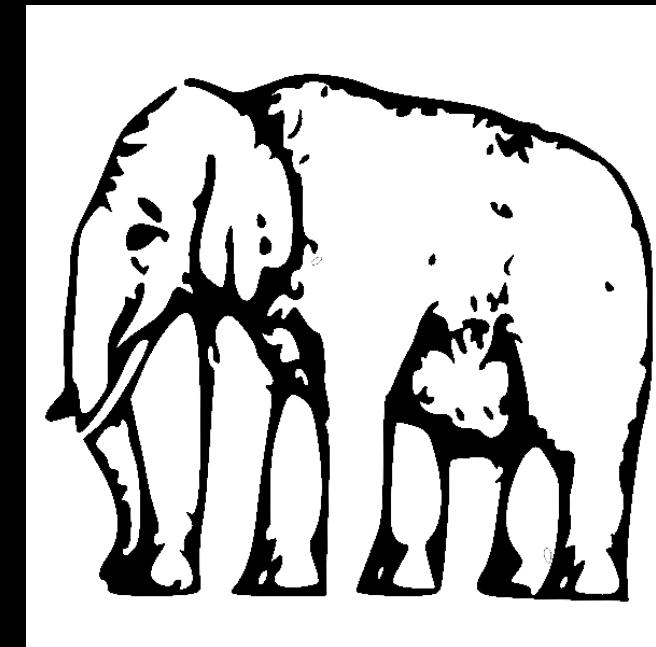


Clean Architecture in production

Lessons learned



@m_mlr

Clean Architecture in production

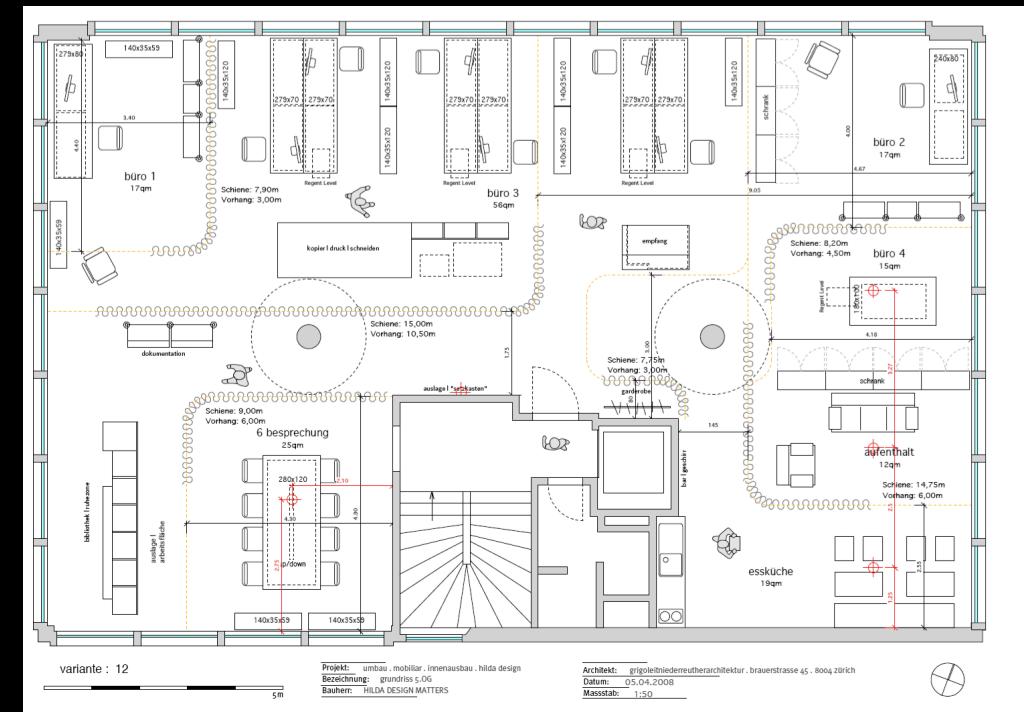
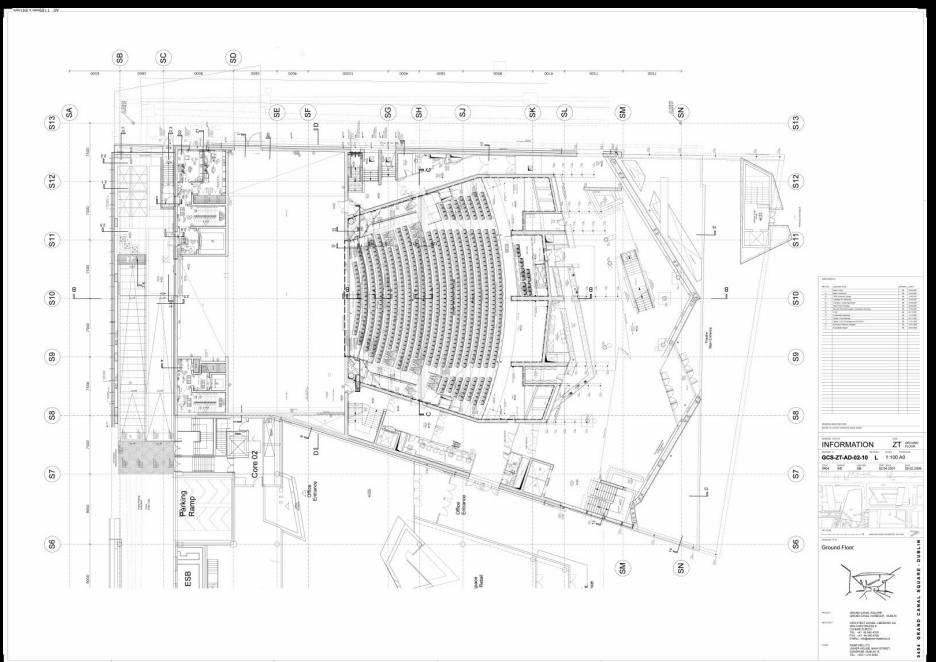
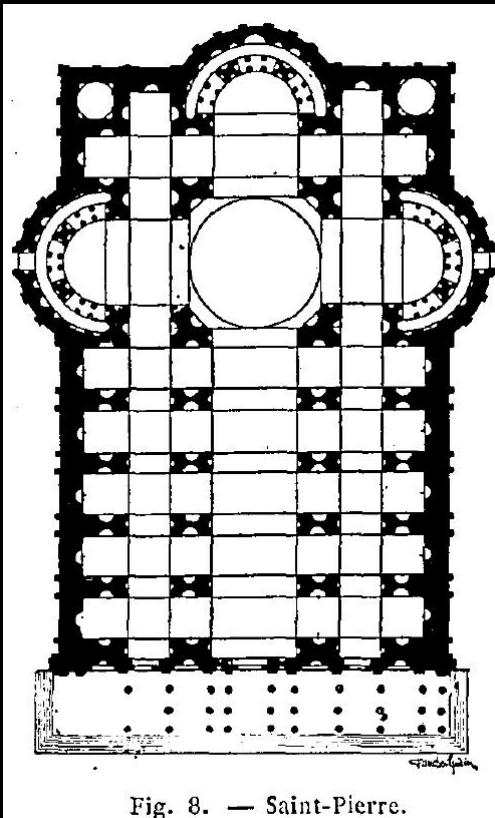
- Clean Architecture?
- Demo anhand einer veröffentlichten App
- Do's
- Don'ts

