Clean Architecture in practice

Hannes Lowette

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Who am I?

- Father of Arne (13), Joren (9) and Marit (7)
- Partner of Barbara (?)
- Head of L&D @ Axxes
- .NET backend dev
- Loves knowledge sharing
- Amateur guitar builder
- Guitarist @
  Dylan Beattie & the Linebreakers
- Mountain biker
- Bad chess player
- Microsoft MVP & NServiceBus Champ

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Who are you?

- What's your name?
- What is your background?
- What are you hoping to learn?
- Tell me 1 cool fact about you!

... or if you don't feel like sharing:

I'm X and I just want to learn.

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Disclaimer

I am here for you,
not the other way around

This means:

- If you have questions, ask!
- If you feel we can do things better/differently, speak up!

The workshop is different every time

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PSA

1. Need a break? Others probably need one too.
   → Let me know! I tend to ramble on.

2. Learning is best when you feel comfortable.
   → Eat snacks, drink, go to the bathroom, …

3. I can talk for a day, but I get hoarse.
   → Let's turn the coding into a conversation!
   → You learn, I learn something too

4. Need me to commit and push?
   →Shout out!

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Agenda

1 _ What are we building?

2 _ Clean Code & SOLID

3 _ Clean Architecture

4 _ Practical Implementation

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What are we building?

–

BeerSender.NET

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Lockdown boredom

💡🇧🇪🍻📦🚚👬😊

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Execution

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Expectation

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Reality

12/01/2022 15:41	**Returned** Returned to shipper MOL, BE
11/01/2022 19:07	**Returning to Sender** UPS initiated contact with receiver or importer for clearance information. Once received, UPS will submit for clearance. / The package will be returned to the sender. Lummen, Belgium

11/01/2022 13:02	UPS initiated contact with the sender to obtain clearance information. Once received, UPS will submit for clearance. / The information requested has been obtained and the hold has been resolved. Lummen, Belgium
10/01/2022 22:22	UPS initiated contact with the sender to obtain clearance information. Once received, UPS will submit for clearance. Lummen, Belgium
10/01/2022 22:21	A missing commercial invoice is causing a delay. We are currently waiting for information from the sender. Lummen, Belgium
10/01/2022 22:20	Warehouse Scan Lummen, Belgium
10/01/2022 19:40	Origin Scan Lummen, Belgium
10/01/2022 14:00	Collection Scan Lummen, Belgium
08/01/2022 11:41	Your parcel is currently at the UPS Access Point™ and is scheduled to be tendered to UPS. Lummen, Belgium
08/01/2022 11:41	Drop-Off Lummen, Belgium
07/01/2022 22:21	Your parcel is pending release from a Government Agency. Once they release it, your parcel will be on its way. Lummen, Belgium
07/01/2022 22:21	Your parcel is on the way
07/01/2022 22:20	Shipper created a label, UPS has not received the package yet. Belgium

Ended up being

- Tracking
- Providing extra customs info
- Emails
- UPS helpdesk 😡
- Packages returned
- Recuperating shipping costs
- Re-sending
- No delivery attempts
- Re-re-sending

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Sending beer is tricky

- Making & filling boxes is fun
- The rest, not so much
- Follow-up is key!

→ We need an app for that!

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BeerSender.NET

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Because it's not written in VB6!

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Clean Code & SOLID

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Uncle Bob's legacy

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An OO dev's evolution

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As perceived by me

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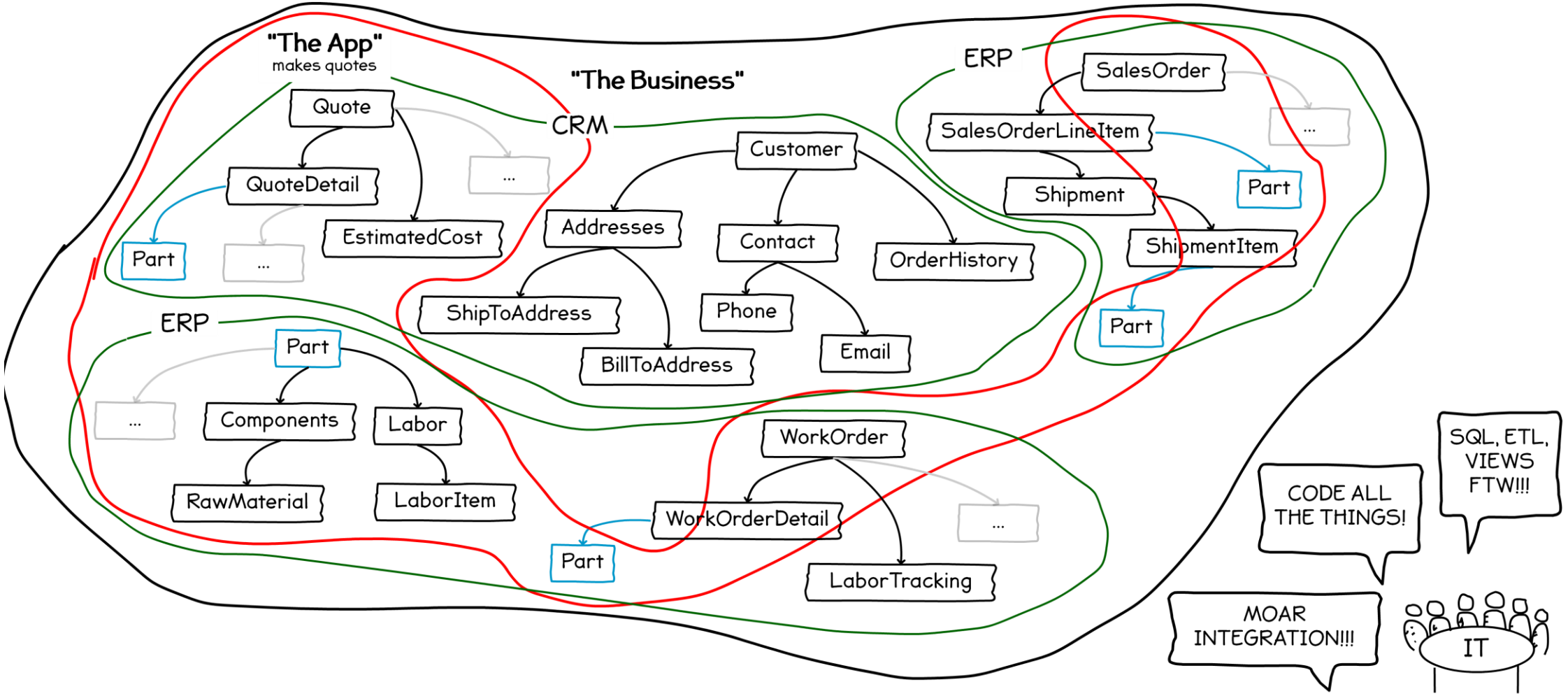
Step 1: Demoware



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Step 2: Layers

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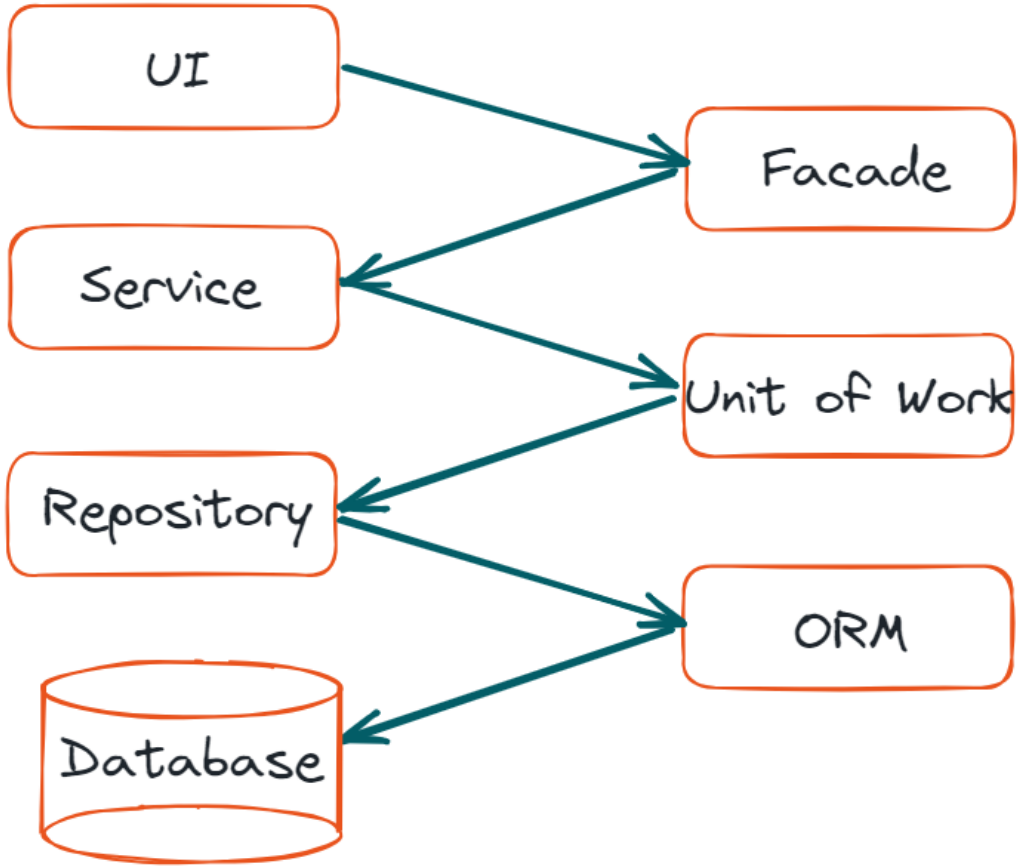
Step 3: “SOLID”



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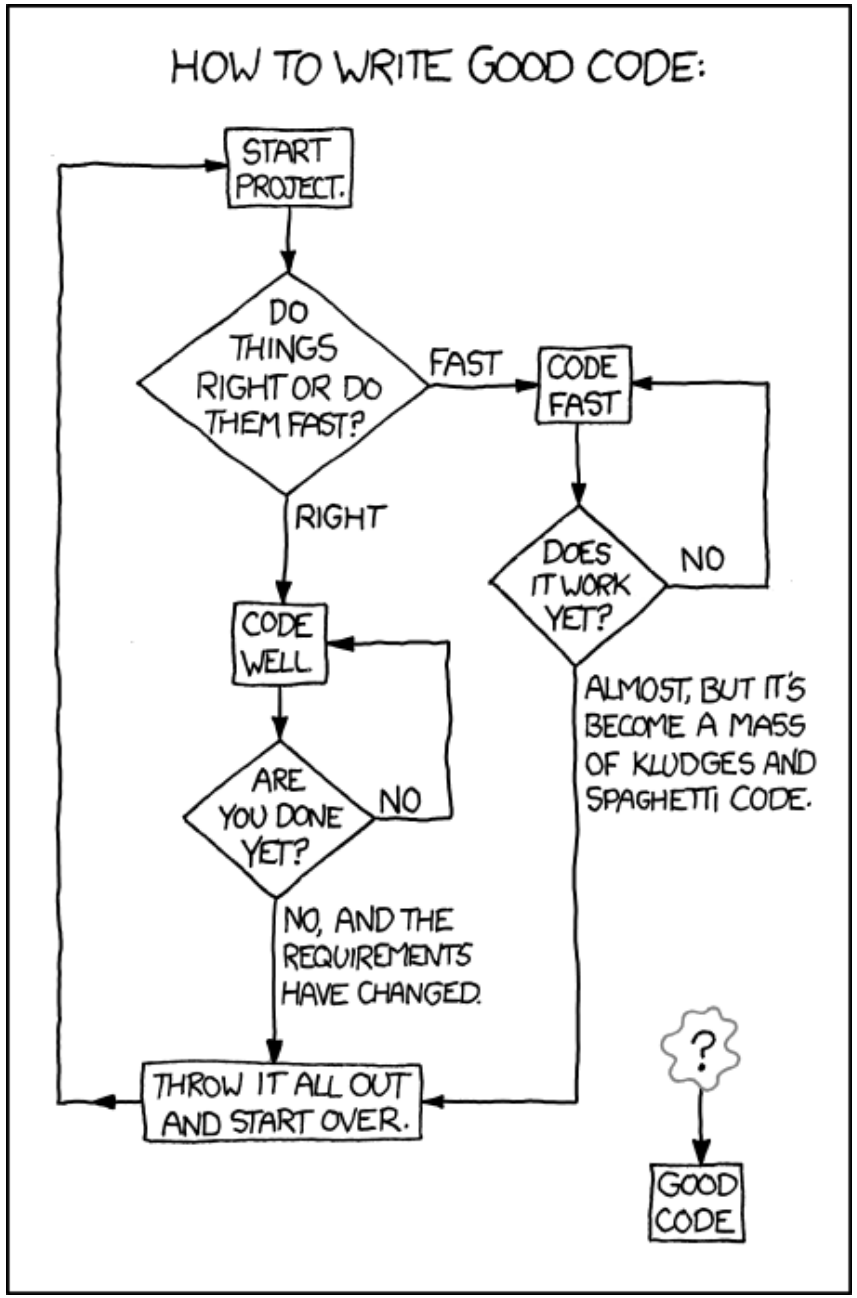
Step 4: SOLID

