ReactiveUI & Xamarin.Forms

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Reactive UI

- Originally Created by Ani Betts
- MVVM Framework….kind of.
- Declarative, asynchronous-friendly way to build UIs
- Support for major .Net Platforms
  - Xamarin.Forms
  - UWP
  - WPF
  - Avalonia
  - Tizen
  - Native Mobile
  - More…

ReactiveUI Features

- View Model Components
- Reactive Platform Wrappers
- Data Binding
- Commands
- Thread Scheduling
- Helpers (Validation, Event Processing, Logging, Service Locator, etc.)

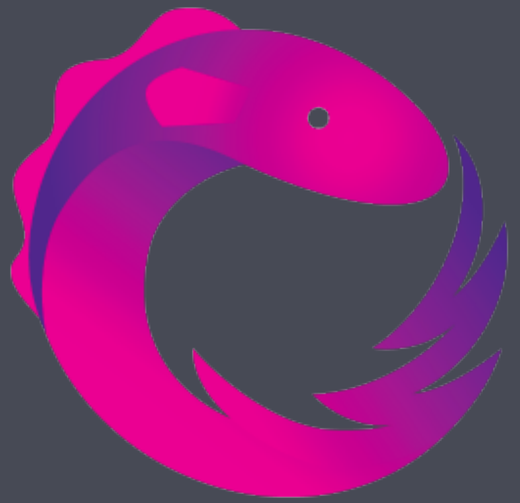
The un-MVVM Framework

- At its core, RxUI is really a bunch of extension methods
- It is extremely **NOT PRESCRIPTIVE**
- Unlike other MVVM frameworks, RxUI leaves it up to the developer to choose which parts they want to use
- There is not exactly one *right way* to use RxUI
- Works great with other MVVM Frameworks like Prism

Reactive Extensions

Splat

Dynamic Data



Reactive Extensions

- API for asynchronous programming using streams
- Listen for events or data notifications
- LINQ-like syntax for data processing
- Operators to make difficult processing easy
- Very popular across languages

http://reactivex.io

It’s Basically LINQ for Events

```
Observable
    .FromEventPattern<TextChangedEventArgs>(
        x ⇒ textEntry.TextChanged += x,
        x ⇒ textEntry.TextChanged -= x)
    .Select(x ⇒ x.EventArgs.NewTextValue)
    .Throttle(TimeSpan.FromSeconds(.75), TaskPoolScheduler.Default)
    .Where(searchText ⇒ !string.IsNullOrWhiteSpace(searchText))
    .SelectMany(
        async searchText ⇒
        {
            var searchService = Locator.Current.GetService<IDuckDuckGoApi>();
            return await searchService.Search(searchText).ConfigureAwait(false);
        })
    .ObserveOn(RxApp.MainThreadScheduler)
    .Do(
        results ⇒
        {
            /* Update the UI */
        })
    .Subscribe();
```

Subscribe to events

Filter Data

New Operators

Async Support

Explicit Scheduling

Splat

- Simple Service Locator
- Light-weight and extremely fast
- Logging
- Cross-Platform type translators

https://github.com/reactiveui/splat

Dynamic Data

- Bridges the world of Rx to collections
- Batman’s utility belt as an ObservableCollection
- Built-in Operators
  - Filtering
  - Sorting
  - Transformation
  - So many more…

https://github.com/ReactiveUI/DynamicData

Features

VS

Xamarin.Forms ViewModel

- Uh, there isn’t one out of the box…
- You likely will need to implement INotifyPropertyChanged
- No good way to prevent property notifications
- No default error handling
- No default instrumentation