Rückschau

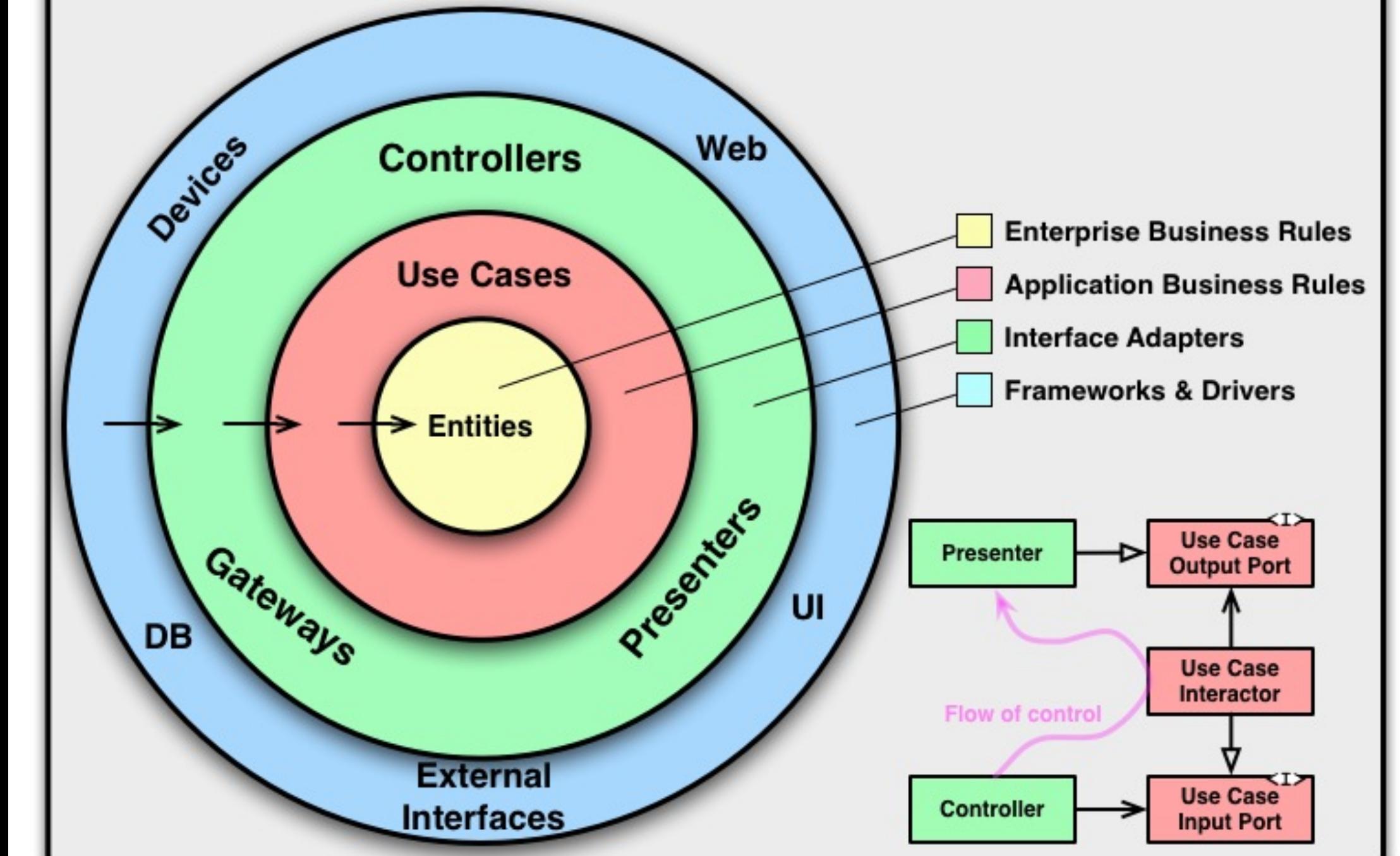
Clean Architecture by Uncle Bob

Clean architecture cocoaheads_le talk von 2014

Screaming intent

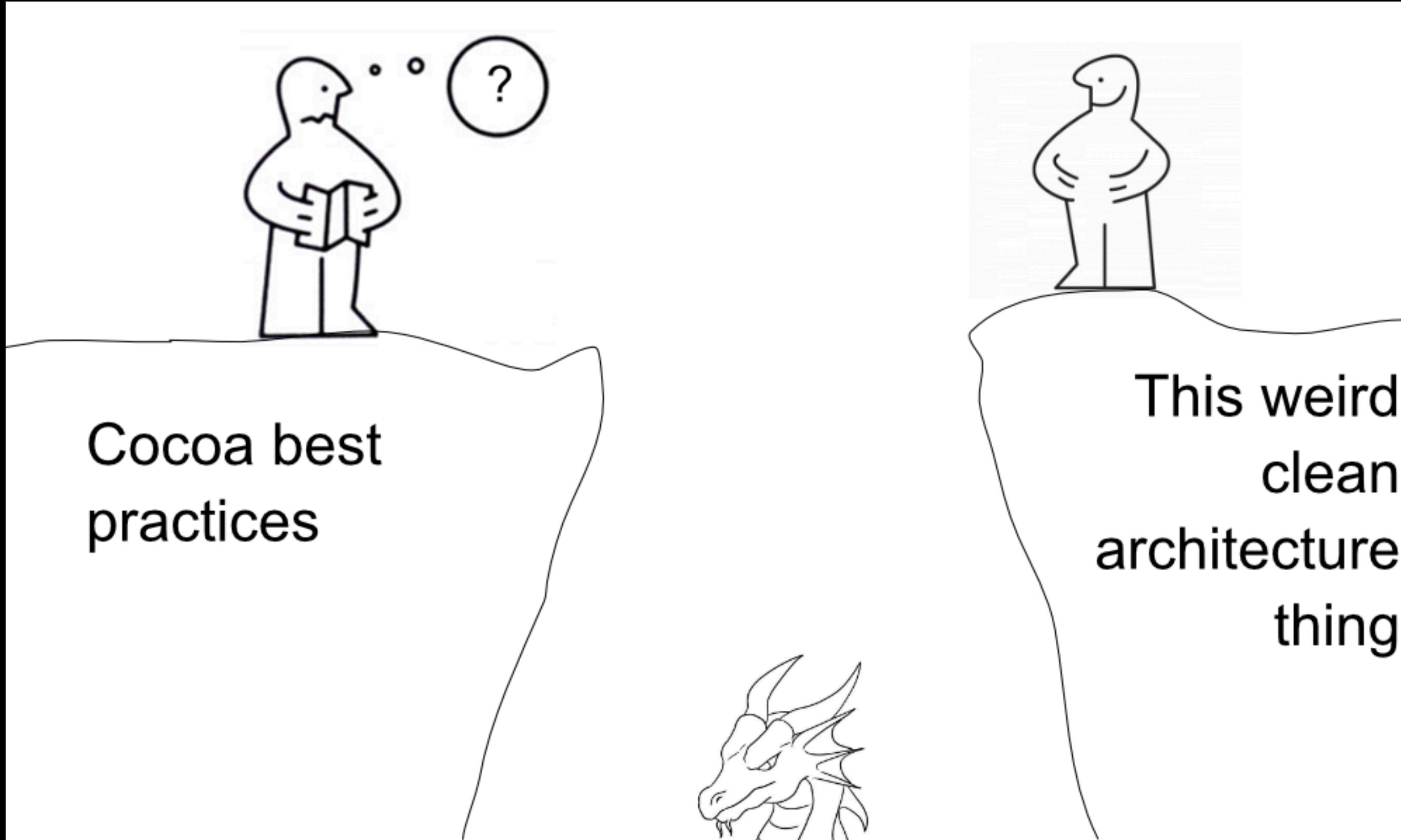


The Clean Architecture



Wozu überhaupt Clean Architecture?

(Hint: **Unabhängigkeit der Geschäftslogik von Frameworks, Datenbanken & UIs, klare Zuständigkeiten, Testing, "saubere" View Controller...**)



Ins Netz geschaut...