- Single Responsibility
- Open/closed
- Liskov Substitution
- Interface Segregation
- Dependency Inversion



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Step 5: Architecture

- Clean Architecture
- Ports & Adapters
- SOA
- Plugins
- Bus Systems
- Microservices
- …

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Clean Code

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How to structure code to be readable

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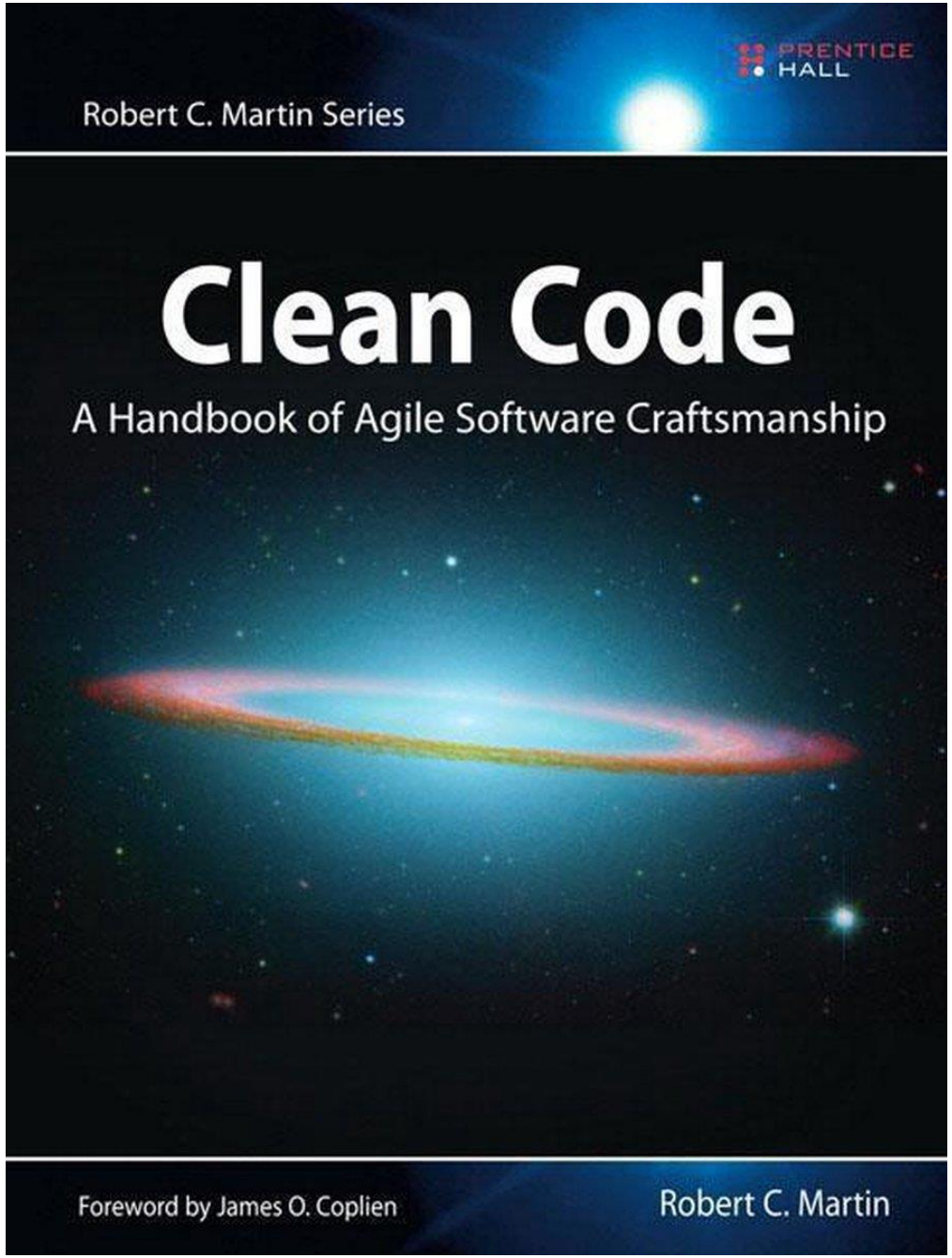

The book

- Naming things
- Structuring functions & flow
- Comments
- Formatting
- Objects & Data structures
- Unit tests
- Classes (incl. SOLID)
- …

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Reading vs. writing code

- More time spent
- Harder to do
  - Other developer's code
  - Your own code
- Risk when misunderstanding:
  - Regressions
  - Time lost
- Written once, read multiple times

→ Optimize for readability

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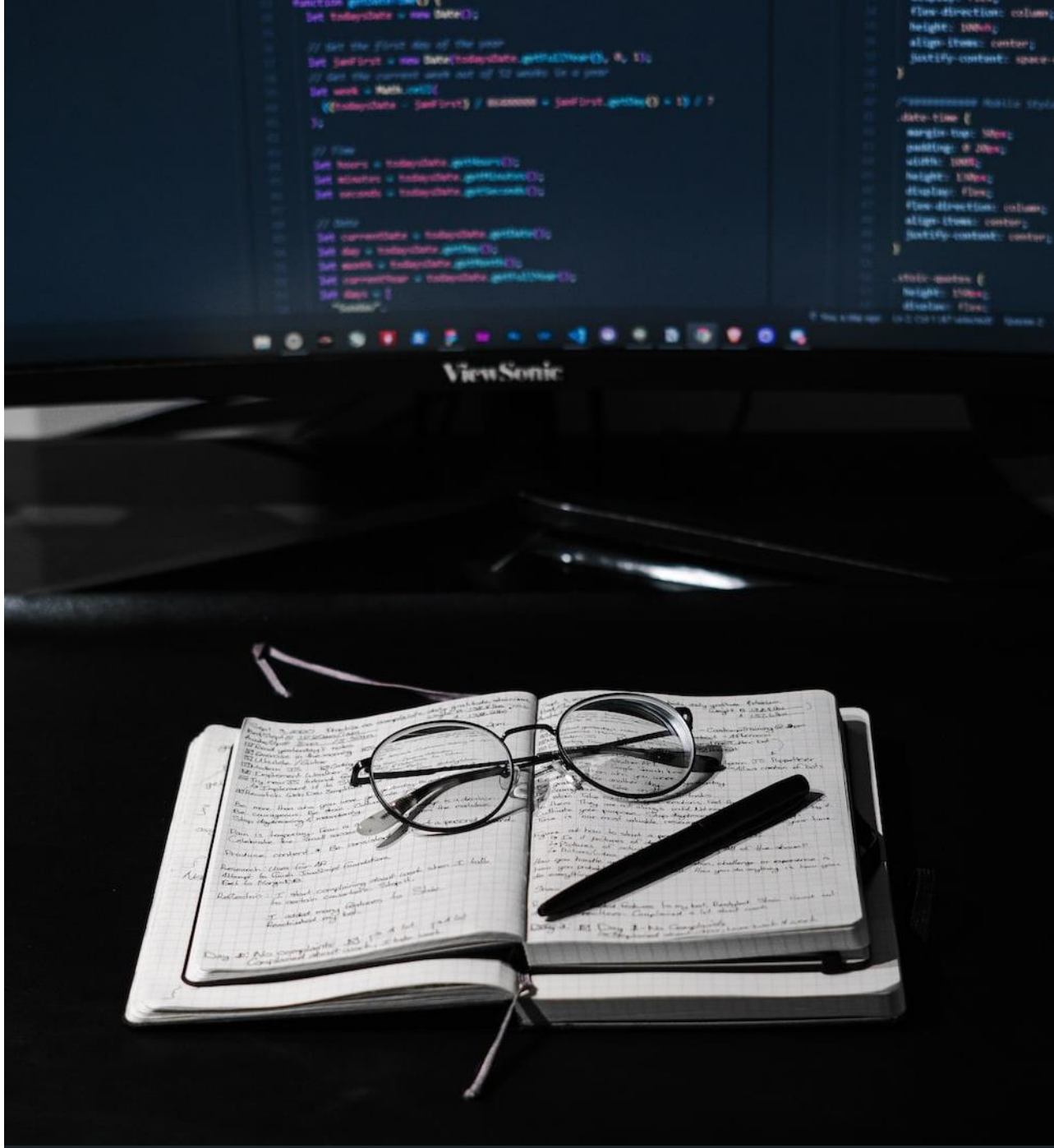

Goals for code

- Easy to understand
- Reads like a story
- Expresses intent
- Comments only when needed
- **Naming things!**
- Easy to test
- Easy to refactor
- Easy to reuse

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SOLID

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A model for OO development

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5 principles

- Single Responsibility principle
- Open/closed principle
- Liskov Substitution principle
- Interface Segregation principle
- Dependency Inversion principle

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```
// Bad:
class BeerPackage {
  public int Capacity { get; set; }

  public bool TryAddBottle(Beer bottle)
  { ... }

  public static BeerPackage GetFromDatabase(int id)
  { ... }

  public void SaveToDatabase()
  { ... }
}

// Better:
class BeerPackage {
  public int Capacity { get; set; }
}

class BottleAdder {
  public bool TryAddBottle(BeerPackage package, Beer bottle)
  { ... }
}

class PackageRepository {
  public BeerPackage GetFromDatabase(int id)
  { ... }

  public void SaveToDatabase(BeerPackage package)
  { ... }
}
```

Single responsibility

A class has a single responsibility

- A class has 1 reason to change:
  - Database schema changed
  - A specific bit of logic has changed
  - Serialization changed
  - API contract changed
  - …

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Open/closed

Software (entities, classes, functions) should be open for extension, but closed for modification

→ Use inheritance & composition

```
// Bad:
class Beer {
  public string Type { get; set; }

  public void Package()
  {
    if(Type == "bottle"){
      AddBubbleWrap();
    } else if(Type == "can")
      AddWrappingPaper();
    } else {
      throw new Exception("unknown type");
    }
  }
}