ReactiveObject

- Base ViewModel Object for RxUI
- Intelligent Property Change Notifications
- Provides the ability to suppress and delay change notifications out of the box
- Support for automatically persisting the data based on changes and time
- Logging support
- Error routing

```
public class ViewModel : ReactiveObject
{
    [Reactive] public string FirstName { get; set; }
    [Reactive] public string LastName { get; set; }

    public string FormattedName { [ObservableAsProperty] get; }

    public BetterViewModel()
    {
        this.WhenAnyValue(
            vm => vm.FirstName,
            vm => vm.LastName,
            (first, last) => $"{last}, {first}")
        .ToPropertyEx(this, x => x.FormattedName);
    }
}
```

```
var simpleViewModel = new SimpleViewModel();

simpleViewModel.FirstName = "Michael";
simpleViewModel.LastName = "Stonis";

using(simpleViewModel.SuppressChangeNotifications())
{
    simpleViewModel.FirstName = "Miguel";
    simpleViewModel.FirstName = "Mike";
}
```

```
var simpleViewModel = new SimpleViewModel();

simpleViewModel.FirstName = "Michael";
simpleViewModel.LastName = "Stonis";

using(simpleViewModel.SuppressChangeNotifications())
{
    simpleViewModel.FirstName = "Miguel";
    simpleViewModel.FirstName = "Mike";
}
```

```
var simpleViewModel = new SimpleViewModel();

simpleViewModel.FirstName = "Michael";
simpleViewModel.LastName = "Stonis";

using(simpleViewModel.DelayChangeNotifications())
{
    simpleViewModel.FirstName = "Miguel";
    simpleViewModel.FirstName = "Mike";
}
```

```
var simpleViewModel = new SimpleViewModel();

simpleViewModel.FirstName = "Michael";
simpleViewModel.LastName = "Stonis";

using(simpleViewModel.DelayChangeNotifications())
{
    simpleViewModel.FirstName = "Miguel";
    simpleViewModel.FirstName = "Mike";
}
```

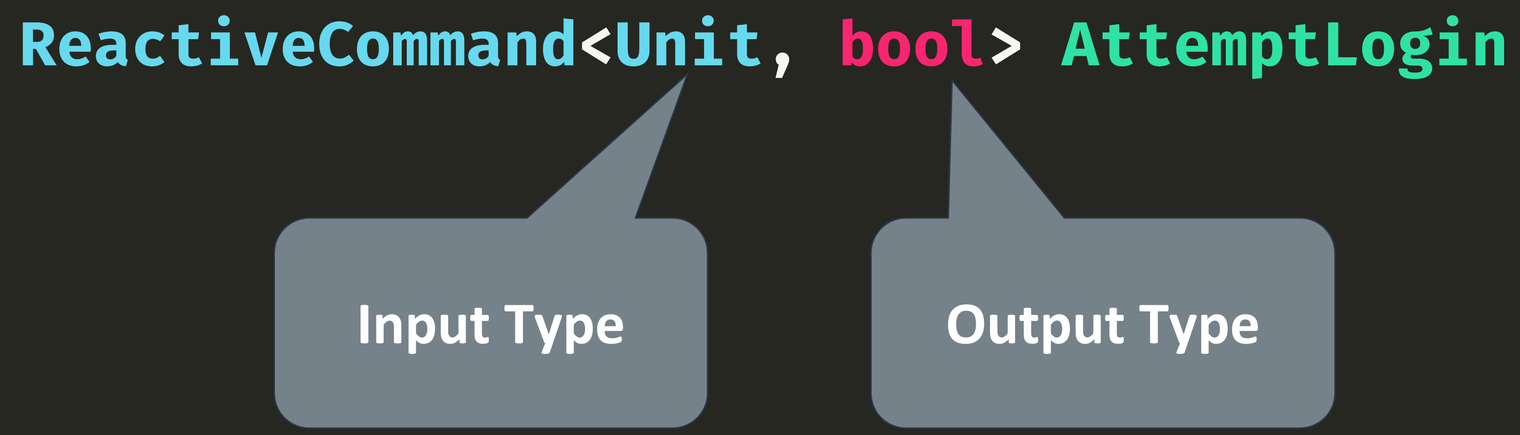
```
this.ThrownExceptions
    .Do(ex ⇒ Debug.WriteLine($"Exception: {ex}"))
    .Subscribe()
    .DisposeWith(ViewModelBindings);

this.Log()
    .Info("Everything is looking good!");
```