Unzählige architecture talks:

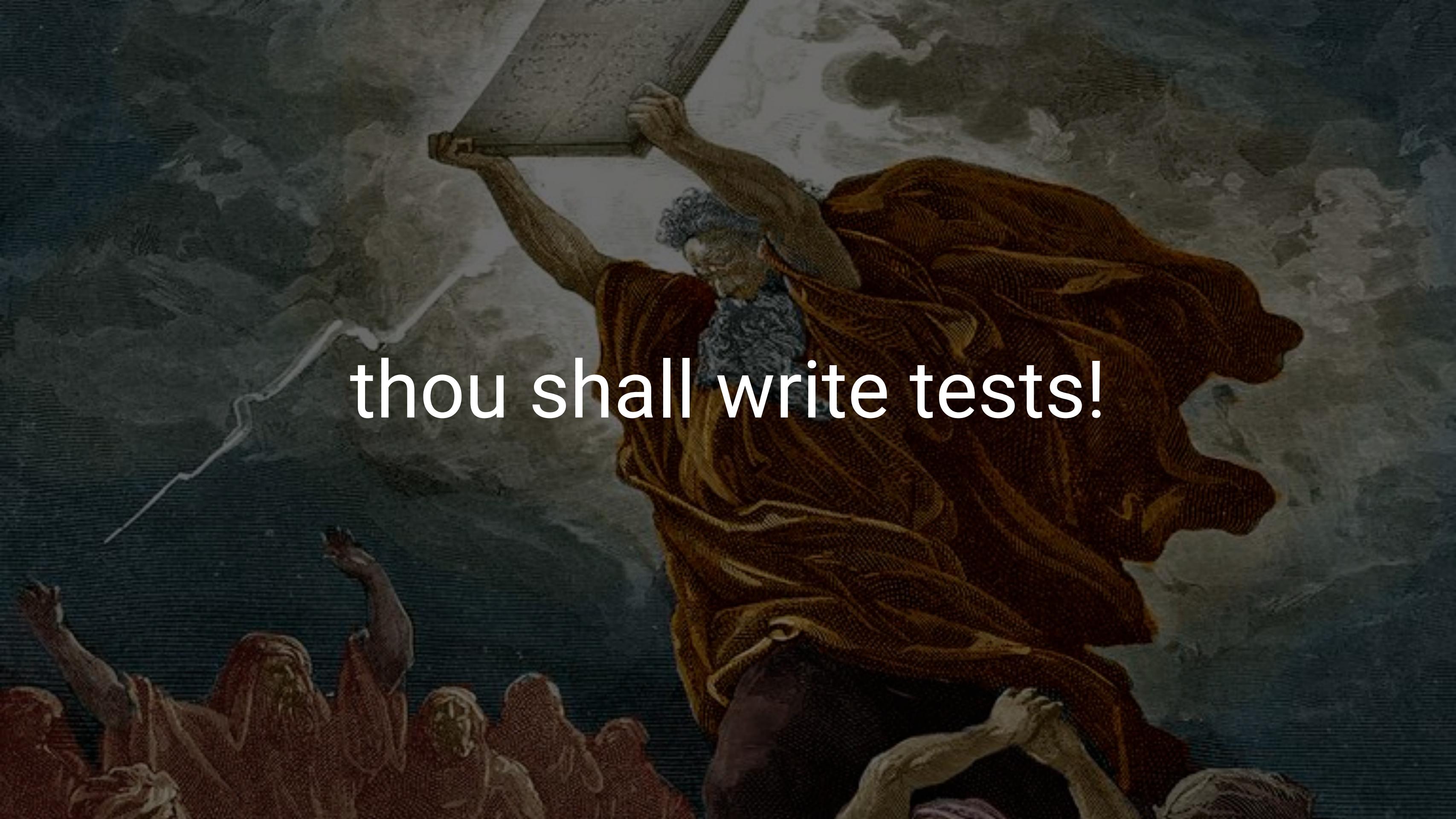
Massive View Controller™

VIP

MANNA

VIP FIR

REACT
-WHATEVER

A dramatic painting depicting a giant, brown, coiled snake. A person's arm is visible, holding a sword that is embedded into the snake's neck. The snake's body is wrapped around the person's arm. The background is dark and smoky.

thou shall write tests!



Fake Twitter Clients & To-Do-List Examples schön und gut, aber...

"Der Unterschied zwischen Theorie
und Praxis ist in der Praxis weit
höher als in der Theorie."

– *Ernst Ferstl*



Johann Sebastian
Bach (1685-1750)



Demo

Bach Kantaten Referenz App

- Clean Architecture (VIPER inspiriert)
- Test driven entwickelt (> 2.500 unit tests)
- Cocoa MVC in der View-Schicht
- isolierter Anwendungskern (iOS/Mac agnostisch)

Bach Kantaten Referenz App

- native iOS Komponenten (AutoLayout, CoreData, Spotlight, Today-Widget, On-Demand-Resources, Dynamic Type, UICollectionView-/UITableView basiertes UI)
- schmerzfreie Releases (mittlerweile 7 major feature updates)
- Objective-C

Don`t take my word...

Excellent reference app for Bach cantatas ★★★★★

This is an invaluable resource for anyone interested in Bach's cantatas. Beautifully designed, the app is easy to use and comprehensive in its detail.

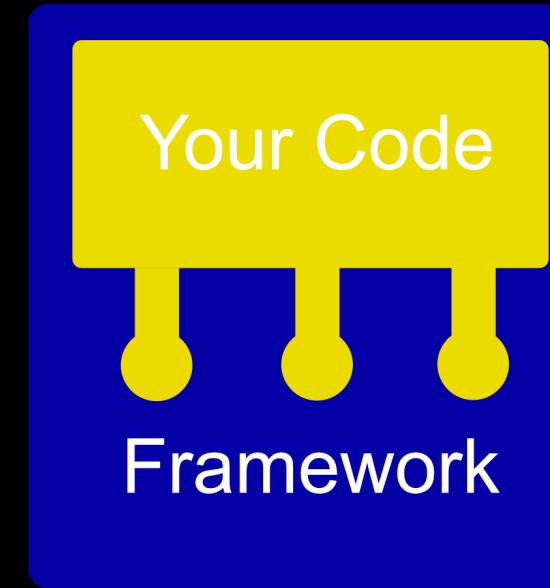
Sehr gut gemacht! ★★★★★

Bachs Kantatenwerk erschließt sich durch diese App auf vielfältige Weise. Eine fantastische Quelle! Ich bin immer wieder aufs Neue begeistert! Ich kenne nichts Vergleichbares.

Very helpful. The "Duerr" for on-the-road ★★★★★

Great App for Bach lovers and professional musicians. Worth the investment.

Frameworks & Libraries



When using a framework, the framework is in charge of running the system. It defines some extensibility points (interfaces) where you need to put your implementation.¹

– Tomas Petricek

¹ <http://tomaspetricek.com/2015/library-frameworks/>

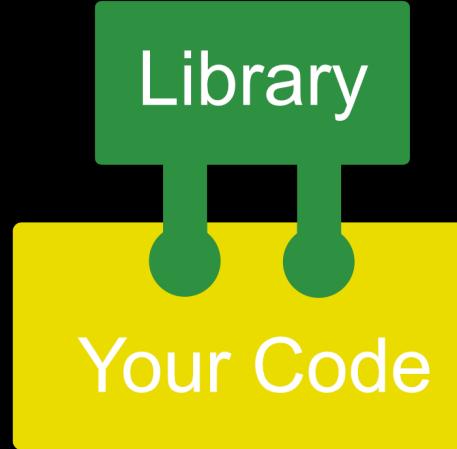


MEDUSA LEMIEUX

WWW.KILLERBRUSH.COM

Frameworks are tools, not ways of
life

– *Uncle Bob*



When using a library, you are in charge of running the system. The library defines some points through which you can access it (functions and types) and your code can call it as it needs.¹

– Tomas Petricek

¹ <http://tomaspetricek.com/2015/library-frameworks/>

Yes, but what about...