// Better:
abstract class Beer {
  public abstract void Package();
}

class BeerBottle : Beer {
  public override void Package(){
    AddBubbleWrap();
  }
}

class BeerCan : Beer {
  public override void Package(){
    AddWrappingPaper();
  }
}
```

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Liskov Substitution

Functions using a base class must be able to use objects of derived classes without knowing.

→Subclasses should not break baseclass behavior

→Mostly enforced by modern OO languages

Violations in C#:

- Throwing in implementations/overrides
- Hiding virtual members with new
- Returning values with limitations (e.g. immutable)
- Violate code policy in derived implementation (e.g. null)

```
abstract class Beer {
  public abstract void Package();
}

class BeerBottle : Beer {
  public override void Package(){
    AddBubbleWrap();
  }
}

// Bad
class BeerCan : Beer {
  public override void Package(){
    throw new Exception("no packaging");
  }
}
```

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Interface Segregation

Clients should not be forced to depend on interfaces they don't use.

→Group interface members by behavior, not implementation

→It's better to have multiple smaller interfaces than a single larger one

TIP: interfaces are owned by the consumer

```
// Bad:
interface IBeerBottle {
  int GetContentInMilliliter();
  decimal GetAlcoholPercentage();
  bool HasScrewCap();
}

interface IBeerCan {
  int GetContentInMilliliter();
  decimal GetAlcoholPercentage();
  bool HasPullOffTab();
}

// Better:
interface IBeer {
  int GetContentInMilliliter();
  decimal GetAlcoholPercentage();
}

interface IHasCap {
  bool HasScrewCap();
}

interface IHasTab {
  bool HasPullOffTab();
}
```

```
// The behavior BeerAdder needs:
interface IPackageRepository {
    BeerPackage GetById(int id);
    SavePackage(BeerPackage package);
}

class BeerAdder {
  // Depends only on the abstraction:
  private readonly IPackageRepository _repo;

  // DI framework delivers implementation:
  public BeerAdder(IPackageRepository repo) {
    _repo = repo;
  }

  public void AddBottleToPackage(
    int packageId, Beer bottle)
  {
    var package = _repo.GetById(packageId);
    package.AddBottle(bottle);
    _repo.SavePackage(package)
  }
}

// BeerAdder doesn't know about implementation:
class PackageRepository: IPackageRepository {
  public BeerPackage GetById(int id)
  { ... }