Xamarin.Forms Command

- No great out of the box support for async/await
- No support for cancellation
- CanExecute functionality is minimal at best
- No typed input
- No notification upon completion

ReactiveCommand

- A *really good* implementation of ICommand
- Supports synchronous and asynchronous operations OOTB
- Practical and easy-to-use support for command disabling
- Pretty dang easy support for command cancellation
- Great integration with Xamarin.Forms


ReactiveCommand<Unit, bool> AttemptLogin
Input Type
Output Type

```
ReactiveCommand
    .CreateFromTask(
        async () =>
        {
            this.Log().Info("Starting Login");
            var result = await ProcessLogin();
            this.Log().Info($"Finished Login");

            return result;
        },
        this.WhenAnyValue(x => x.Username, x => x.Password,
            (username, password) =>
                !string.IsNullOrWhiteSpace(username) &&
                !string.IsNullOrWhiteSpace(password)));
```

```
ReactiveCommand
    .CreateFromTask(
        async () =>
        {
            this.Log().Info("Starting Login");
            var result = await ProcessLogin();
            this.Log().Info($"Finished Login");

            return result;
        },
        this.WhenAnyValue(x => x.Username, x => x.Password,
            (username, password) =>
                !string.IsNullOrWhiteSpace(username) &&
                !string.IsNullOrWhiteSpace(password)));
```

Can create from synchronous, observable, and other commands too

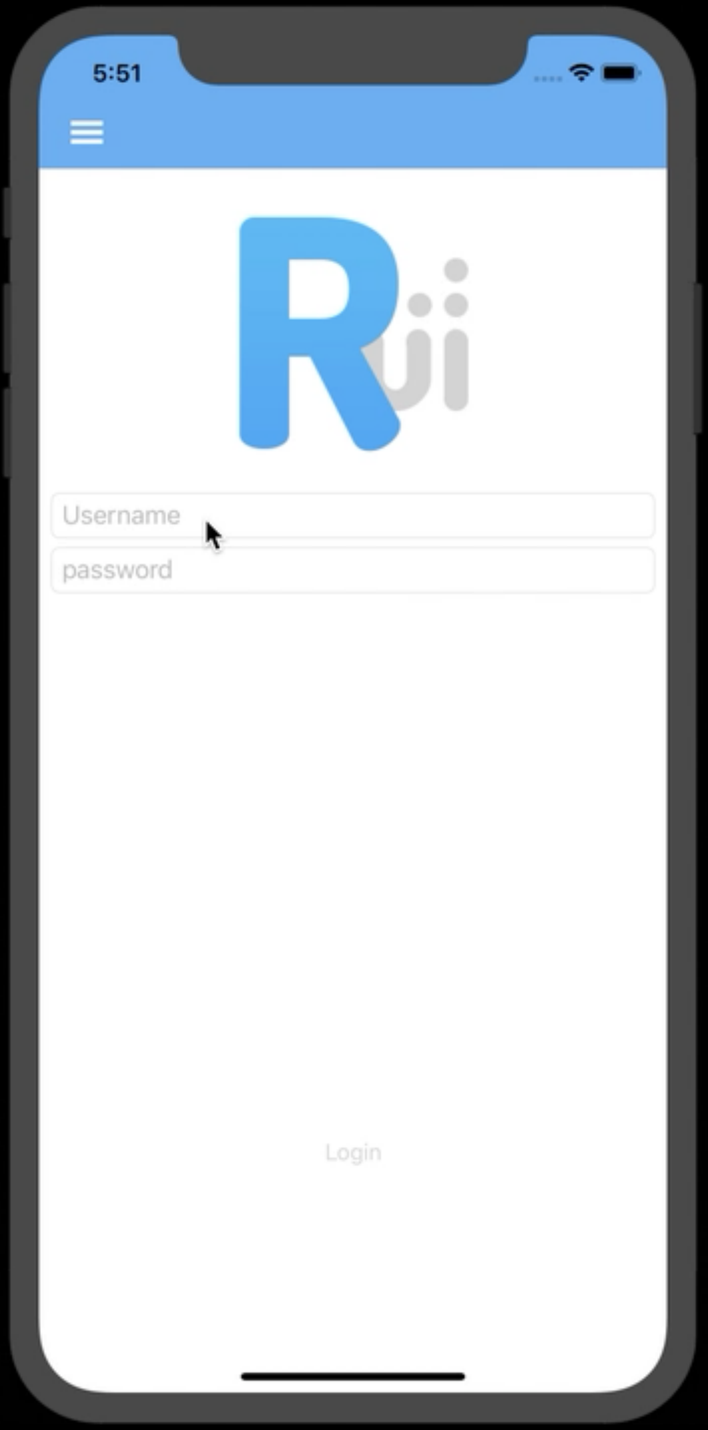
```
ReactiveCommand
    .CreateFromTask(
        async () =>
        {
            this.Log().Info("Starting Login");
            var result = await ProcessLogin();
            this.Log().Info($"Finished Login");

            return result;
        },
        this.WhenAnyValue(x => x.Username, x => x.Password,
            (username, password) =>
                !string.IsNullOrWhiteSpace(username) &&
                !string.IsNullOrWhiteSpace(password)));
```

