Managing State with RxJava

Jake Wharton

Why Reactive?

Unless you can model your entire system synchronously...

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Unless you can model your entire system synchronously, a single asynchronous source breaks imperative programming.

Why Reactive?

```
interface UserManager {
  User getUser();
}
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interface UserManager {
  User getUser();
  void setName(String name);
  void setAge(int age);
}
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UserManager um = new UserManager();
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interface UserManager {
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UserManager um = new UserManager();
System.out.println(um.getUser());
```

Why Reactive?

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interface UserManager {
  User getUser();
  void setName(String name);
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UserManager um = new UserManager();
System.out.println(um.getUser());

um.setName("Jane Doe");
```

Why Reactive?

```
interface UserManager {
  User getUser();
  void setName(String name);
  void setAge(int age);
}

UserManager um = new UserManager();
System.out.println(um.getUser());

um.setName("Jane Doe");
System.out.println(um.getUser());
```

Why Reactive?

```
interface UserManager {
  User getUser();
  void setName(String name); // <-- now async
  void setAge(int age); // <-- now async
}
```

Why Reactive?

```
interface UserManager {
  User getUser();
  void setName(String name);
  void setAge(int age);
}

UserManager um = new UserManager();
System.out.println(um.getUser());

um.setName("Jane Doe");
System.out.println(um.getUser());
```

Why Reactive?

```
interface UserManager {
  User getUser();
  void setName(String name, Runnable callback);
  void setAge(int age, Runnable callback);
}
```

Why Reactive?

```
interface UserManager {
  User getUser();
  void setName(String name, Runnable callback);
  void setAge(int age, Runnable callback);
}

UserManager um = new UserManager();
System.out.println(um.getUser());

um.setName("Jane Doe", () -> {
  System.out.println(um.getUser());
});
```

Why Reactive?

```
interface UserManager {
  User getUser();
  void setName(String name, Listener listener);
  void setAge(int age, Listener listener);

  interface Listener {
    void success(User user);
    void failure(IOException e);
  }
}
```

Why Reactive?

```
UserManager um = new UserManager();
System.out.println(um.getUser());

um.setName("Jane Doe");
```

Why Reactive?

```
UserManager um = new UserManager();
System.out.println(um.getUser());

um.setName("Jane Doe", new UserManager.Listener() {
  @Override public void success() {
    System.out.println(um.getUser());
  }

  @Override public void failure(IOException e) {
    // TODO show the error...
  }
});
```

Why Reactive?

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UserManager um = new UserManager();
System.out.println(um.getUser());

um.setName("Jane Doe", new UserManager.Listener() {
  @Override public void success() {
    System.out.println(um.getUser());
  }
  @Override public void failure(IOException e) {
    // TODO show the error...
  }
});

um.setAge(40, new UserManager.Listener() {
  @Override public void success() {
    System.out.println(um.getUser());
  }
  @Override public void failure(IOException e) {
    // TODO show the error...
  }
});
```

Why Reactive?

```
UserManager um = new UserManager();
System.out.println(um.getUser());

um.setName("Jane Doe", new UserManager.Listener() {
  @Override public void success() {
    System.out.println(um.getUser());

    um.setAge(40, new UserManager.Listener() {
      @Override public void success() {
        System.out.println(um.getUser());
      }
      @Override public void failure(IOException e) {
        // TODO show the error...
      }
    });
  }
  @Override public void failure(IOException e) {
    // TODO show the error...
  }
});
```