  public SavePackage(BeerPackage package)
  { ... }
}
```

Dependency Inversion

Abstractions should not depend upon details.
Details should depend upon abstractions.

→Write code that consumes interfaces

→Define behavior, then implement

→Invert references (implementations reference abstractions)

AGAIN: interfaces are owned by the consumer

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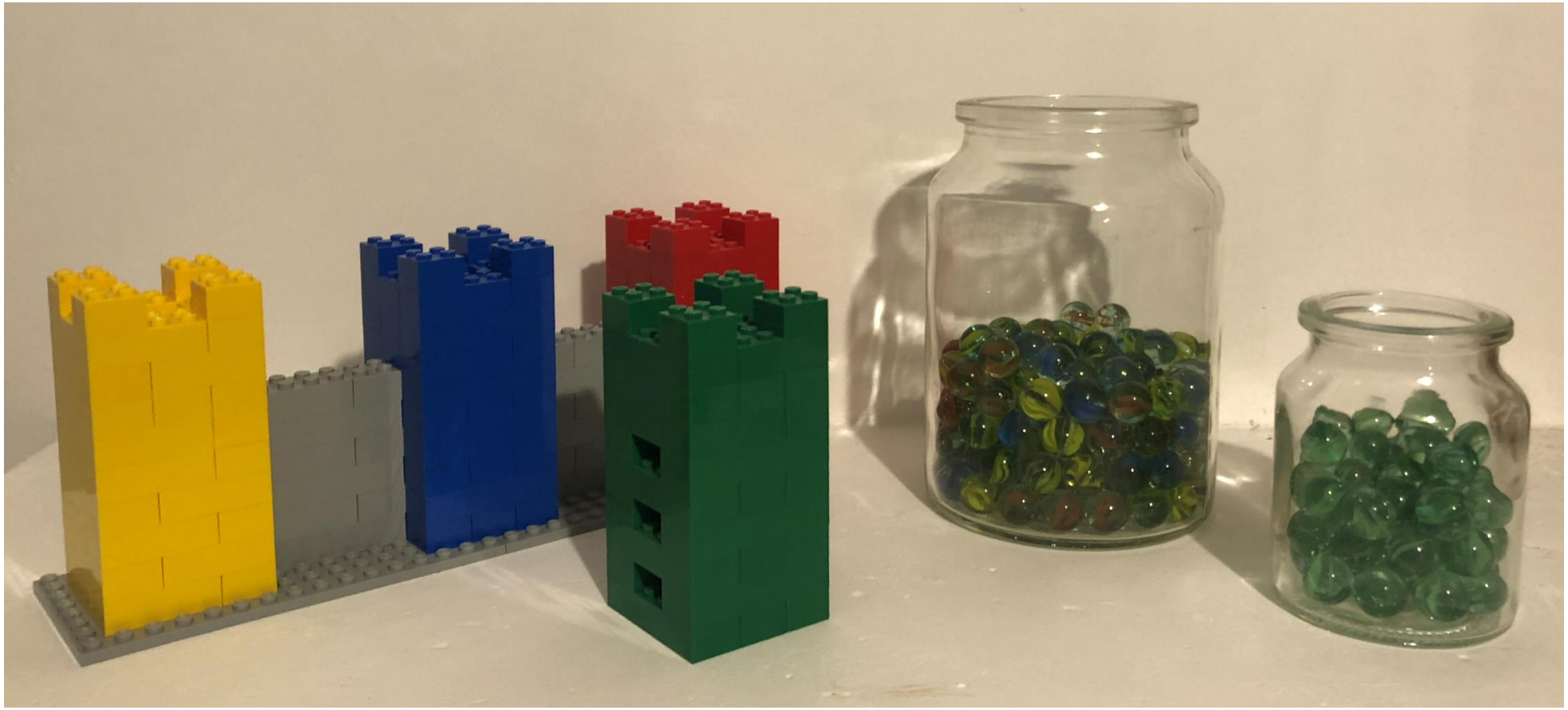
Proper SOLID



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Clean Architecture

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SOLID – facilitating architecture

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What I learned in college

-

(and is still being taught)

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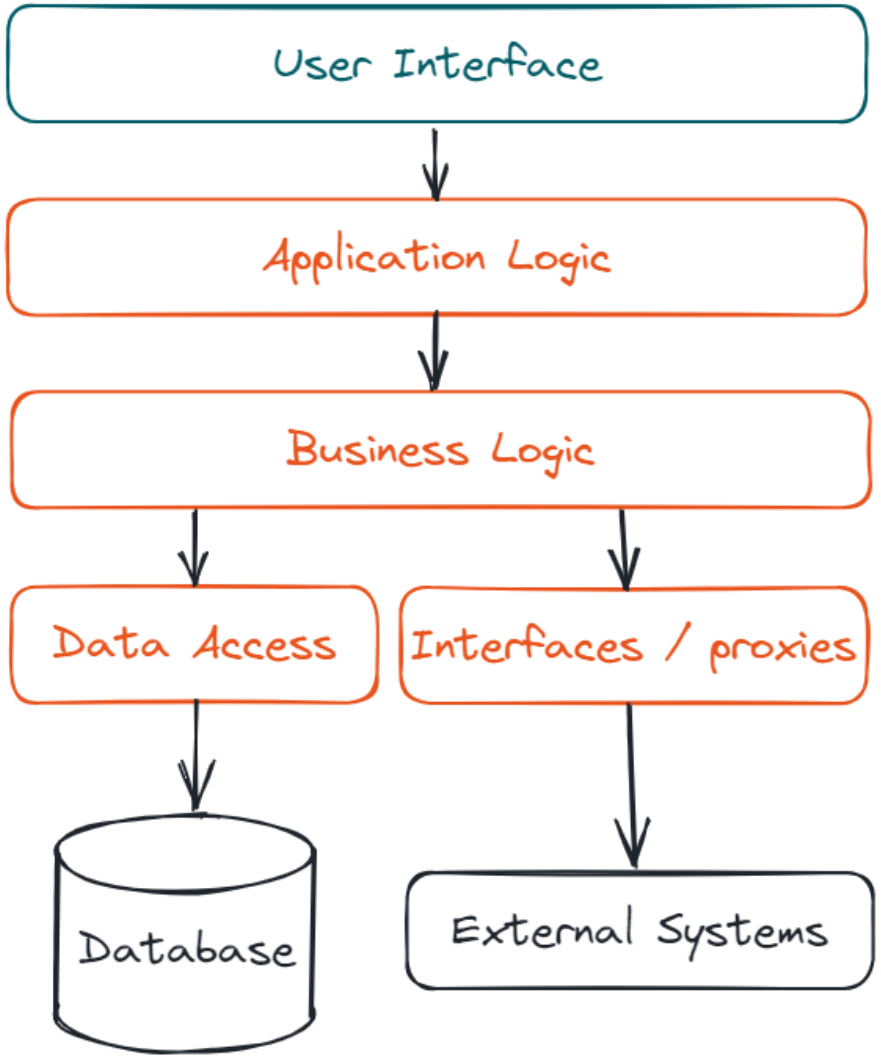
Layered Architecture

- Dependencies point 'downwards'
- Replicates the path from UI to DB

- Layers have 'knowledge' of what's 'below'

- Separately deployed layers= tiers

→ Matches up-front design approach



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A different way of thinking

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The software business evolved