This is the work that the command will do

```
ReactiveCommand
    .CreateFromTask(
        async () =>
        {
            this.Log().Info("Starting Login");
            var result = await ProcessLogin();
            this.Log().Info($"Finished Login");

            return result;
        },
        this.WhenAnyValue(x => x.Username, x => x.Password,
            (username, password) =>
                !string.IsNullOrWhiteSpace(username) &&
                !string.IsNullOrWhiteSpace(password)));
```

```
ReactiveCommand
    .CreateFromTask(
        async () =>
        {
            this.Log().Info("Starting Login");
            var res
            this.Lo

            retur
        },
        this.WhenAnyValue(x => x.Username, x => x.Password,
            (username, password) =>
                !string.IsNullOrWhiteSpace(username) &&
                !string.IsNullOrWhiteSpace(password)));
```

This will control whether the command *CAN* be executed


5:51
Username
password
Login

Xamarin.Forms Bindings

- Value Converters are a ton of fun
- Can be difficult to determine binding mode
- No direct way to bind *ANY* event to a command
- Can’t batch bindings
- No great way to bind to the completion of an event or notification
- Bindings are getting better though with things like Multi-Bindings
- Check out the C# Markup Bindings!

Bindings & Update Notifications

- Two-Way and One-Way Bindings
- Built-In Type Conversion and Easy Value Conversion Overrides
- Command Binding
- Control when binding updates source
- Support for Xamarin.Forms, Xamarin.iOS, Xamarin.Android, WPF, Windows Forms, Avalonia, UWP, etc.

The Binding Host View

The Notifying Property

```
this.Bind(ViewModel, vm => vm.Username, view => view.username.Text)
```