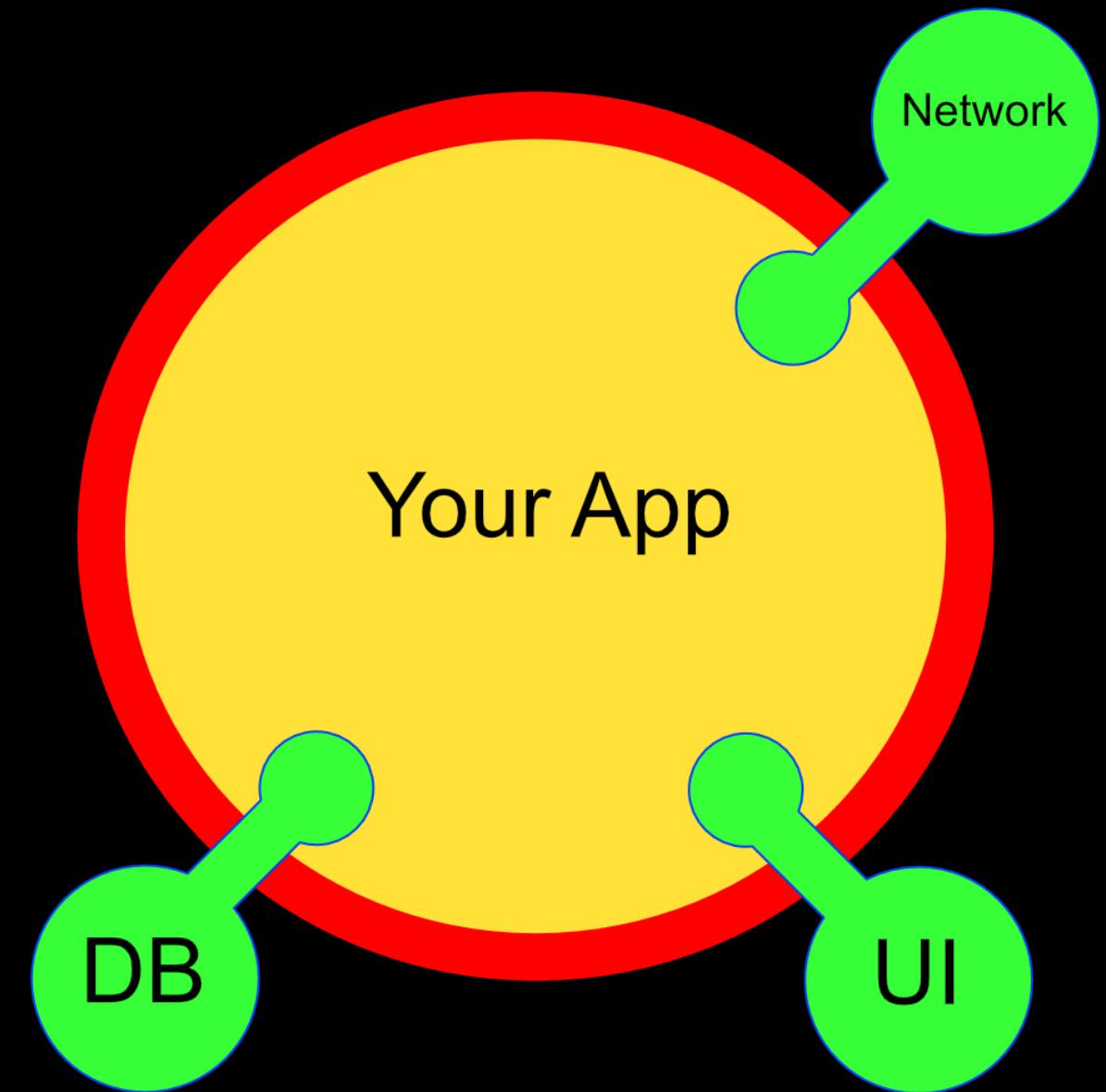
...do not fight the framework!

– *meine innere Stimme*

Make use of the framework but
don't marry it!

– *Uncle Bob*

Frameworks as libraries



VIPER



There are two hard things in
computer science: cache
invalidation, naming things, and off-
by-one errors.

– Phil Karlton



- Clean architecture ist letztlich bloß ein Name für bewährte Softwareentwicklungs-Methodik (Composition, Delegation, SRP, DIP, DRY etc)
- keine den Cocoa best practices zuwider laufende Technik

Use cases

Carrier 2:13 PM

< Cantata title 1 of 259

Ach Gott, vom Himmel sieh darein

BWV 2

Designation 2nd Sunday after Trinity

1st performance Sunday, June 18, 1724 - Leipzig

Vocal Soloists Alto, Tenor, Basso, Choir

Orchestra 4 Trombones, 2 Oboes, 2 Violins, Viola, Continuo

Text Martin Luther (1, 4, 6), Anonymous (2-3, 5)

Chorale Ach Gott vom Himmel, sieh darein Verse 1 (1), Verse 4 (4), Verse 6 (6)

Next performance Sunday, June 10, 2018
in liturgical year

Movements Reading Chorals Scores

1.Choral (Choir) More

Ach Gott, vom Himmel sieh darein

4 Trombones, 2 Oboes, 2 Violins, Viola, Continuo

2.Recitativo (Tenor) More

Sie lehren eitel falsche List

Continuo

3.Aria (Alto) More

Tilg, o Gott, die Lehren

Violin, Continuo

4 Recitativo Chorale (Bassoon) More

Cantatas Search Chorals Bible More

@protocol InspectCantataInterface <NSObject>

- (void)inspectCantata:(NSString*)identifier;
- (void)inspectNext;
- (void)inspectPrevious;
- (void)noSelection;
- (void)handleURL:(NSURL *)url fromRect:(CGRect)rect;

@end

use case

2, 3 & 4
use cases

use case

Movement search

Movement types

- Arioso
- Recitatives
- Choirs
- Chorals

Instrumentation

[Add](#)

- Oboe
- Violin



Optional instruments

[More](#)

- Soprano, Alto, Tenor & Basso
- Choir
- Orchestra
- Continuo

[Perform search](#)[Reset search criterias](#)

Cantatas



Search



Chorals



Bible



More

```
@protocol EditMovementCatalogItemInterface <NSObject>
```

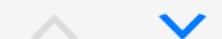
- (void)selectMovementTypeAtIndex:(NSUInteger)theIndex;
- (void)toggleRequiredInstrumentations;
- (void)selectRequiredInstrumentationAtIndex:(NSUInteger)theIndex;
- (void)increaseRequiredInstrumentCountAtIndex:(NSUInteger)theIndex;
- (void)decreaseRequiredInstrumentCountAtIndex:(NSUInteger)theIndex;
- (void)toggleAvailableInstruments;
- (void)selectOptionalInstrumentAtIndex:(NSUInteger)theIndex;
- (void)performSearch;
- (void)reset;

```
@end
```

Use case

[Back](#)

Chapter 1 of 24



Luke 1: 1-80

[Close](#)

1	2	3	4	5	6
●	●			●	
7	8	9	10	11	12
			●		
13	14	15	16	17	18
	●			●	●
19	20	21	22	23	24
				●	●

Used in

[BWV 10](#), [BWV 243](#), [BWV 243a](#)

(1) Forasmuch as many have taken in hand to set forth in order a declaration of those things which are most surely believed among us, (2) Even as they delivered them unto us, which from the beginning were eyewitnesses, and ministers of the word; (3) It seemed good to me also, having had perfect understanding of all things from the very first, to write unto thee in order, most excellent Theophilus, (4) That thou mightest know the certainty of those

```
@protocol InspectBiblicalBookInterface <NSObject, NavigatableList>
```

- (void)inspectBiblicalBook:(BiblicalBook)book;
- (void)toggleAvailableChapters;
- (void)selectChapterAtIndex:(NSUInteger)selectedIndex;
- (void)handleURL:(NSURL *)url fromRect:(CGRect)rect;

```
@end
```

use case



Cantatas



Search



Chorals



Bible



More

VIPER

view

- UI/NSViewController
- klassisches MVC mit "dummen" View-Models
- Cocoa Views
- Humble Object

VIPER

interactor

- eigentlicher use case, welcher die Geschäftlogik umsetzt
- isolierter Kern der App
- arbeitet mit den Entities

Presenter

- Kümmert sich um alle mit View-Models verbundene Aufgaben (Erzeugung, Umrechnung von NSIndexPath etc, Lokalization)
- Formatierung von Listen, Text und Datum etc.
- NSFomatter/NSValueTransformer

VIPER

Entities

- anwendungsübergreifende Geschäftslogik
- wird einzig von Interaktoren verwendet
- nicht zu verwechseln mit CoreData- oder ORM-Entities

VIPER

Router

- implementiert das jeweilige Modulinterface
- dirigiert den control flow eines use cases zw. Interactor, View, Presenter
- löst auch UI Änderungen aus wie etwa Navigation zum nächsten Screen

...one more thing!

Wireframe

```
@protocol Wireframe <NSObject>
```

```
- (UIViewController*)instantiateViewController;
```

```
@end
```

- fasst alle für einen use case benötigten Objekte zusammen
- instanziert und verwaltet die Viewcontroller

Zusammenfassung

- eigener App code ohne Abhängigkeit zu Framework-Details
- Tell, don't ask!
- klare Zuständigkeiten
- Kommunikation über definierte Boundaries mittels value objects

"Protocol oriented programming"

– *hip phrase of the week*

a.k.a. Dependency inversion principle:

„Abstraktionen sollten nicht von Details abhängen. Details sollten von Abstraktionen abhängen.“

– *SOLID principles*

Show me the code!