Why Reactive?

```
public final class UserActivity extends Activity {
  private final UserManager um = new UserManager();

  @Override protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);

    setContentView(R.layout.user);
    TextView tv = (TextView) findViewById(R.id.user_name);
    tv.setText(um.getUser().toString());

    um.setName("Jane Doe", new UserManager.Listener() {
      @Override public void success() {
        tv.setText(um.getUser().toString());
      }
      @Override public void failure(IOException e) {
        // TODO show the error...
      }
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    TextView tv = (TextView) findViewById(R.id.user_name);
    tv.setText(um.getUser().toString());

    um.setName("Jane Doe", new UserManager.Listener() {
      @Override public void success() {
        if (isDestroyed()) {
          tv.setText(um.getUser().toString());
        }
      }
      @Override public void failure(IOException e) {
        // TODO show the error...
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  }
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    setContentView(R.layout.user);
    TextView tv = (TextView) findViewById(R.id.user_name);
    tv.setText(um.getUser().toString());

    um.setName("Jane Doe", new UserManager.Listener() {
      @Override public void success() {
        runOnUiThread(new Runnable() {
          @Override public void run() {
            if (isDestroyed()) {
              tv.setText(um.getUser().toString());
            }
          }
        });
      }
      @Override public void failure(IOException e) {