The ViewModel Property

The View/Control Property

```
this.OneWayBind(ViewModel, vm => vm.WorkStatus, view => view.workStatus.Text)
```

```
this.BindCommand(ViewModel, vm => vm.StartWorking, view => view.startWork)
```

```
this.WhenAnyValue(x => x.ViewModel.UsernameValidation.IsValid)
    .Select(isValid => isValid ? Color.Green : Color.Red)
    .ObserveOn(RxApp.MainThreadScheduler)
    .BindTo(this, view => view.username.BackgroundColor)
```

```
this.WhenAnyObservable(x => x.ViewModel.CancelProcessing)
    .ObserveOn(RxApp.MainThreadScheduler)
    .Do(
        async _ =>
        {
            await this.DisplayAlert(
                "Cancelled", "Processing Cancelled", "OK");
        })
    .Subscribe()
    .DisposeWith(viewDisposables);
```

```
this.WhenAnyValue(x => x.ViewModel.UsernameValidation.IsValid)
    .Select(isValid => isValid ? Color.Green : Color.Red)
    .ObserveOn(RxApp.MainThreadScheduler)
    .BindTo(this, view => view.username.BackgroundColor)
```

```
this.WhenAnyObservable(x => x.ViewModel.CancelProcessing)
    .ObserveOn(RxApp.MainThreadScheduler)
    .Do(
        async _ =>
        {
            await this.DisplayAlert(
                "Cancelled", "Processing Cancelled", "OK");
        })
    .Subscribe()
    .DisposeWith(viewDisposables);
```

```
this.WhenAnyValue(x ⇒ x.ViewModel.Load)
    .IsNotNull()
    .ObserveOn(RxApp.MainThreadScheduler)
    .Do(
        async load ⇒
        {
            _contentContainer.Opacity = 0f;

            _logo.Source = load.VendorImageUrl;
            _vendorName.Text = load.Vendor;
            _loadId.Text = load.LoadId;
            _payment.Text = load.Payment.ToCurrencyDisplay();
            _pickupDatetime.Text = load.PickupDateTime.ToLongDisplay();
            _locationPickup.Text = load.PickupLocation;
            _locationDestination.Text = load.DestinationLocation;
            _totalDistance.Text = $"{load.TotalDistance:n0} mi";
            _totalStops.Text = $"{load.TotalStops} stops";
            _payloadInfo.Text = $"{load.Equipment} / {load.Commodity} / {load.Weight}";

            await _contentContainer.FadeTo(1f, Durations.FadeIn, easing: Easing.CubicInOut);
        })
    .Subscribe()
    .DisposeWith(ControlBindings);
```

Xamarin.Forms ObservableCollection

- Barebones implementation
- Sledgehammer approach to updates
- Doesn’t support batch updates
- Each update/insert/delete triggers a notification
- No built-in filtering, transformation, etc.

DynamicData

- Observable Lists and Caches
- Granular controls for change notification including batch updates
- Built-In support for filtering, transformation, sorting, aggregation
- Provides the ability to listen to property changes of items
- Highly optimized and extremely fast

```
_resultsSourceList =
    new SourceList<TaskResultCaptureViewModel>()
        .DisposeWith(ViewModelBindings);

_resultsSourceList
    .Connect()
    .BufferIf(this.WhenAnyValue(x => x.Categories).Select(x => x == null))
    .GroupOn(x => x.TaskInstance.CategoryId)
    .Transform(x =>
        new TasksByCategory
        {
            CategoryId = x.GroupKey.Value,
            Category = Categories.FirstOrDefault(c => c.Id == x.GroupKey.Value),
            TaskResultCaptures = x.List.Items.ToList()
        })
    .Sort(OrderedComparer<TasksByCategory>.OrderBy(x => x.Category.Name))
    .ObserveOn(RxApp.MainThreadScheduler)
    .Bind(out var results)
    .DisposeMany()
    .Subscribe()
    .DisposeWith(ViewModelBindings);
```