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Evolution

Long-lived software projects led to:

- Agile manifesto
- Continuous value delivery
- Changing requirements
- …

→ Up-front architecture fails

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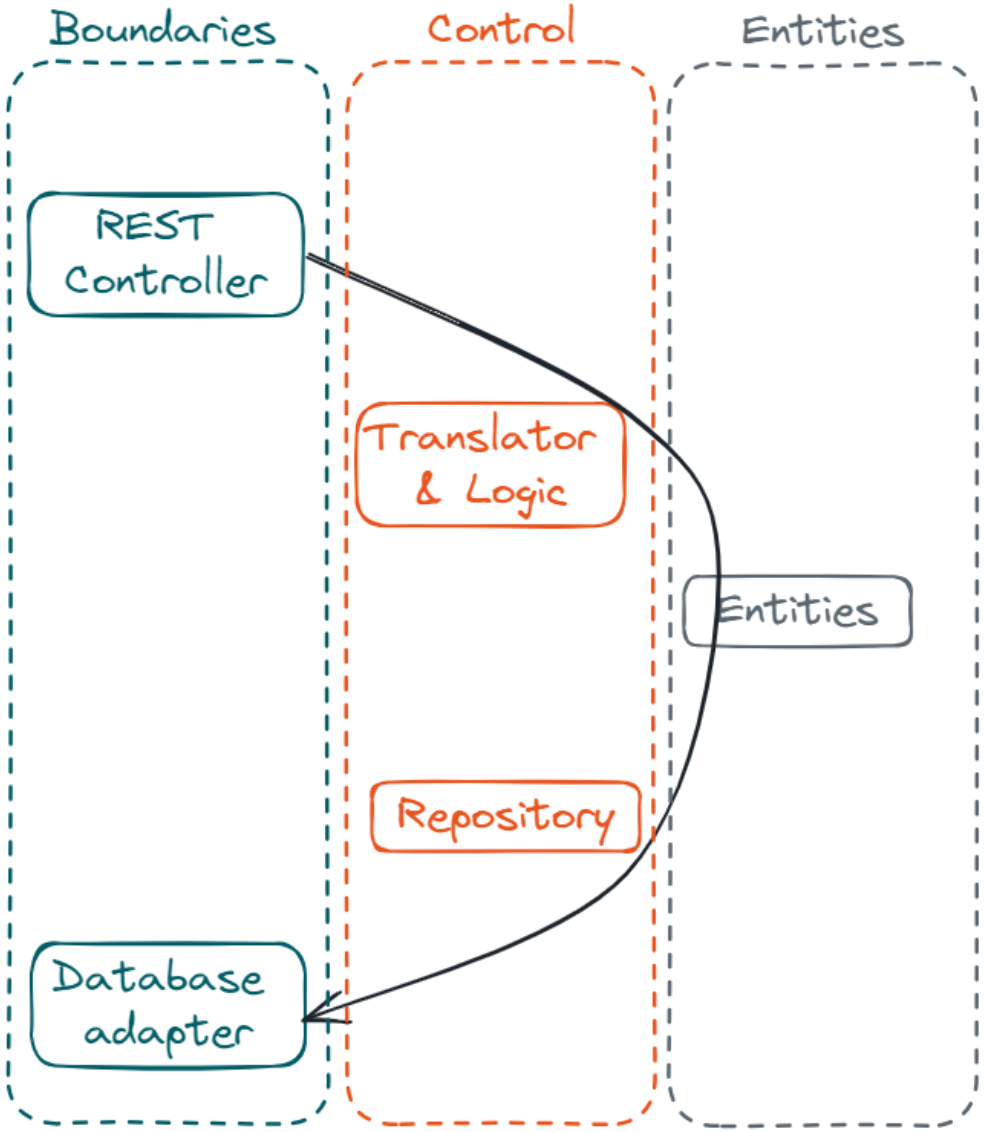

Boundary – Control - Entity

- 1992
- Ivar Jacobson

- Organization of classes by responsibility

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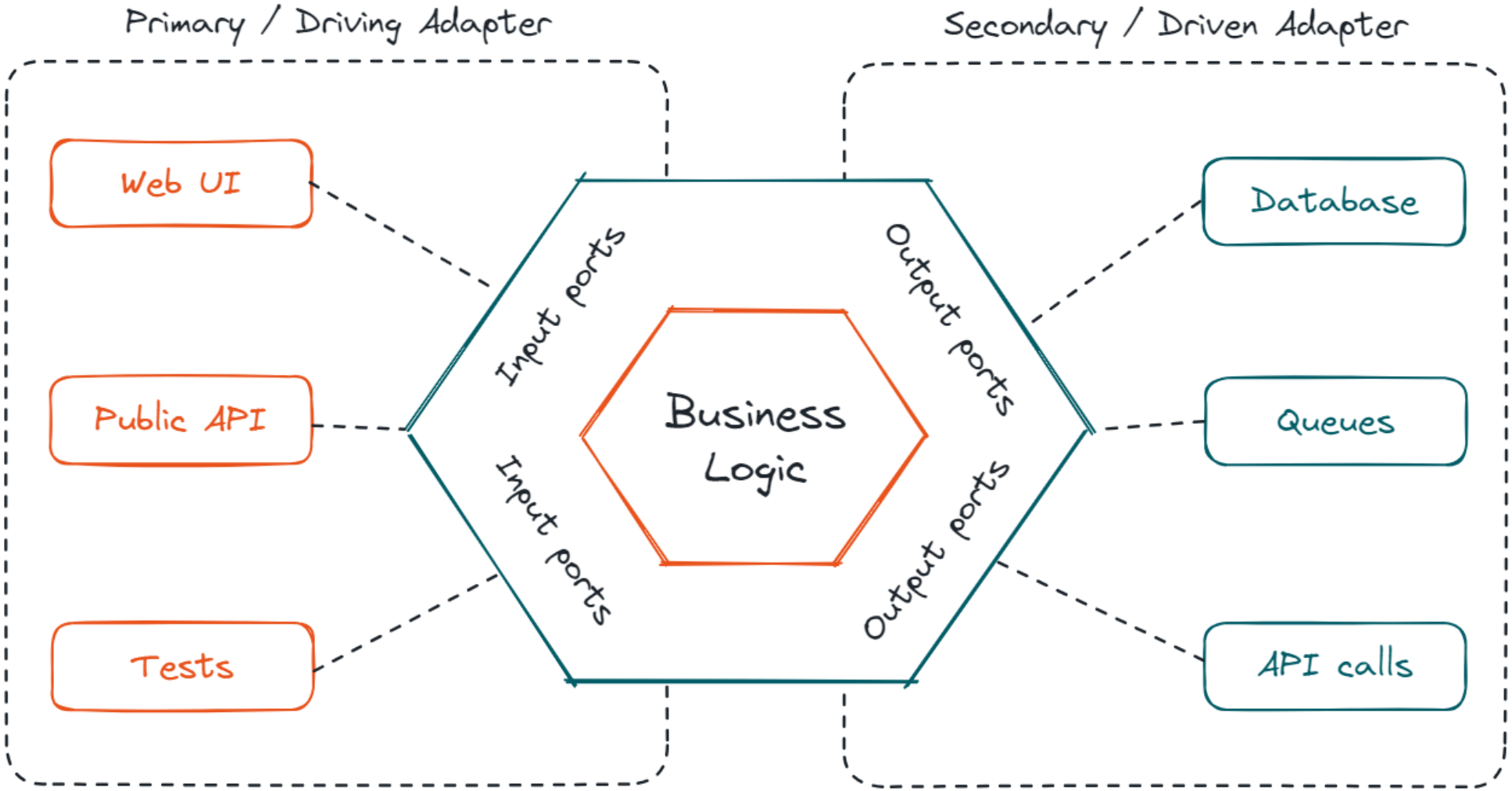
Hexagon architecture / ports & adapters



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Hexagon architecture / ports & adapters

- 2005
- Alistair Cockburn
- Avoids pitfalls in object-oriented software:
  - Undesired dependencies
  - Contaminations of UI with business logic

- Port: integration point for the core application
- Adapter: an implementation/consumer of the port

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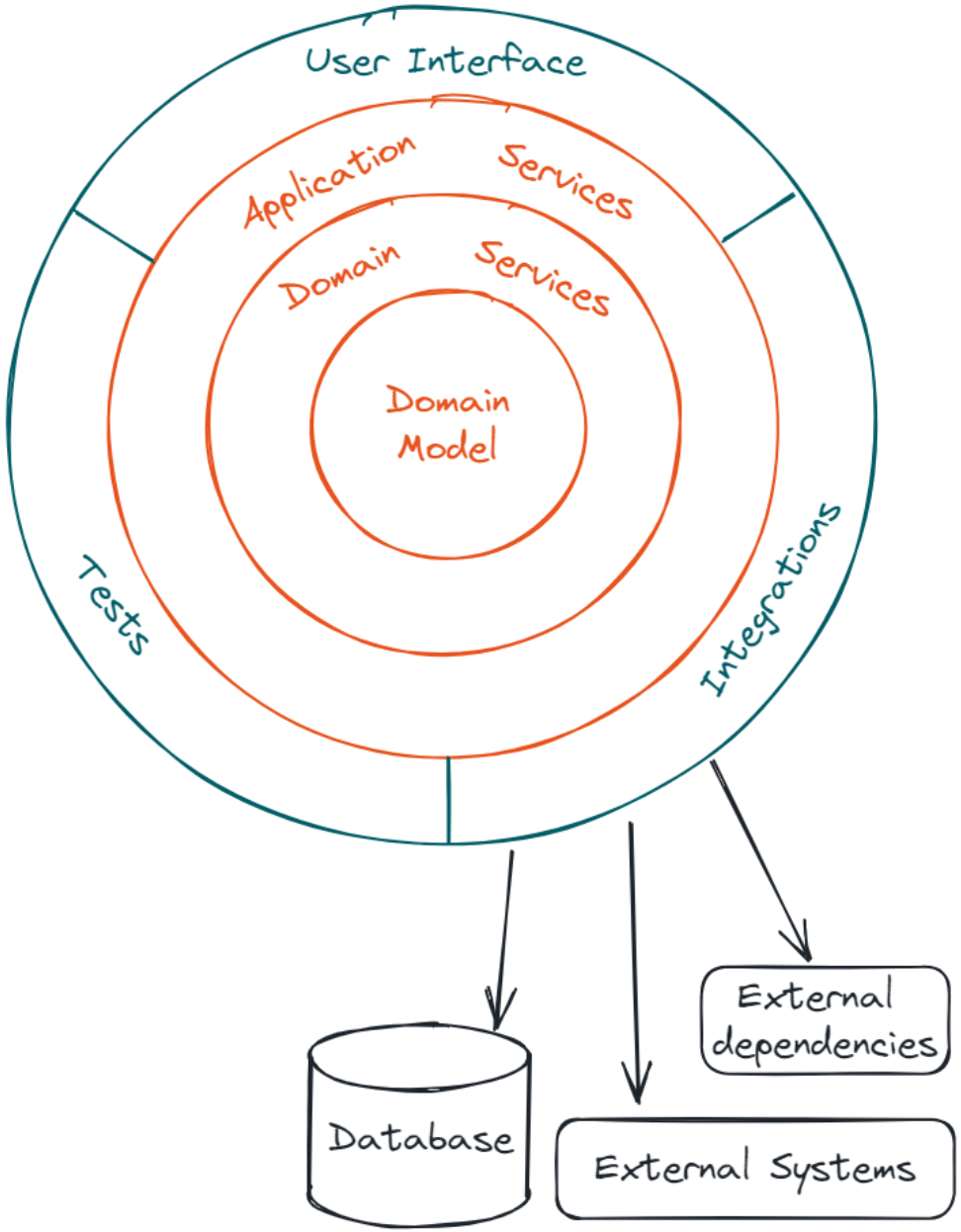

Onion Architecture

- 2008
- Jeffrey Palermo

- Focus on limiting coupling

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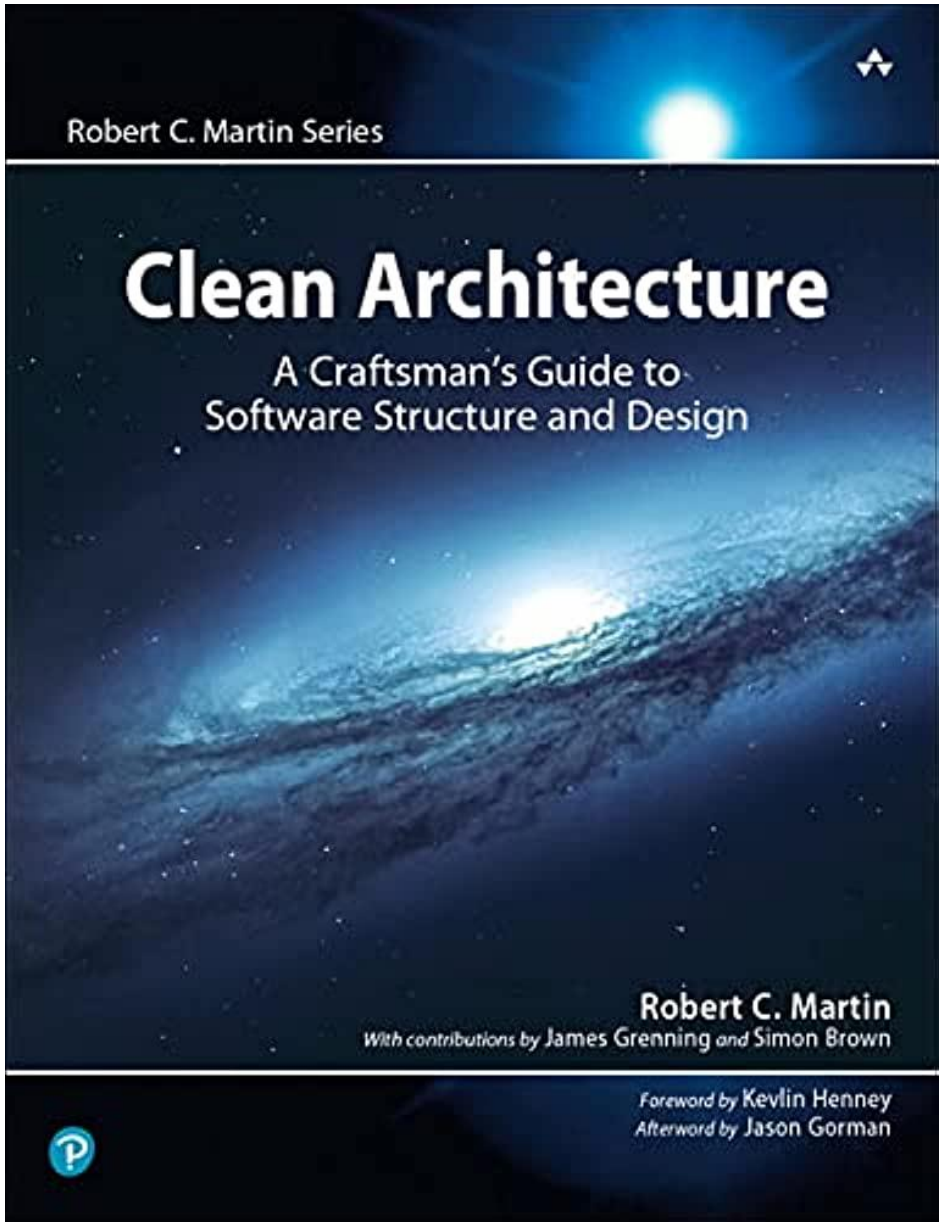
