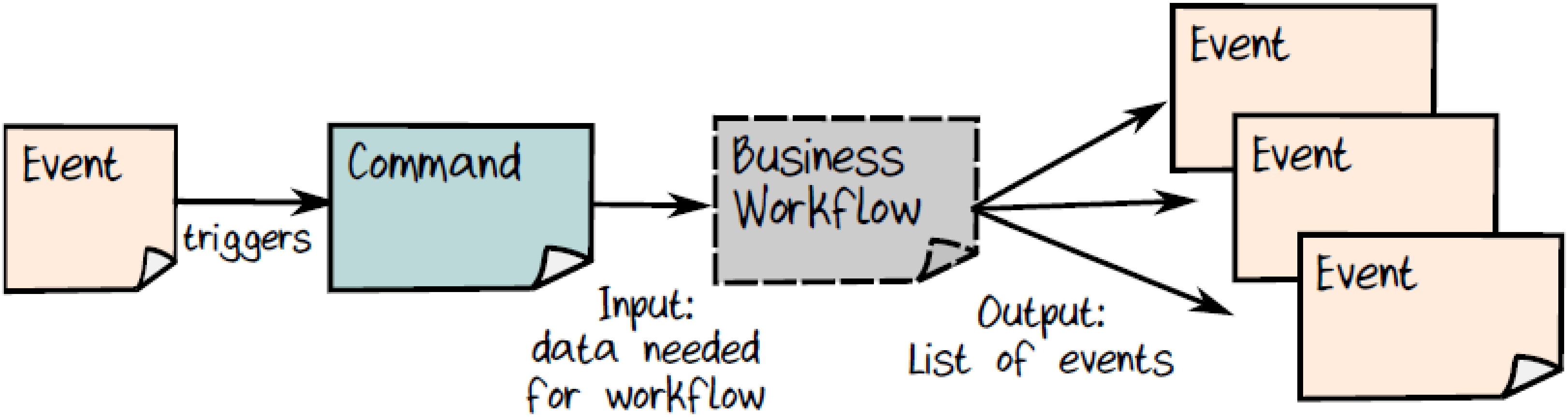
Document choices with OR

```
data ContactInfo =
  EmailAddress
  OR PhoneNumber

data OrderQuantity =
  UnitQuantity
  OR KilogramQuantity

data UnitQuantity = integer between 1 and ?
data KilogramQuantity = decimal between ? and ?
```

Exercises:
You are the domain expert!

For each of the following domains, document the events and the associated data.

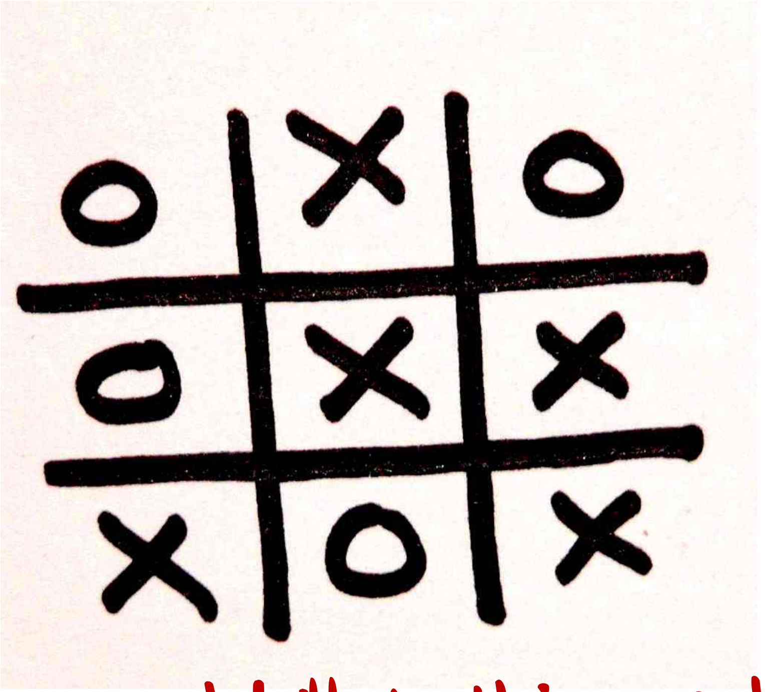
Events, commands, workflows



These are the units of work for
specs, coding, & delivery

Exercise:

Tic-Tac-Toe / Noughts and Crosses



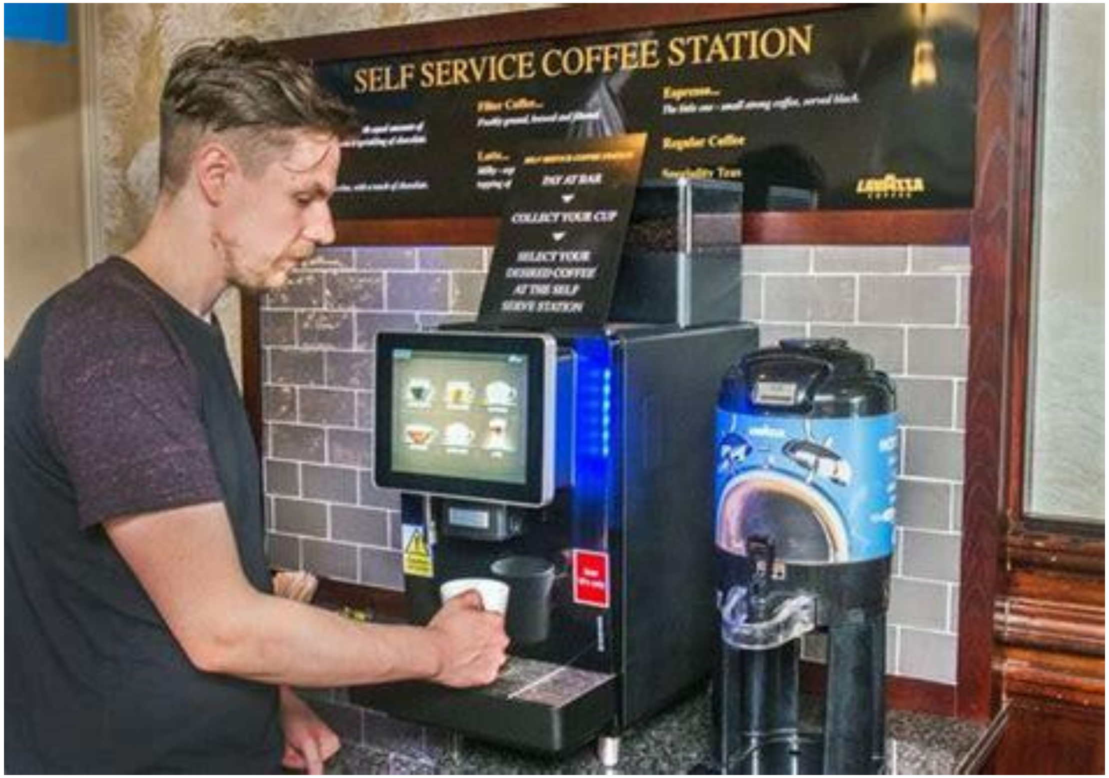
O	X	O
O	X	X
X	O	X

We'll do this one together

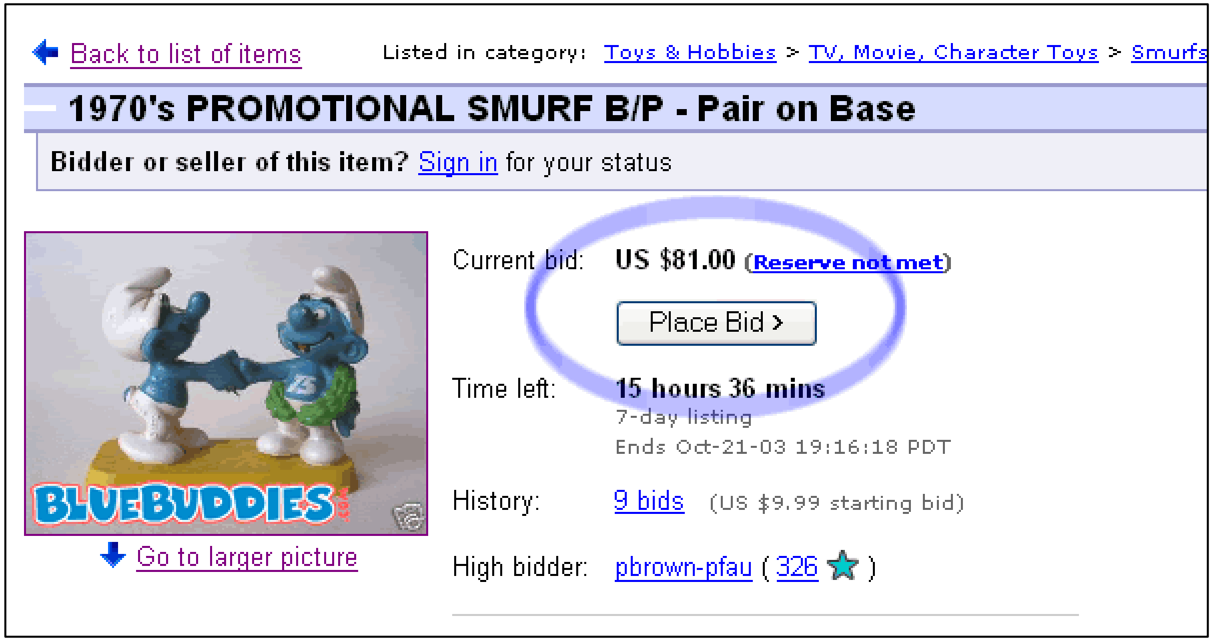
Exercise: ATM / Cash machine

Exercise: Microwave

Exercise: Self-service coffee maker



Exercise: Ebay-style bidding



Back to list of items   Listed in category: Toys & Hobbies > TV, Movie, Character Toys > Smurfs

1970's PROMOTIONAL SMURF B/P - Pair on Base

Bidder or seller of this item? Sign in for your status

Current bid: US $81.00 (Reserve not met)

Time left: 15 hours 36 mins
7-day listing
Ends Oct-21-03 19:16:18 PDT

History: 9 bids (US $9.99 starting bid)

High bidder: pbrown-pfau (326 ★)

Keep it simple!

Exercise: Your own favourite domain

Discussing the models

For each of these domains, document the events and the associated data.

Then paste your domain models into the Google Docs file.

End