Boundaries

The UI is a delivery mechanism and the database is a detail.

– Uncle Bob Martin

How to draw an owl

1.



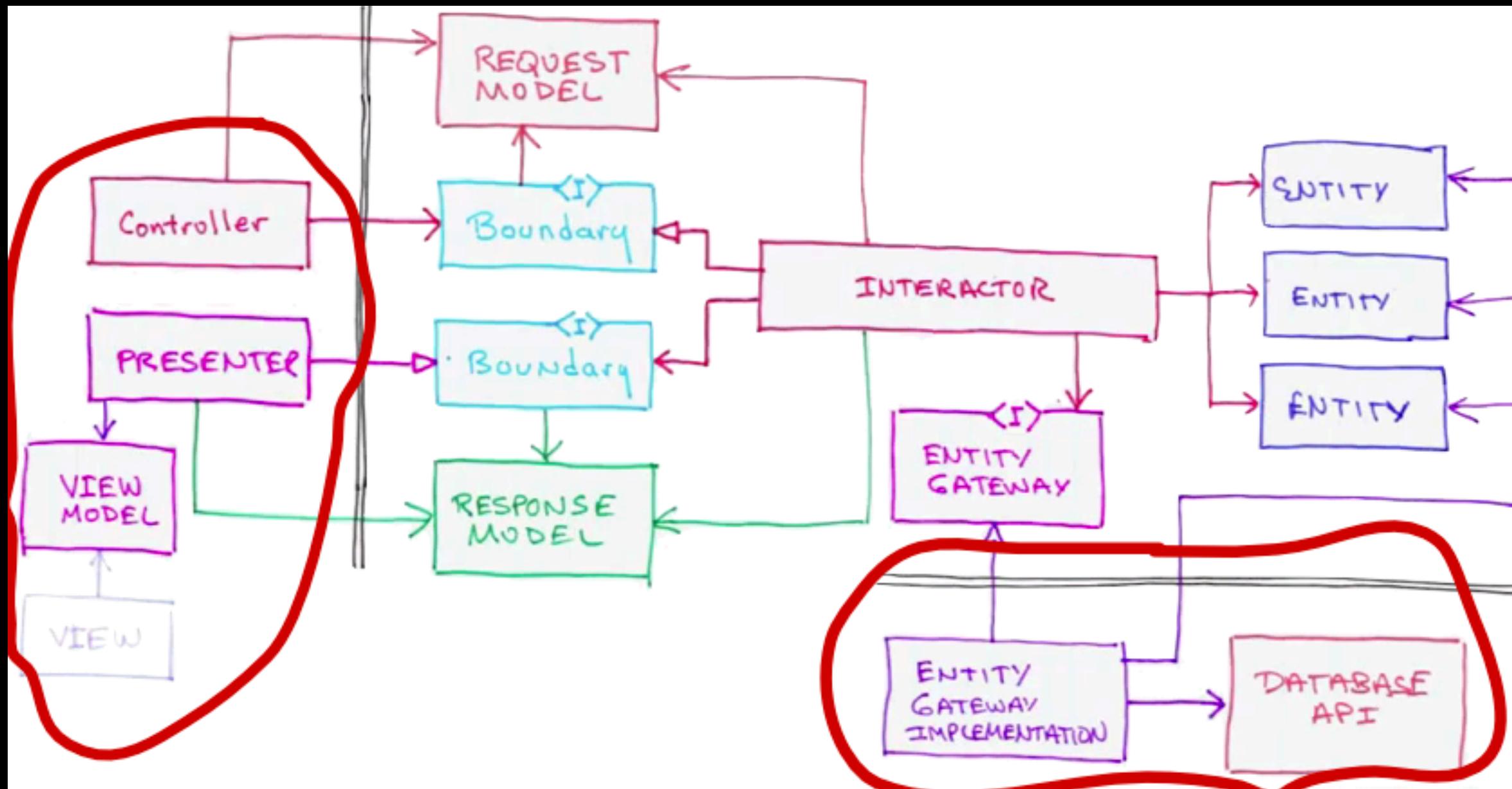
2.



1. Draw some circles

2. Draw the rest of the fucking owl

The rest of the fucking owl



Viewmodels

- "Endprodukt" eines use case
- Anfangspunkt für einen ViewController
- simple data structures ohne Verhalten
- M in **MVC**
- **value semantics**

```
@protocol MKMTextualContentItem <NSObject>

@property (nonatomic, copy, readonly) NSString *primaryContent;
@property (nonatomic, copy, readonly) NSString *secondaryContent;
@property (nonatomic, copy, readonly) NSString *primarySupplementalContent;
@property (nonatomic, copy, readonly) NSString *secondarySupplementalContent;

@end
```

```
@protocol MKMSectionInfo <NSObject>

@property (nonatomic, readonly, copy) NSString *identifier;
@property (nonatomic, readonly, copy) NSArray *items;
```

```
@end
```

```
@protocol MKMSectionedListViewModel <NSObject>
```

```
@property (nonatomic, readonly, copy) NSString *identifier;
@property (nonatomic, readonly, copy) NSArray<id<MKMSectionInfo>> *sections;
```

```
@end
```

```
@interface MKMItemViewModel : NSObject <MKMTextualContentItem>
@end
```

```
@interface MovementViewModel : MKMItemViewModel
```

```
@property(nonatomic, copy, readonly) NSAttributedString *originalParodyContent;
```

```
@end
```

Klassischer UITableView/UICollectionView Aufbau



```
@protocol CantatasListView <NSObject>
```

- (void)updateCantatasList:(id<MKMSectionedListViewModel>)viewModel;
- (void)showNoContentPlaceholder:(id<MKMTextualContentItem>)viewModel;

```
@end
```

Carrier 2:13 PM

< Cantata title 1 of 259

Ach Gott, vom Himmel sieh darein

BWV 2

Designation 2nd Sunday after Trinity

1st performance Sunday, June 18, 1724 - Leipzig

Vocal Soloists Alto, Tenor, Basso, Choir

Orchestra 4 Trombones, 2 Oboes, 2 Violins, Viola, Continuo

Text Martin Luther (1, 4, 6), Anonymous (2-3, 5)

Chorale [Ach Gott vom Himmel, sieh darein](#) Verse 1 (1), Verse 4 (4), Verse 6 (6)

Next performance Sunday, June 10, 2018
in liturgical year

Movements [Reading](#) [Chorale](#) [Scores](#)

1.Choral (Choir) [More](#)
Ach Gott, vom Himmel sieh darein
4 Trombones, 2 Oboes, 2 Violins, Viola, Continuo

2.Recitativo (Tenor) [More](#)
Sie lehren eitel falsche List
Continuo

3.Aria (Alto) [More](#)
Tilg, o Gott, die Lehren
Violin, Continuo

4 Recitativo Chorale (Bassoon) [More](#)

Cantatas **Search** **Chorals** **Bible** **More**

`@protocol InspectCantataView <NSObject>`

- `(void)updateCantataDetails:(MKMListViewModel*)viewModel;`
- `(void)showNoSelectionPlaceholder:(id<MKMTextualContentItem>)viewModel;`

`@end`

`@protocol CantataMovementsView <NSObject>`

- `(void)updateMovements:(id<MKMSectionedListViewModel>)viewModel;`
- `(void)updateMovementsViewWithNoContentViewModel:(id <MKMTextualContentItem>)noContentViewModel;`

`@end`

Section

Section

Section

Movement search

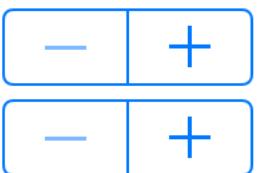
Movement types

- Arioso
- Recitatives
- Choirs
- Chorals

Instrumentation

[Add](#)

- Oboe
- Violin



Optional instruments

[More](#)

- Soprano, Alto, Tenor & Basso
- Choir
- Orchestra
- Continuo

[Perform search](#)[Reset search criterias](#)