Clean Architecture

- Uncle Bob
- 2017

- All the above



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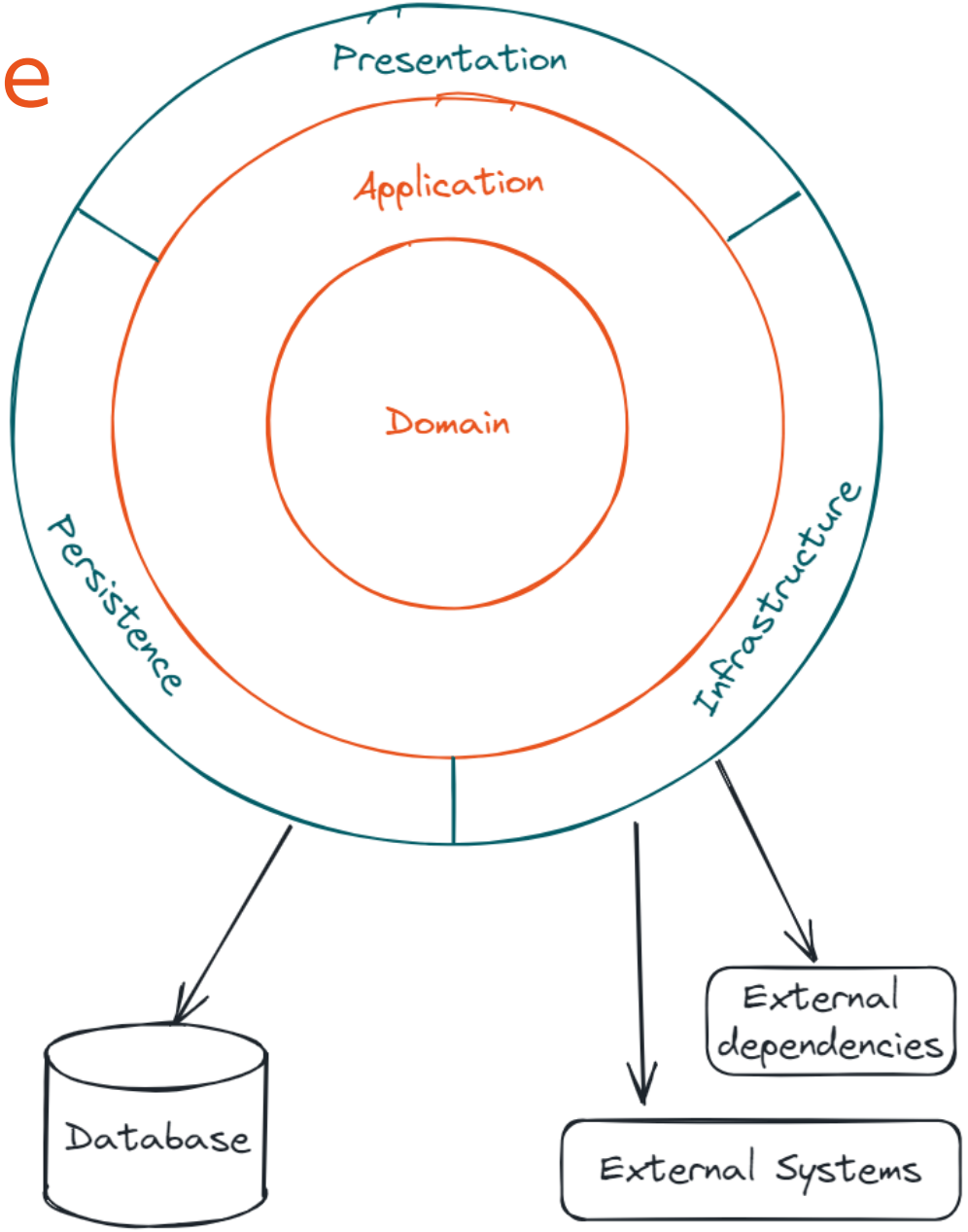
Clean Architecture



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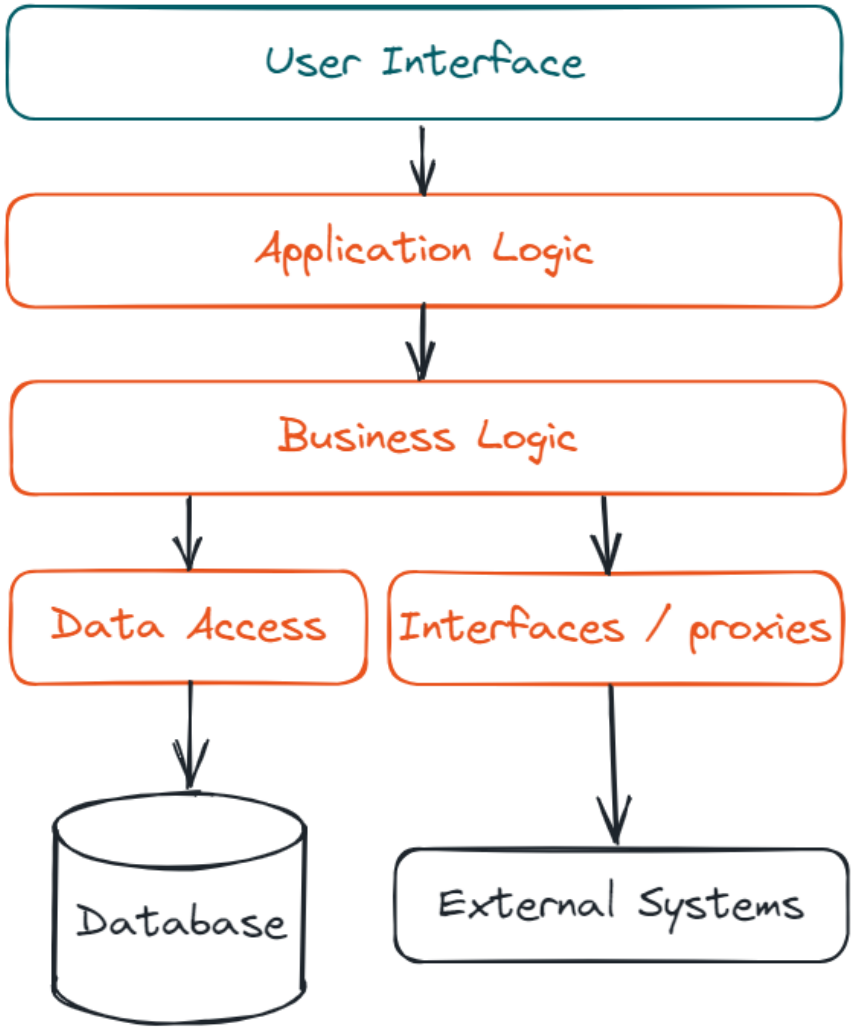
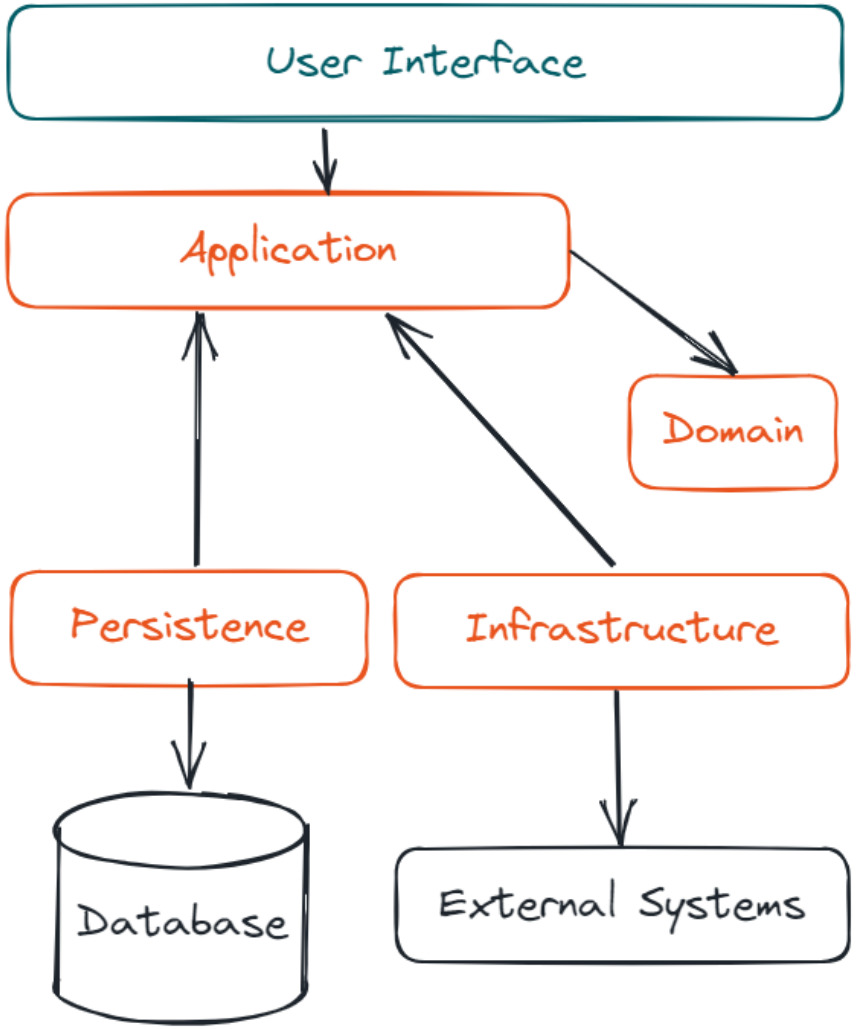
What has changed?





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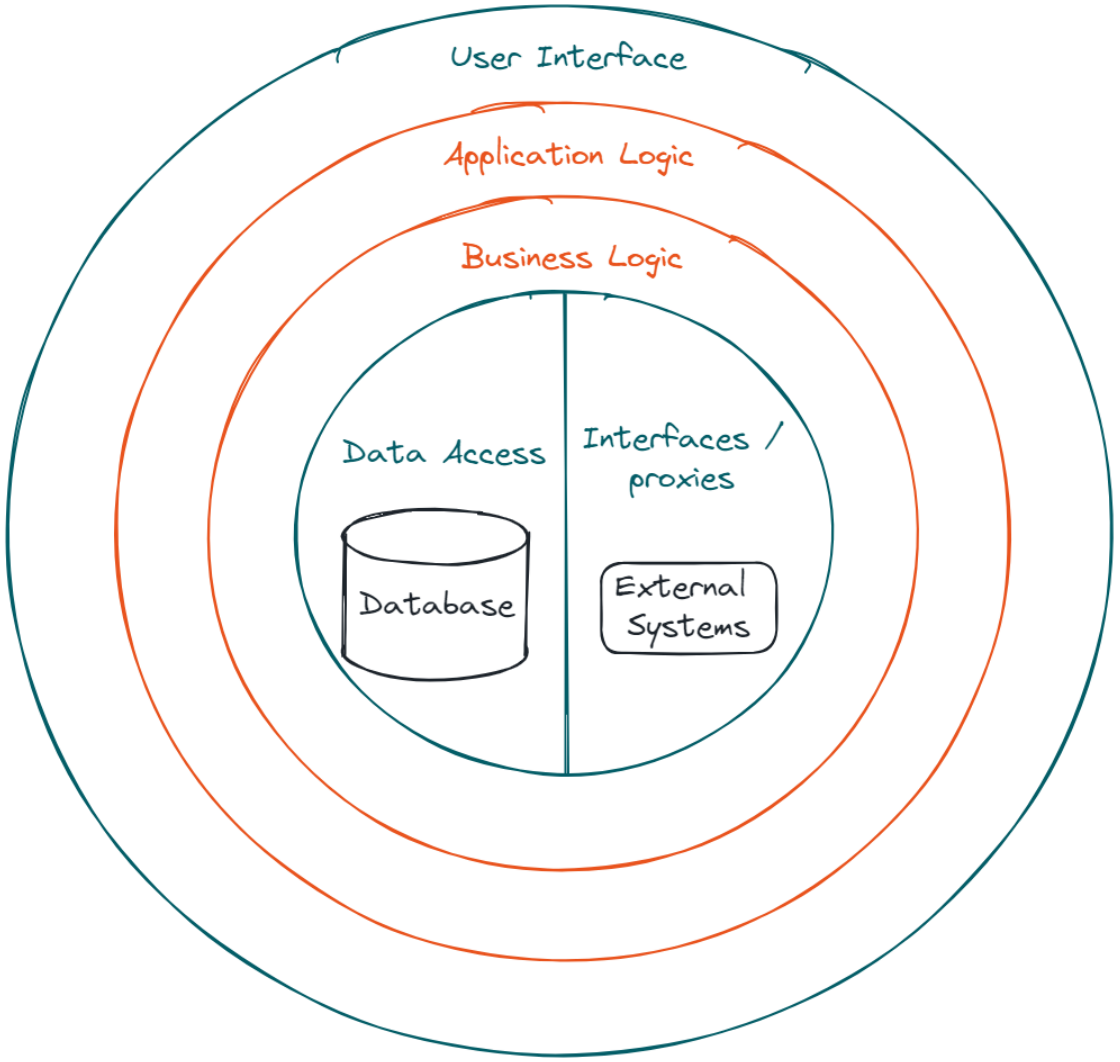
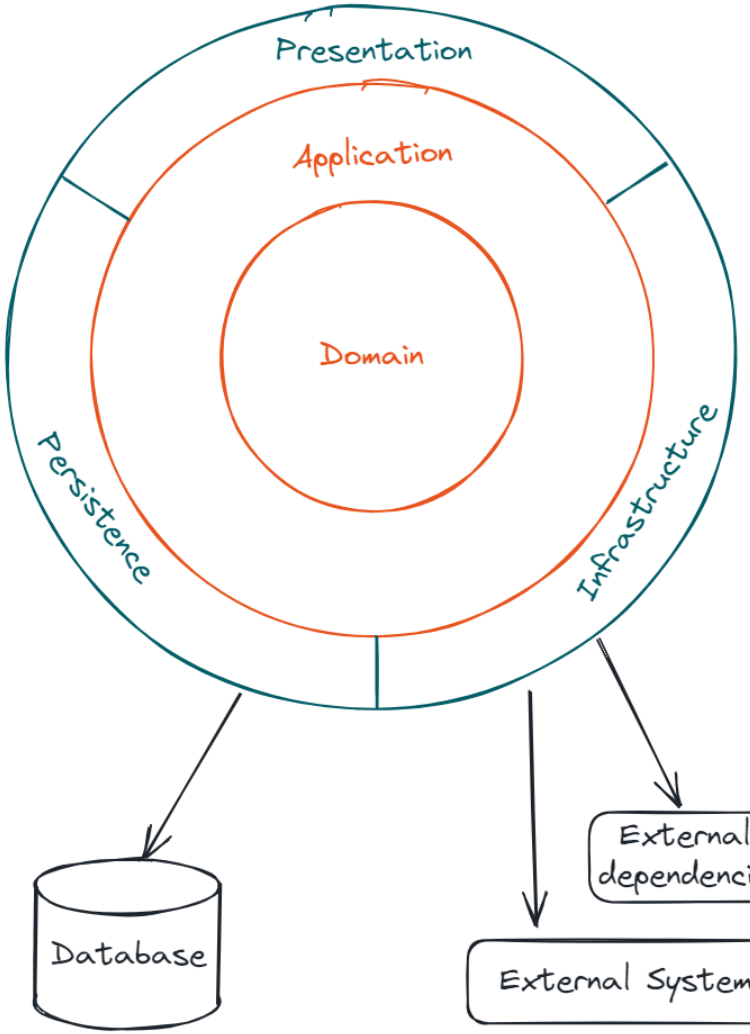
What has changed?





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Domain-centric architecture

- Domain doesn't have dependencies
- Application logic (use cases) depends only on domain
- Implementations & integrations are handled by DI

→Focus on domain & core logic
→Cleaner dependencies
→Allows for evolution with the system's needs

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Structured Dependencies

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vs. Flow of Control

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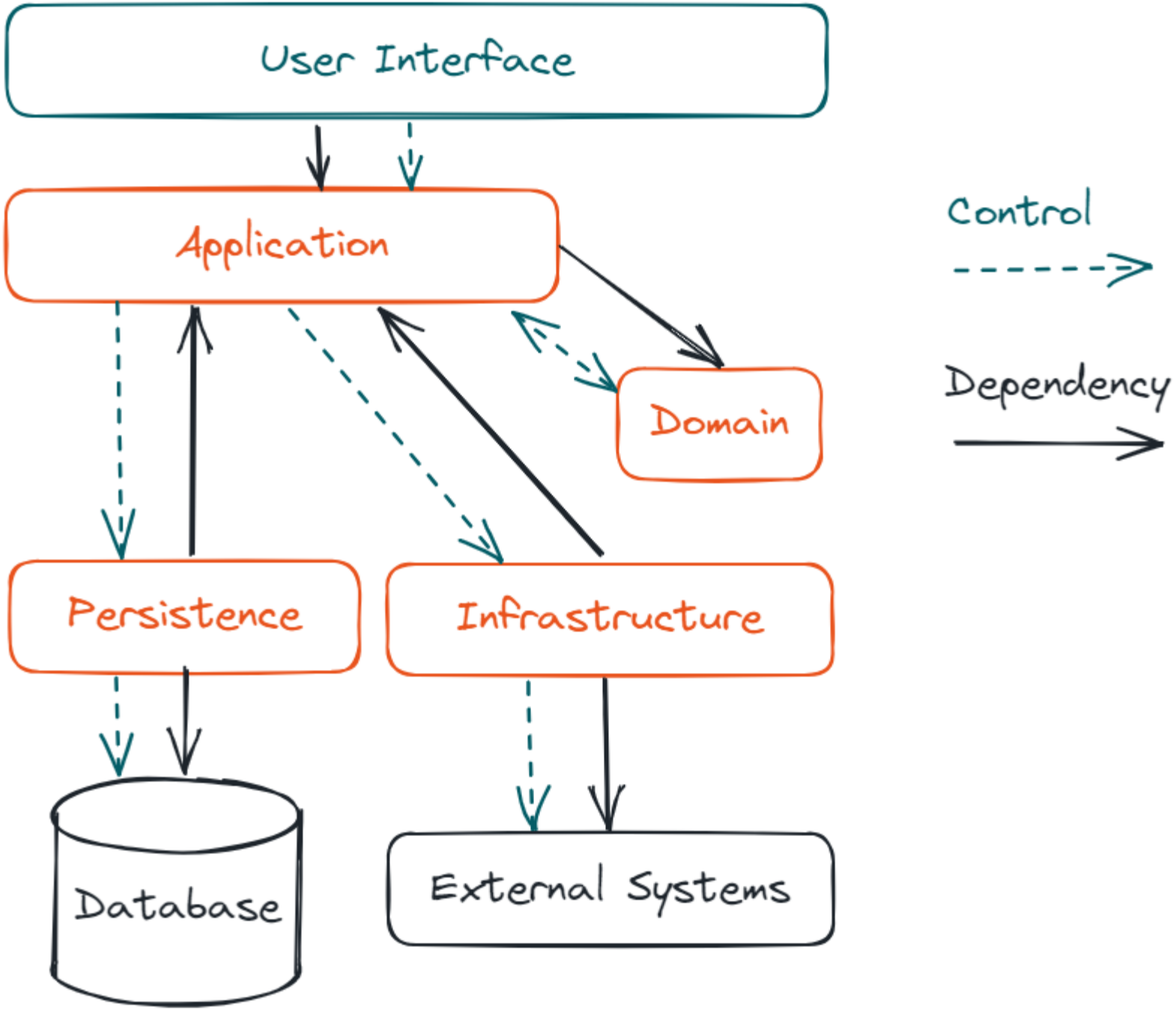
User Interface
Application
Domain
Persistence
Infrastructure
Database
External Systems
Control
Dependency