Connect to list updates

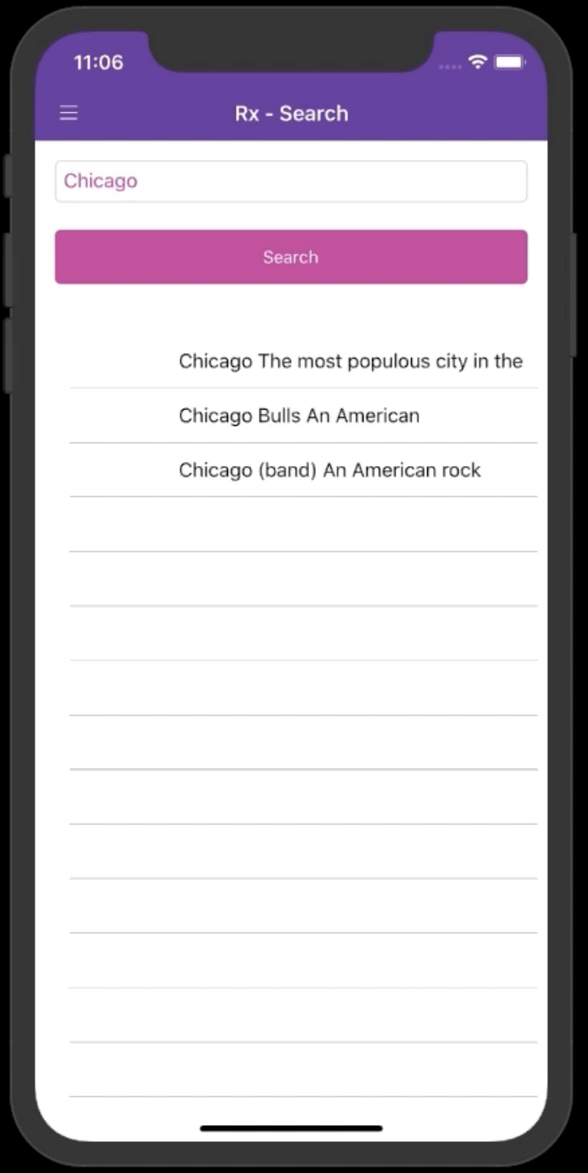
Buffer changes

Group Data

Transform Data

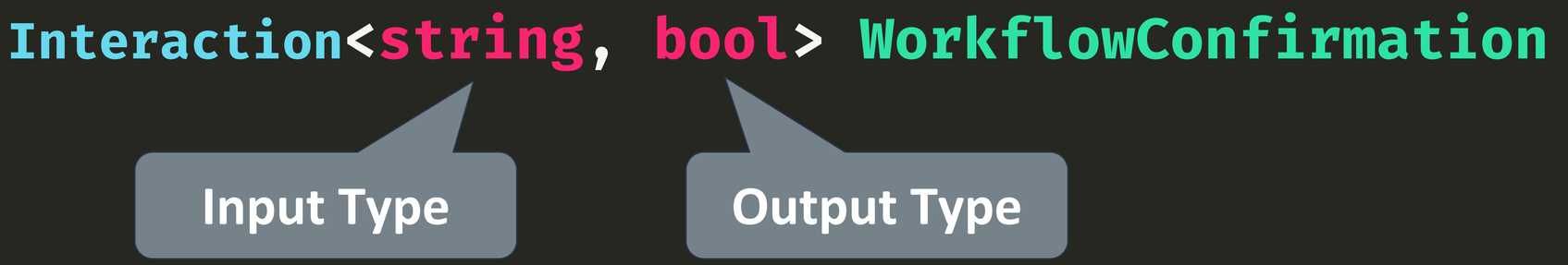
Efficiently Sort Results

Send Updates


11:06
Rx - Search
Chicago
Search
Chicago The most populous city in the
Chicago Bulls An American
Chicago (band) An American rock

Interactions

- Simple way for our VM to kick out to an outside process and get feedback
- Great for when you need user input from an alert or a picker
- Allows us to send and receive typed data
- Can be mocked out for unit tests


Interaction<string, bool> WorkflowConfirmation
Input Type
Output Type

```
ReactiveCommand
    .CreateFromTask(
        async () =>
        {
            var doesWantToWork =
                await WorkflowConfirmation
                    .Handle("Are you sure you want to work?");

            WorkStatus =
                 doesWantToWork
                    ? "I guess we can work, but I'm not happy about it"
                    : "Please don't scare us next time and just ";
        })
```

This is in the ViewModel and knows nothing about the implementation. So, this is nice and unit testable.

```
this.ViewModel
    .WorkflowConfirmation
    .RegisterHandler(
        async x =>
        {
            var result =
                await DisplayAlert("Work Status", x.Input, "yes", "no");

            x.SetOutput(result);
        })
```

Here is an example of a handler that is provided in a Xamarin.Forms page

```
this.ViewModel
    .WorkflowConfirmation
    .RegisterHandler(
        async x =>
        {
            var result =
                await DisplayAlert("Work Status", x.Input, "yes", "no");

            x.SetOutput(result);
        })
```