Cantatas



Search



Chorals



Bible



More

```
@protocol EditMovementCatalogItemView <NSObject>
```

- (void)updateMovementTypesView:(MKMListViewModel *)viewModel;
- (void)updateRequiredInstrumentsView:(MKMListViewModel *)viewModel;
- (void)updateOptionalInstrumentsView:(MKMListViewModel *)viewModel;
- (void)showEmptyInstrumentsPlaceholder:(MKMItemViewModel *)viewModel;

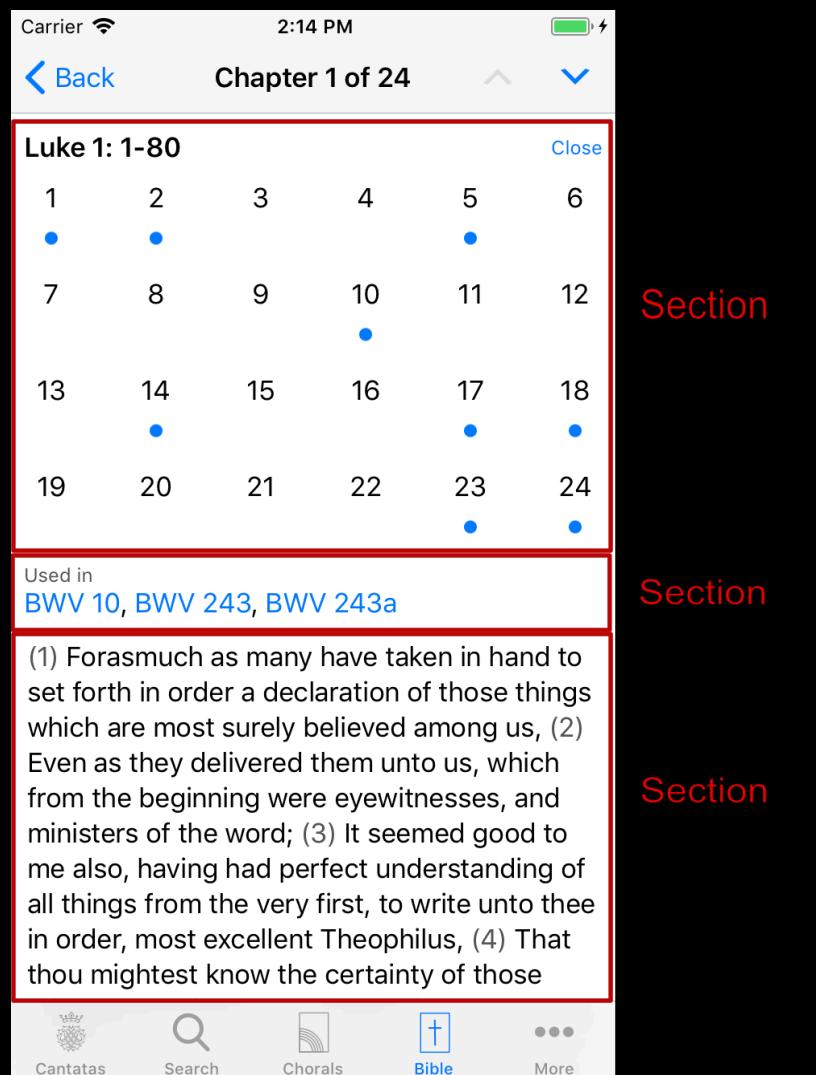
```
@end
```

Section

Section

Section

Section



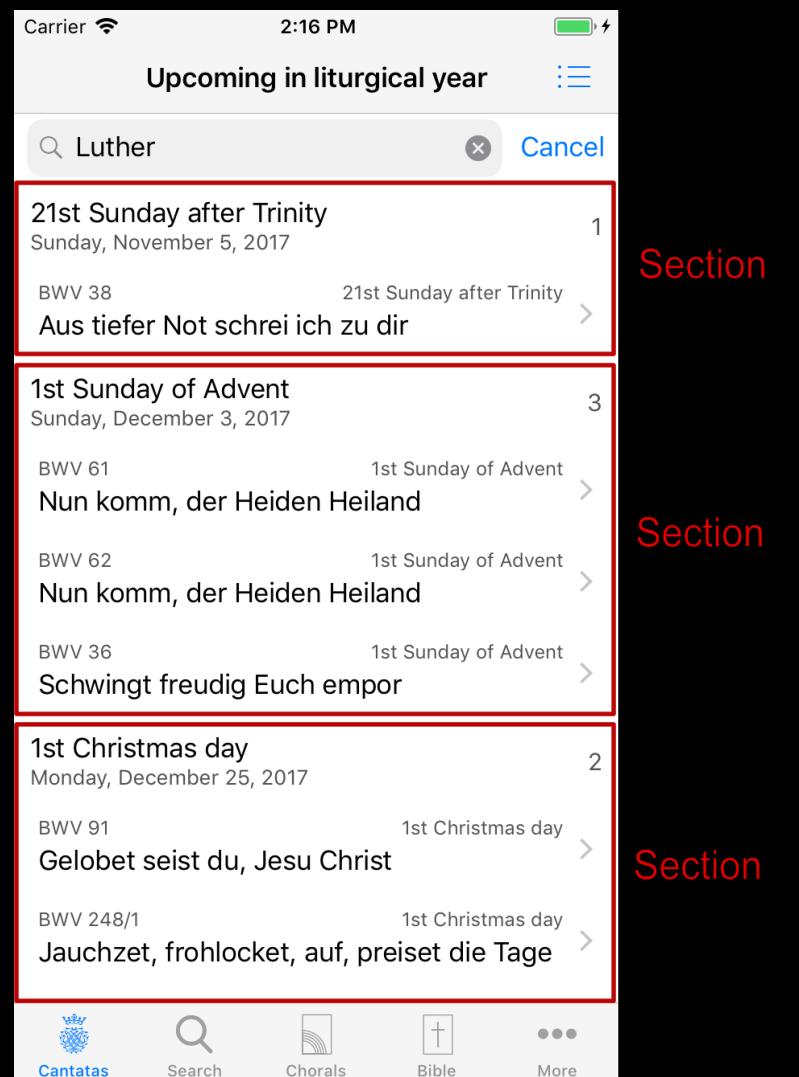
Section

Section

Section

```
@protocol InspectBiblicalBookView <NSObject>
- (void)updateBiblicalBookAvailableChapters:(id <MKMSectionInfo, MKMTextualContentItem>)chapterViewModel;
- (void)updateBiblicalBookDetailViewModel:(id<MKMSectionInfo, MKMTextualContentItem>)detailViewModel;
- (void)updateBiblicalBookVerses:(NSAttributedString *)viewModel;
- (void)showNoChaptersAvailablePlaceholder:(id<MKMTextualContentItem>)viewModel;
@end
```