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Structure the solution

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What parts go where?

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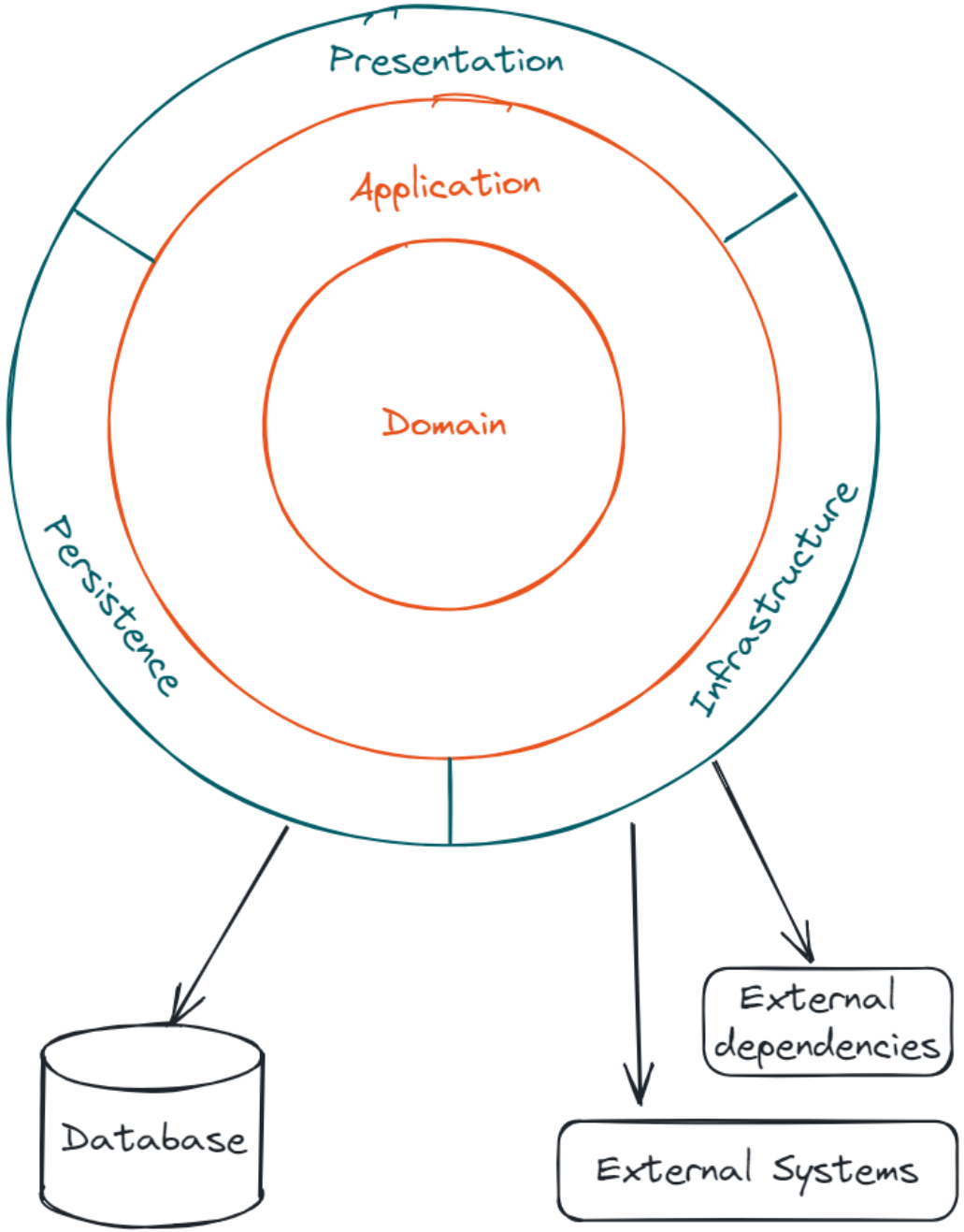

Domain

- Entities
- (Domain Logic):
  - Aggregates
  - Value Types

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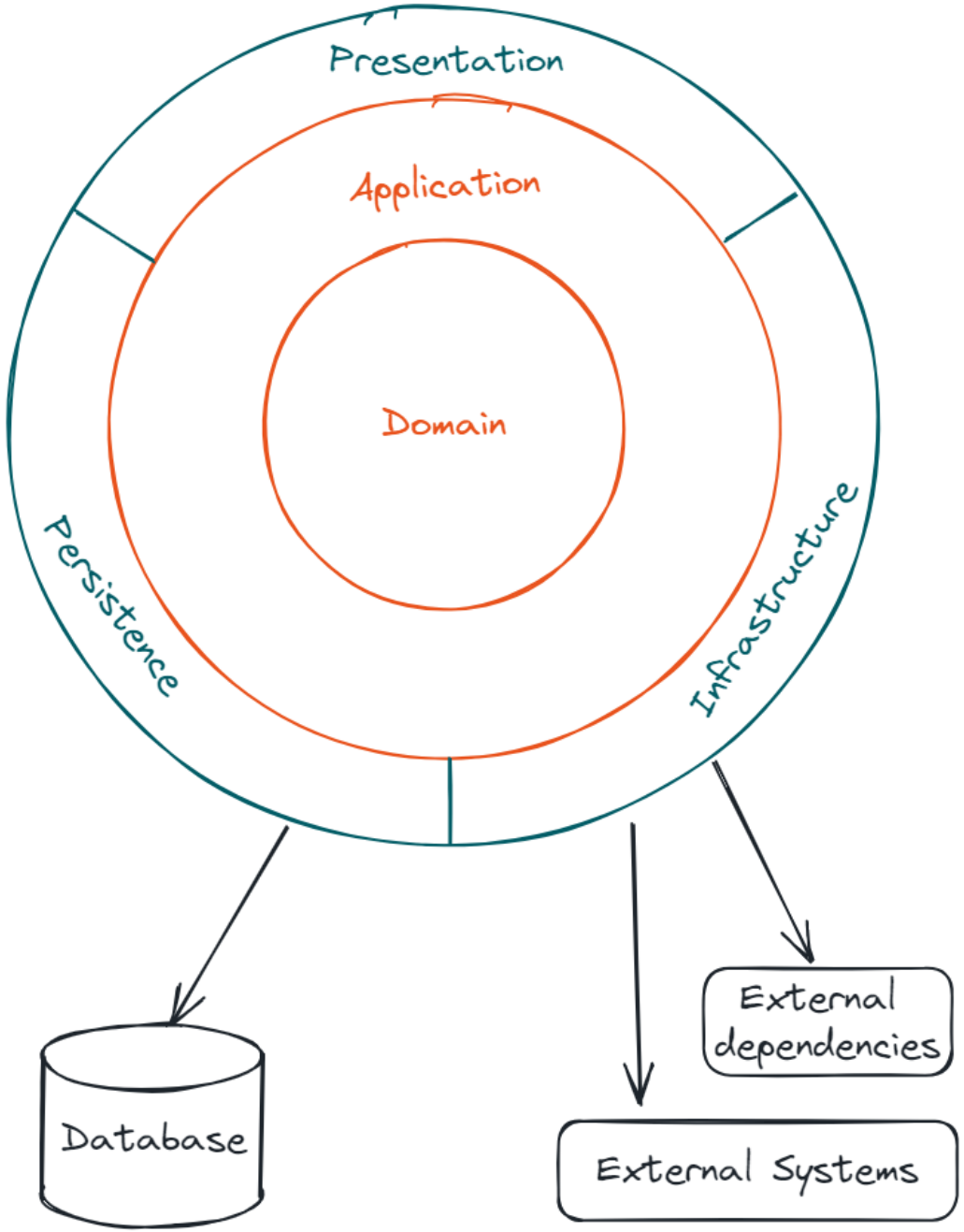

Application

- Use cases (application logic)
- Contracts:
  - Application services
  - Persistence
  - Infrastructure (dependencies & systems)

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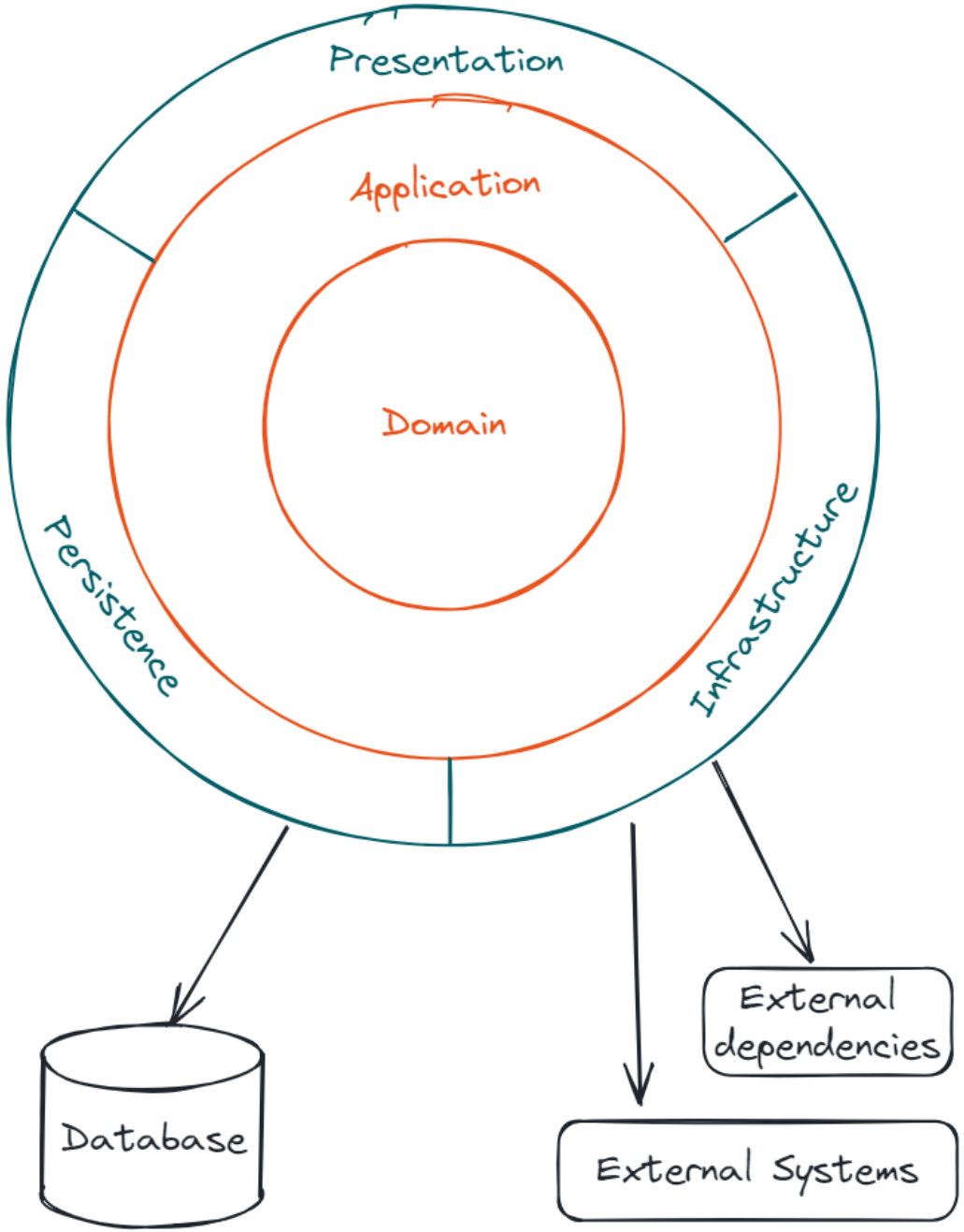

Infrastructure & Persistance

- Persistence implementations (repositories)
- Infrastructure implementations:
  - Service proxies
  - Bus/queue integrations
  - Dependency (package) abstractions
- (DI wiring code)

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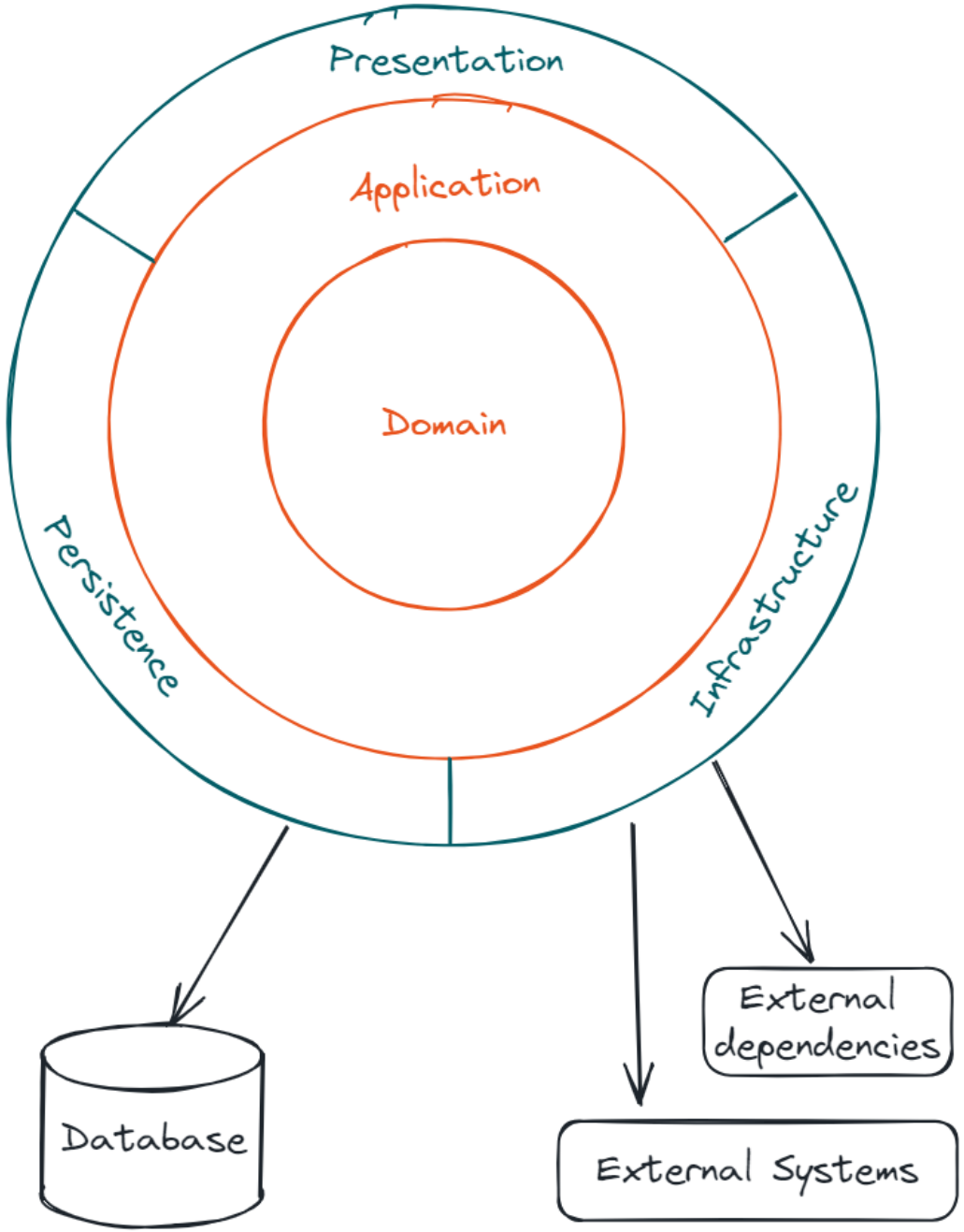

Presentation

Translation between:

- Application
- User Interface
- API contract
- …

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Architectural ideas

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Things we will do throughout