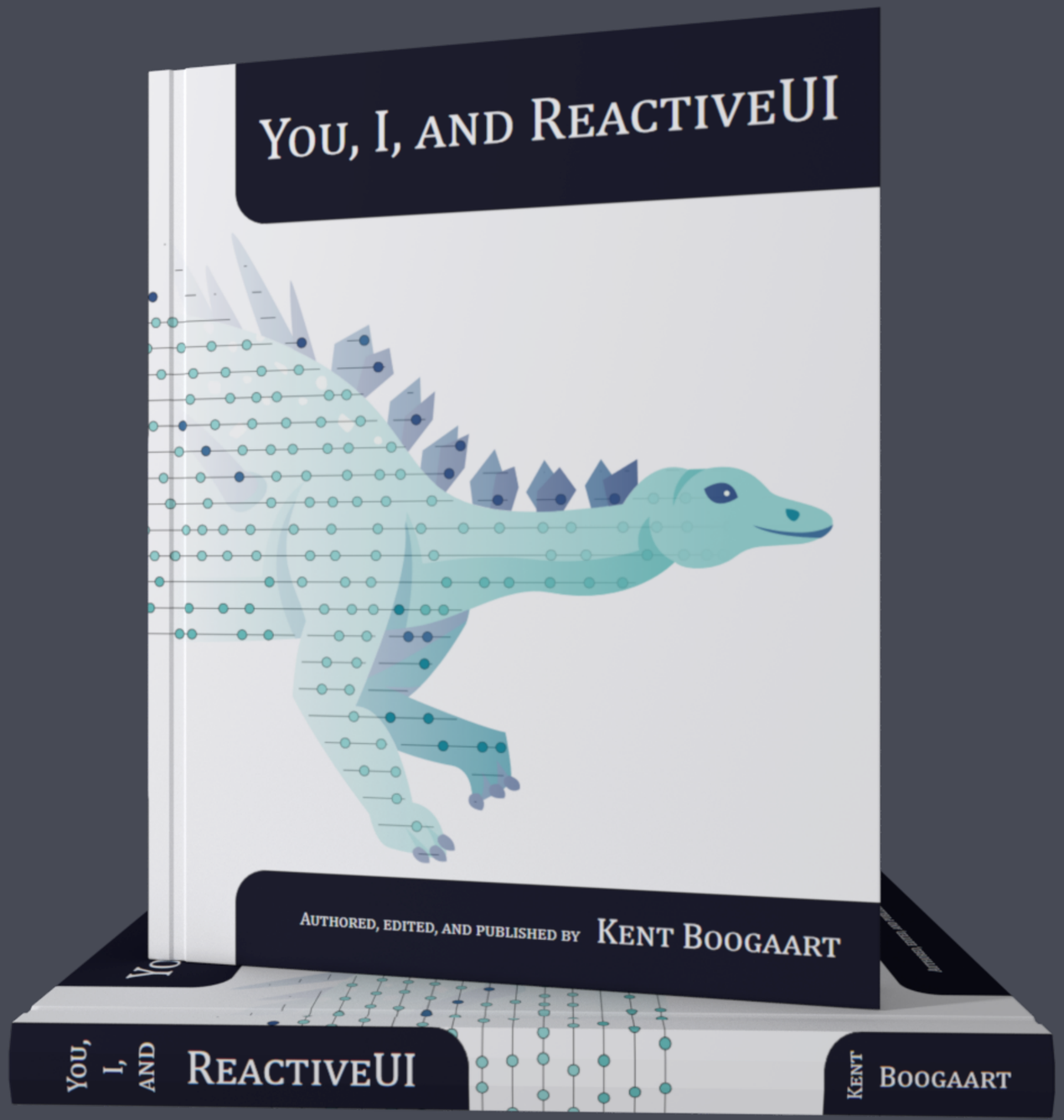
```
this.ViewModel
    .WorkflowConfirmation
    .RegisterHandler(
        async x =>
        {
            var result =
                await DisplayAlert("Work Status", x.Input, "yes", "no");

            x.SetOutput(result);
        })
```

We can call UI components and gather the output values we want from Dialogs, Cameras, File Pickers, etc.

```
this.ViewModel
    .WorkflowConfirmation
    .RegisterHandler(
        async x =>
        {
            var result =
                await D                                    ut, "yes", "no");

            x.SetOutput(result);
        })
```

We can send the data back to the ViewModel from when we are done

DEMO TIME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