Liste von vielen gleichförmigen Cells über mehrere Sektionen

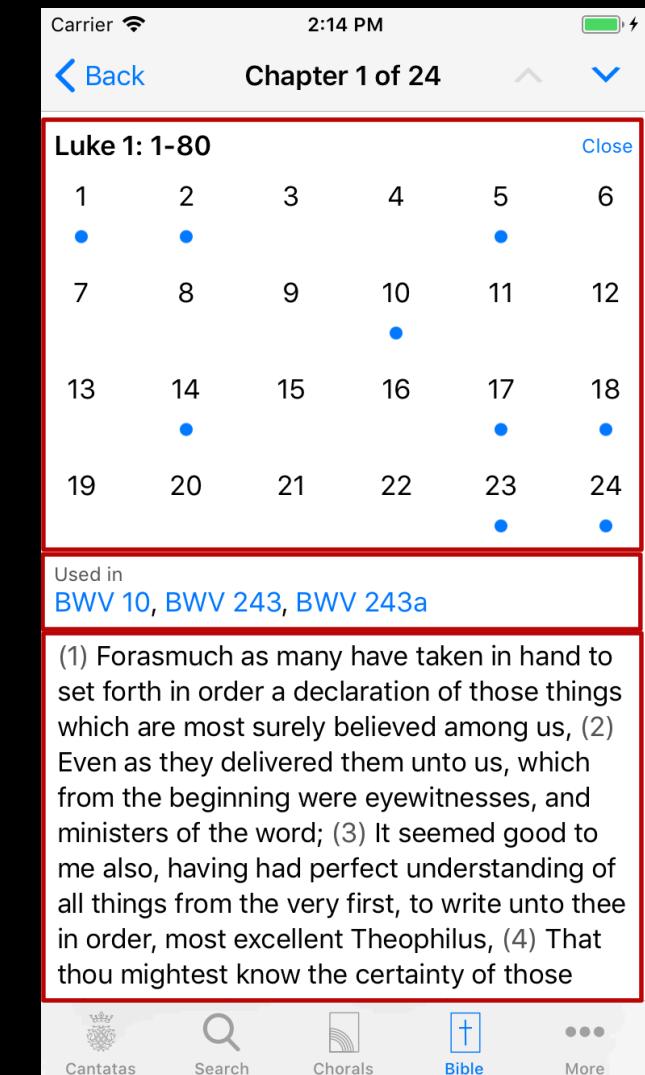
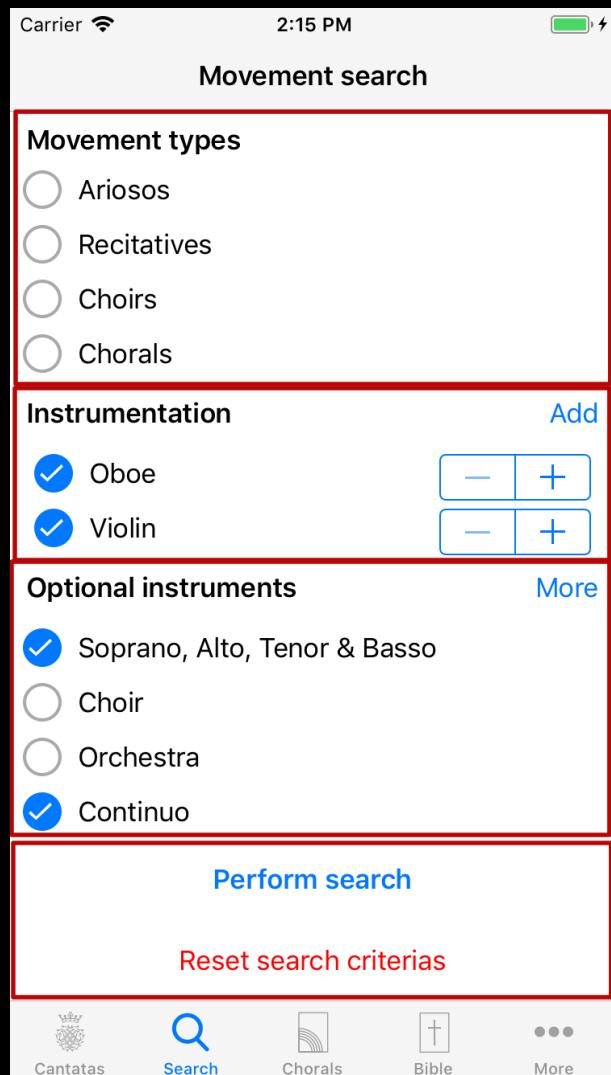


Section

Section

Section

Sektionen mit unterschiedlichen Cells



Datasources

MVC as your grandparents knew it

```
@protocol MKDataSource <NSObject>

@property (nonatomic, readonly)NSUInteger numberOfSections;

- (NSUInteger)numberOfItemsInSection:(NSUInteger)section;
- (id)objectAtIndexPath:(NSIndexPath*)indexPath;
- (id<MKMSectionInfo>)infoForSection:(NSUInteger)section;
- (void)selectItemAtIndexPath:(NSIndexPath*)indexPath;

@end
```

MKMIItemDataSource

The screenshot shows a mobile application interface. At the top, it says "Carrier" with signal strength, "2:14 PM", and battery level. Below that, it says "Chapter 1 of 24". The main area has a red border and contains a grid of numbers from 1 to 24. Blue dots are placed at positions (1,1), (2,2), (5,3), (10,4), (14,4), (17,5), (20,5), (23,6), and (24,6). Below the grid, a section titled "Used in" lists "BWV 10, BWV 243, BWV 243a". At the bottom, there is a large text block in a red-bordered box containing a passage from the Bible (Luke 1:1-80). The bottom navigation bar includes icons for Cantatas, Search, Chorals, Bible (highlighted in blue), and More.

Luke 1: 1-80

1	2	3	4	5	6
•	•			•	
7	8	9	10	11	12
			•		
13	14	15	16	17	18
	•			•	•
19	20	21	22	23	24
				•	•

Used in
BWV 10, BWV 243, BWV 243a

(1) Forasmuch as many have taken in hand to set forth in order a declaration of those things which are most surely believed among us, (2) Even as they delivered them unto us, which from the beginning were eyewitnesses, and ministers of the word; (3) It seemed good to me also, having had perfect understanding of all things from the very first, to write unto thee in order, most excellent Theophilus, (4) That thou mightest know the certainty of those

Cantatas Search Chorals **Bible** More

- single item

MKMArryDataSource

MKMArryDataSource

- array of items

MKMIItemDataSource

MKMIItemDataSource

MKMSectedDataSource

- array of array of similar items

MKMSectedDataSource

The screenshot shows a mobile application interface with a search bar at the top containing the text "Luther". Below the search bar is a list of search results. Each result item has a blue border and contains the following information:

- 21st Sunday after Trinity** (Section header, index 1)
- Sunday, November 5, 2017
- BWV 38 21st Sunday after Trinity >
- Aus tiefer Not schrei ich zu dir
- 1st Sunday of Advent** (Section header, index 3)
- Sunday, December 3, 2017
- BWV 61 1st Sunday of Advent >
- Nun komm, der Heiden Heiland
- BWV 62 1st Sunday of Advent >
- Nun komm, der Heiden Heiland
- BWV 36 1st Sunday of Advent >
- Schwingt freudig Euch empor
- 1st Christmas day** (Section header, index 2)
- Monday, December 25, 2017
- BWV 91 1st Christmas day >
- Gelobet seist du, Jesu Christ
- BWV 248/1 1st Christmas day >
- Jauchzet, frohlocket, auf, preiset die Tage

At the bottom of the screen are navigation icons: Cantatas, Search, Chorals, Bible, and More.

Datasource Composition

MKMCombinedDataSource

The screenshot shows a mobile application interface for a cantata. At the top, it displays the title "Ach Gott, vom Himmel sieh darein" in large bold letters, followed by "BWV 2". Below this, there is detailed performance information: "Designation: 2nd Sunday after Trinity", "1st performance: Sunday, June 18, 1724 - Leipzig", "Vocal Soloists: Alto, Tenor, Basso, Choir", "Orchestra: 4 Trombones, 2 Oboes, 2 Violins, Viola, Continuo", and "Text: Martin Luther (1, 4, 6), Anonymous (2-3, 5)". The chorale is listed as "Ach Gott vom Himmel, sieh darein Verse 1 (1), Verse 4 (4), Verse 6 (6)". A note indicates the "Next performance in liturgical year" is on "Sunday, June 10, 2018". At the bottom of this section is a navigation bar with tabs: "Movements" (selected), "Reading", "Chorale", and "Scores". The main content area below the title card lists three movements: "1.Choral (Choir)" with "Ach Gott, vom Himmel sieh darein" and instrumentation "4 Trombones, 2 Oboes, 2 Violins, Viola, Continuo"; "2.Recitativo (Tenor)" with "Sie lehren eitel falsche List" and instrumentation "Continuo"; and "3.Aria (Alto)" with "Tilg, o Gott, die Lehren" and instrumentation "Violin, Continuo". Each movement entry includes a "More" link on the right.