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Screaming architecture

"The architecture should scream the intent of the system"

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Categorical

- Classes by “type” (e.g. controllers)
- Default for many frameworks:
  - Easy for the framework
  - Hard for the developer

Functional

- Classes by “use case”
- Extra effort with many libraries
- Easier to reason about
- Code that works together sits together

After a period of getting used to, it is awesome

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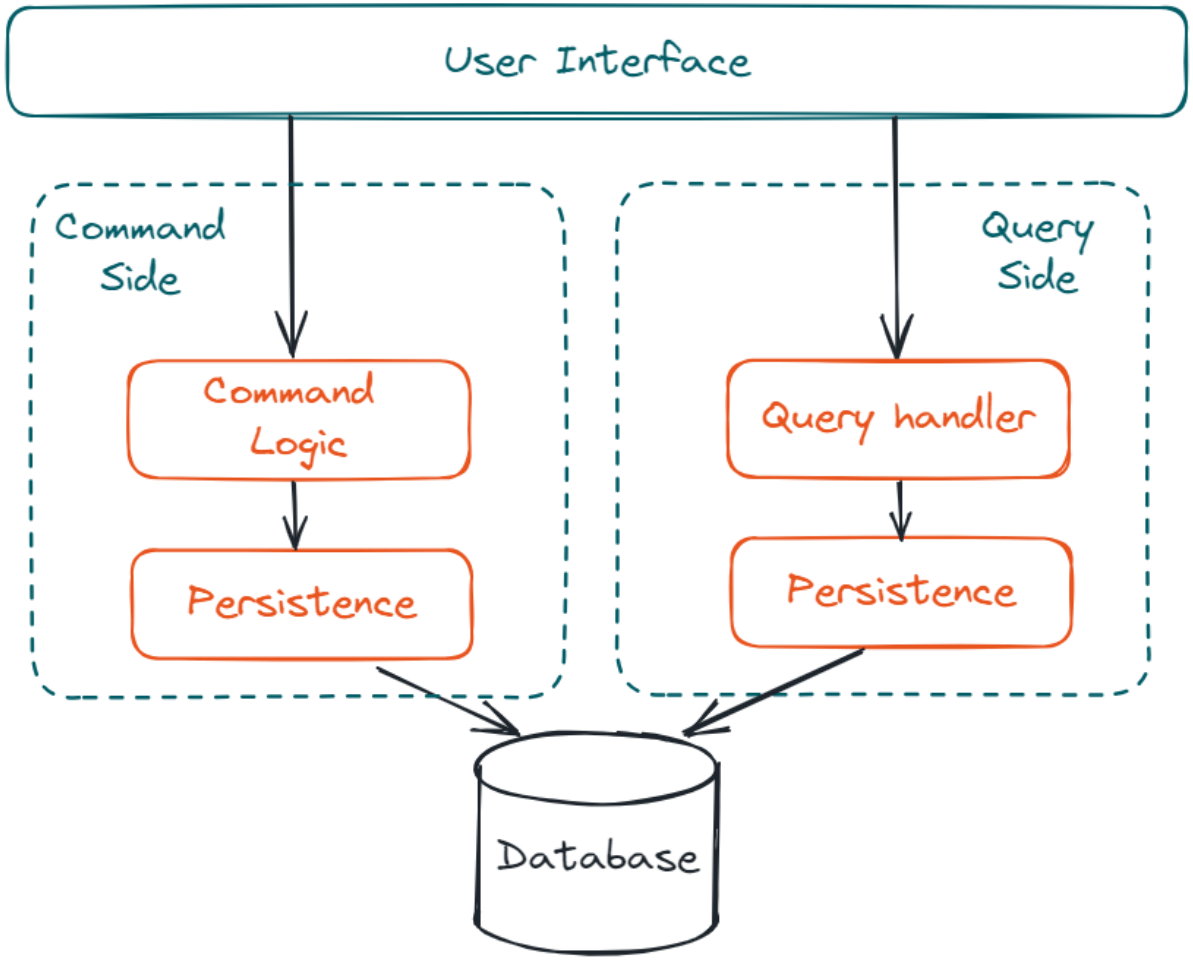
Commands

- Change the state of the system
- Don't return results



Queries

- Return results
- Don't change the state

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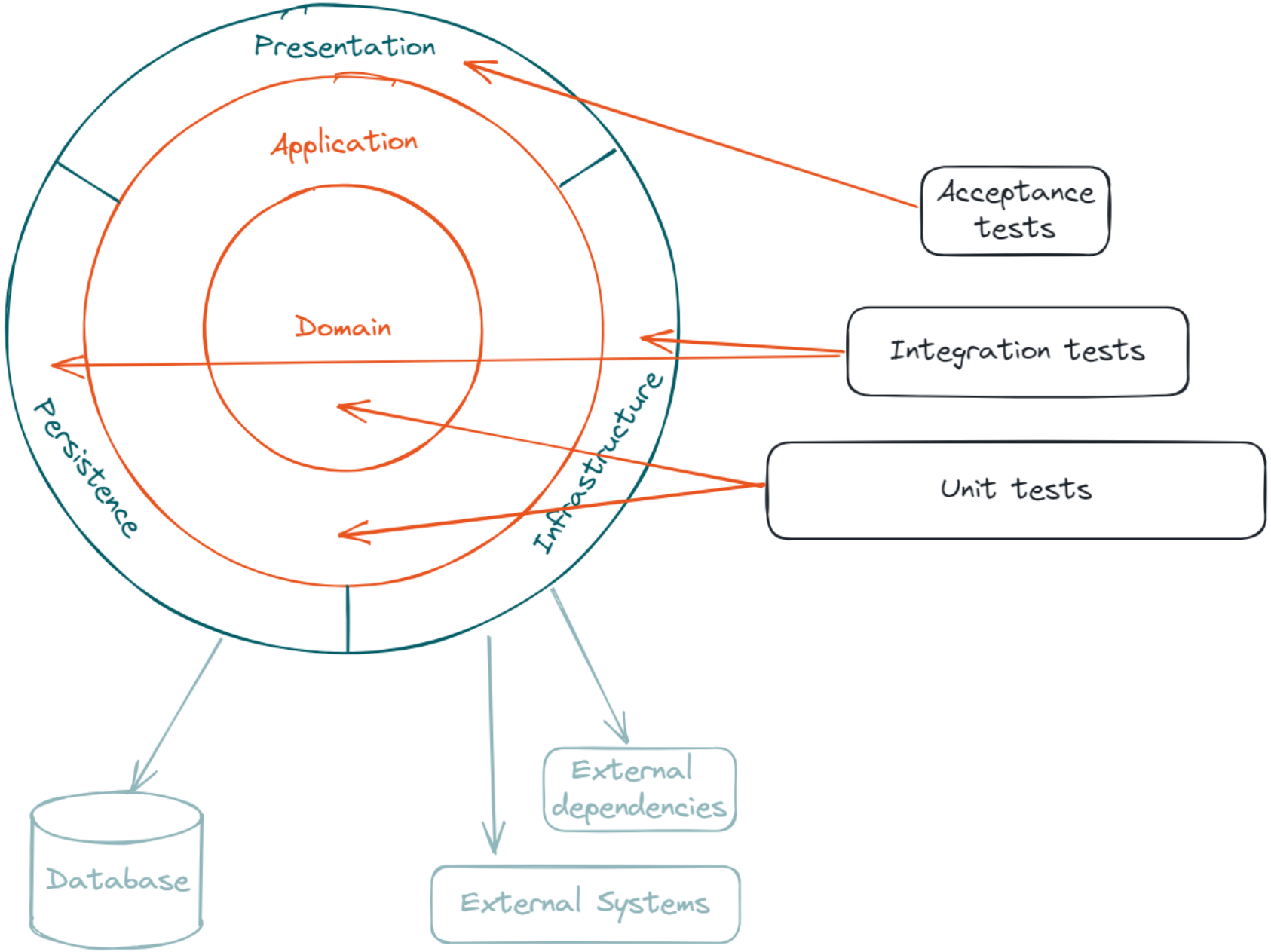
Tests


Presentation
Application
Domain
Persistence
Infrastructure
Acceptance tests
Integration tests
Unit tests
Database
External dependencies
External Systems

Let’s start building!

miro

tinyurl.com/devsum-clean-miro
Password: ***

GitHub

tinyurl.com/devsum-clean-git

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