MKMArryDataSource

MKMSegmentedDataSource

MKMSectedDataSource

MKMSegmentedDataSource

- mehrere child datasources
- jeweils selektierte wird angezeigt

MKMCombinedDataSource

- mehrere child datasources
- alle werden gleichzeitig untereinander angezeigt

Datasources & View-Models

- Datasources verwalten die view models
- View models sind das **M** in **MVC**
- berechnen diffs für dynamische UITableView/UICollectionView updates (view models haben value semantic)
- Eigene, reguläre NSObjects ohne Abhängigkeit zu UIKit/AppKit -> Unabhängigkeit vom main thread

Simple view controller

```
// InspectCantataTableViewController

- (void)updateCantataDetails:(id<MKMSectionInfo>)viewModel {
    self.detailDataSource.content = viewModel;
}

- (void)updateMovements:(id<MKMSectionedListViewModel>)viewModel {
    self.movementsDataSource.sections = viewModel.sections;
}

- (void)showNoSelectionPlaceholder:(id<MKMTextualContentItem>)viewModel {
    [self.combinedDataSource setEmptyContentItem:viewModel];
}
```

Layout

Layout

- Beschreibung des Layouts pro Sektion
- Cell & Header (class oder nib)

```
@interface MKMSectionMetrics : NSObject

@property (nonatomic) CGFloat rowHeight;
@property (nonatomic) CGFloat headerHeight;
@property (nonatomic, readonly) Class cellClass;
@property (nonatomic, readonly) Class headerClass;
@property (nonatomic, strong) UIColor *backgroundColor;
@property (nonatomic, strong) UIColor *headerBackgroundColor;
@property (nonatomic, copy) MKMHeaderConfigurationBlock headerConfigurationHandler;
@property (nonatomic, copy) MKMCellConfigurationBlock cellConfigurationHandler;
@property (nonatomic, readonly) UINib *cellNib;
@property (nonatomic, readonly) UINib *headerNib;
@property(nonatomic) CGSize itemSize;

@end
```

```
@protocol MKMSectionLayoutProvider <NSObject>

- (MKMSectionMetrics *)metricsForSection:(NSUInteger)section
contentState:(MKMDataSourceState)contentState;

@end
```

Jetzt wächst zusammen, was
zusammen gehört

– *Ein Altkanzler*

MKMDatasourceUITableViewController

```
@interface MKMDatasourceUITableViewController : NSObject
```

```
@property (nonatomic, weak) UITableView *tableView;
```

```
- (instancetype)initWithDataSource:(id<MKMDatasource>)datasource  
layoutMetricsProvider:(id<MKMSectionLayoutProvider>)metricsProvider;
```

```
@end
```

- implementiert UITableViewDataSource & UITableViewDelegate

MKMDatasourceUICollectionviewAdapter

```
@interface MKMDatasourceUICollectionviewAdapter : NSObject  
  
@property (nonatomic, weak) UICollectionView *collectionView;  
  
- (instancetype)initWithDatasource:(id<MKMDatasource>)datasource  
layoutMetricsProvider:(id<MKMSectionLayoutProvider>)metricsProvider;
```

```
@end
```

- implementiert UICollectionViewDataSource,
UICollectionViewDelegate &
UICollectionViewDelegateFlowLayout

Zusammenfassung Viewschicht

- Composition von datasources ermöglicht komplexe, dynamische Uls
- Trennung von Daten und Layout
- Diffing der view models durch die datasources
- Datasources können mit jeglichen List-Views verwendet werden
- Benutzeraktionen werden an das Modulinterface (Router) weitergeleitet

Repositories

The database is a detail

Tell, don't ask!

```
@protocol InspectCantataRepository <NSObject>

- (void)cantataWithOpus:(NSString*)opus completionBlock:(void(^)(Cantata*))completionHandler;

@end
```

```
@protocol CantatasListRepository <NSObject>

- (void)executeCantatasListRequest:(CantatasListRepositoryRequest*)request
completionBlock:(void(^)(NSArray<Cantata*>*))completionHandler;
```

```
@end
```

Humble object pattern

Code?

Dis

Know your tools

GUIDE TO YOUR TOOLBOX

@HOPELESSSURFER



Flat Screwdriver

For opening tins of paint.



Phillips Head Screwdriver

Use in conjunction with the Hammer to puncture holes in wood.



Chisel

Use to scrape dried paint off windows, work tops and sinks.



Spanner

Backup Hammer.



Pinhead Nail

Use liberally in all projects. Remember DIY Rule #1 - if in doubt stick some, or more, nails in it.



Tough Nail

Use when you run out of Pinhead Nails



Hammer

Use for driving nails, tapping glass to check for cracks and levelling putty around windows.



Pliers

Use to twist nails that have hit a "Bastard Knot" into decorative shapes that disguise the problem.



Long Nose Pliers

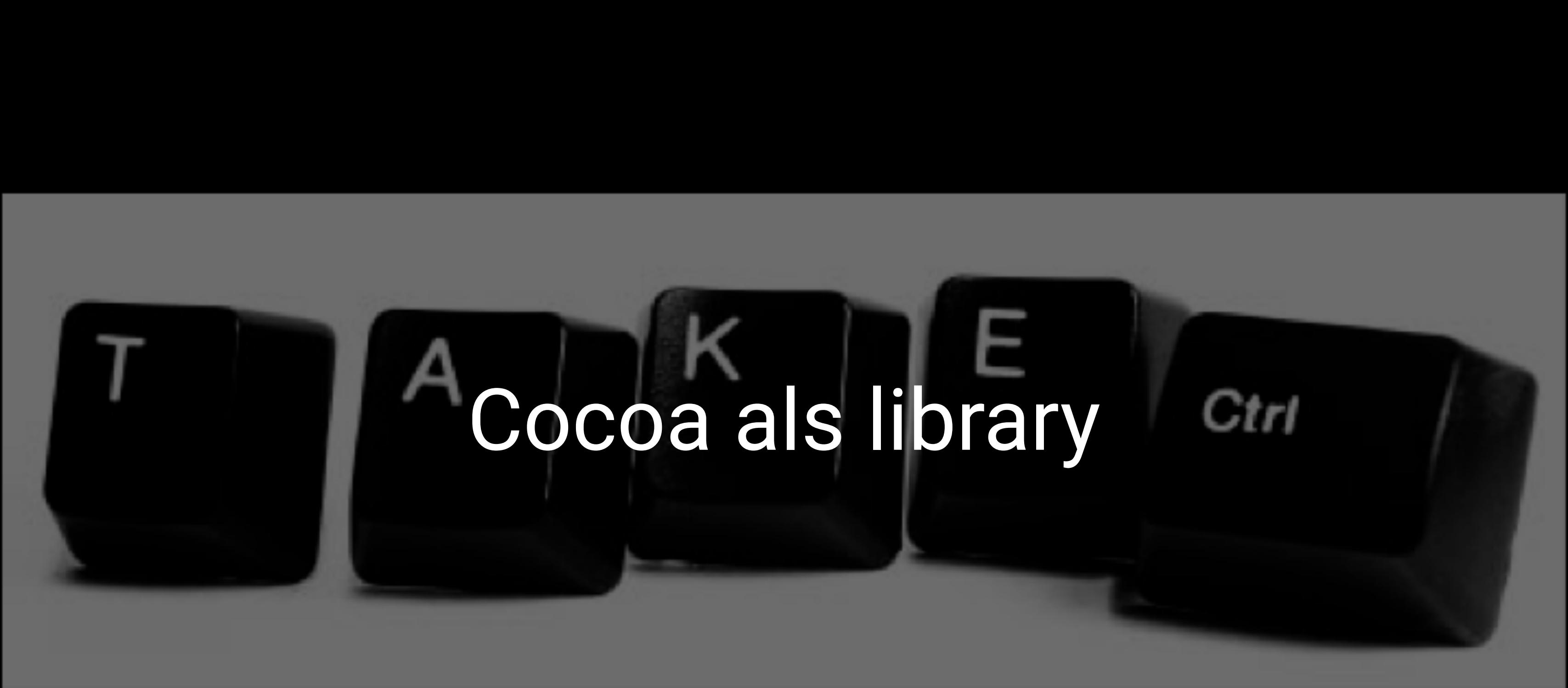
Use to pick up creepy crawlies that have made a home in your toolbox.



Auf Bewährtes zurückgreifen

Composition, Delegation, Cocoa Design
patterns

durch die Architektur gewonnene
Freiräume nutzen



Cocoa als library

SAY WHAT YOU MEAN

Be explicit!

AND MEAN WHAT THE FUCK YOU

SAY

Don'ts

Do not marry the framework!

GAME OVER

KIOSK

The search for the perfect abstraction
42



**Boundaries everywhere
know their costs!**



ALLEES w rappen
Foundation is your friend

Links

- Philippe Herreweghe & Collegium Vocale Ghent
- Advanced User Interfaces with Collection Views
- Framework Bound
- Library patterns - Why frameworks are evil
- Bach Kantaten App

Danke