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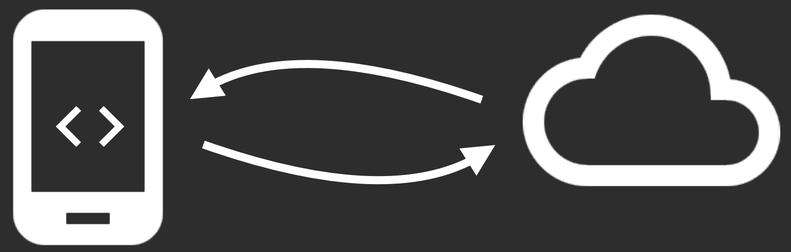
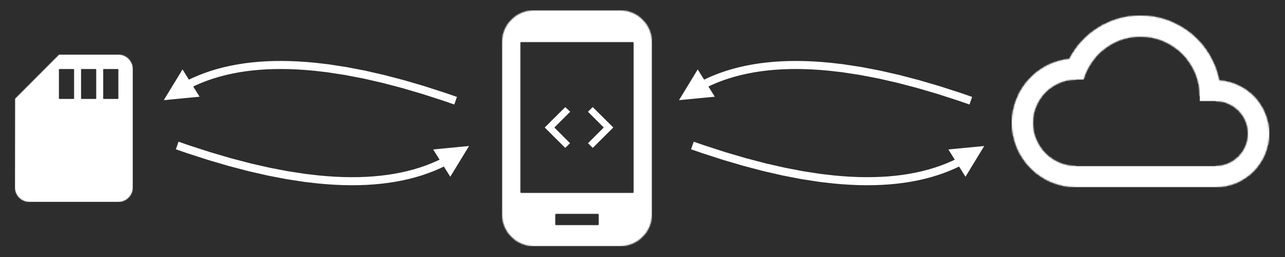


Why Reactive?



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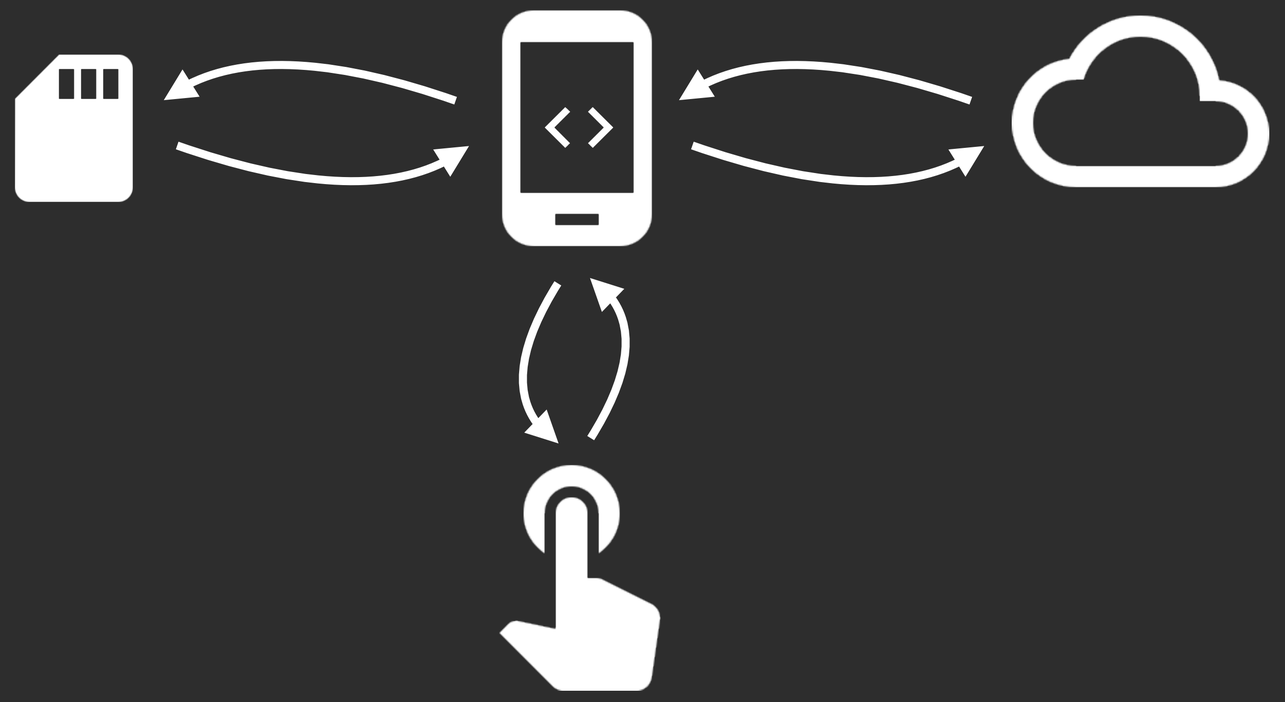

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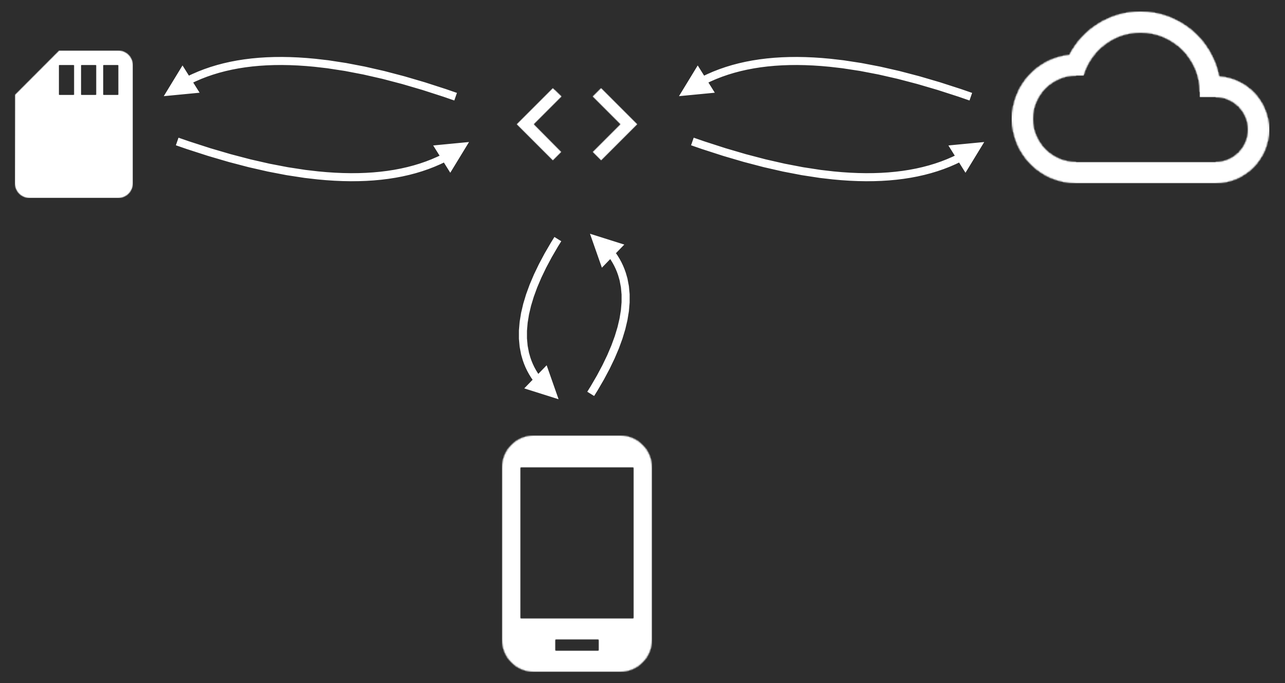

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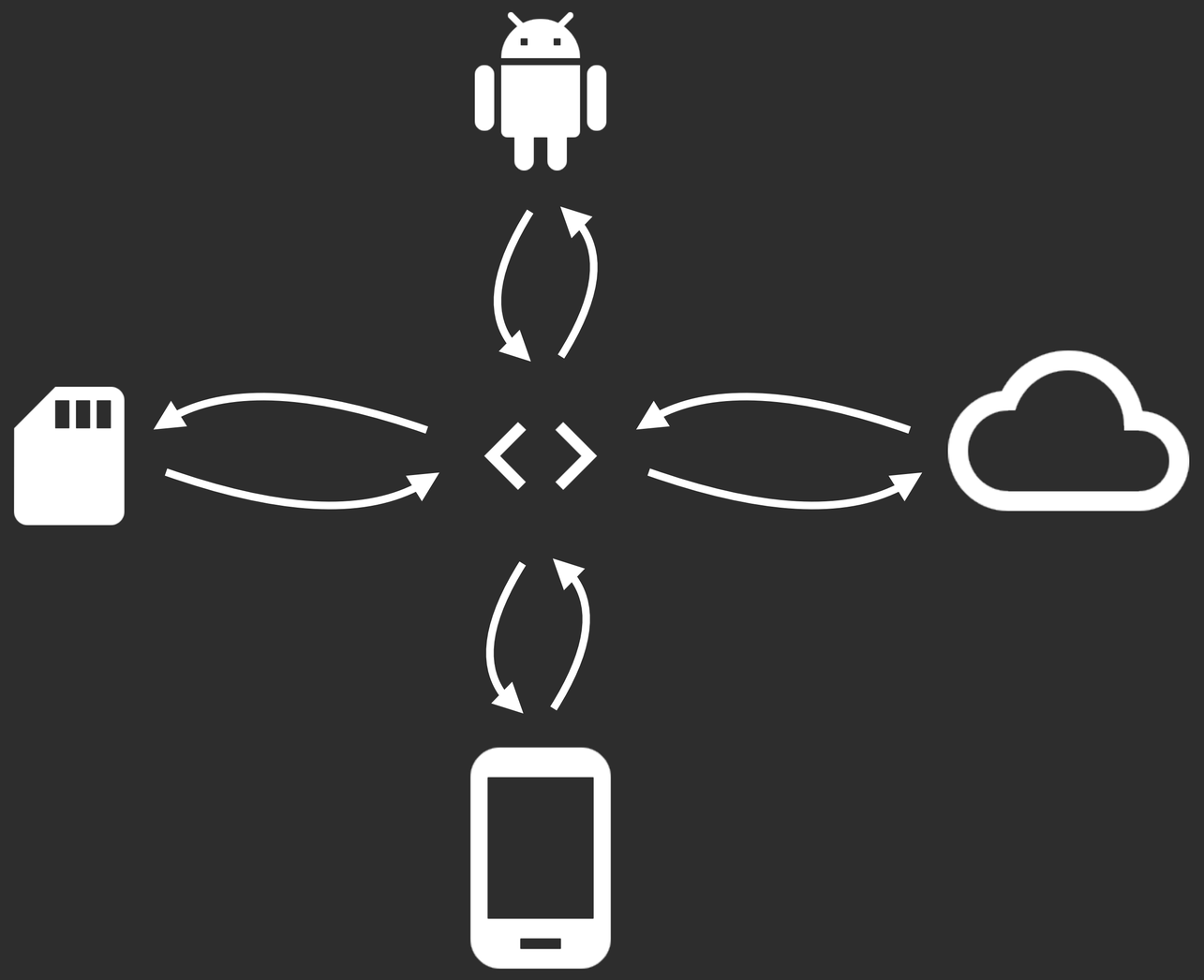

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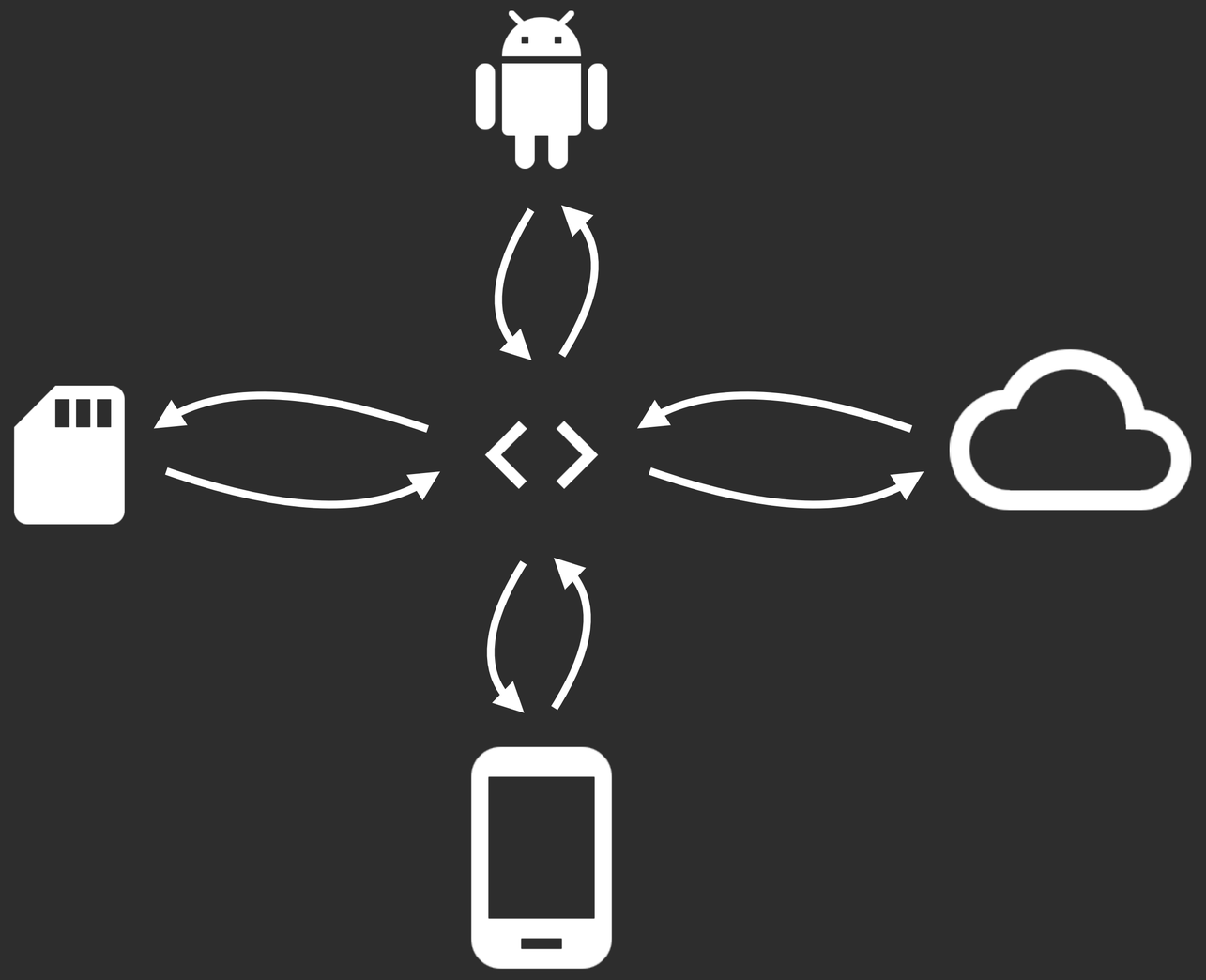

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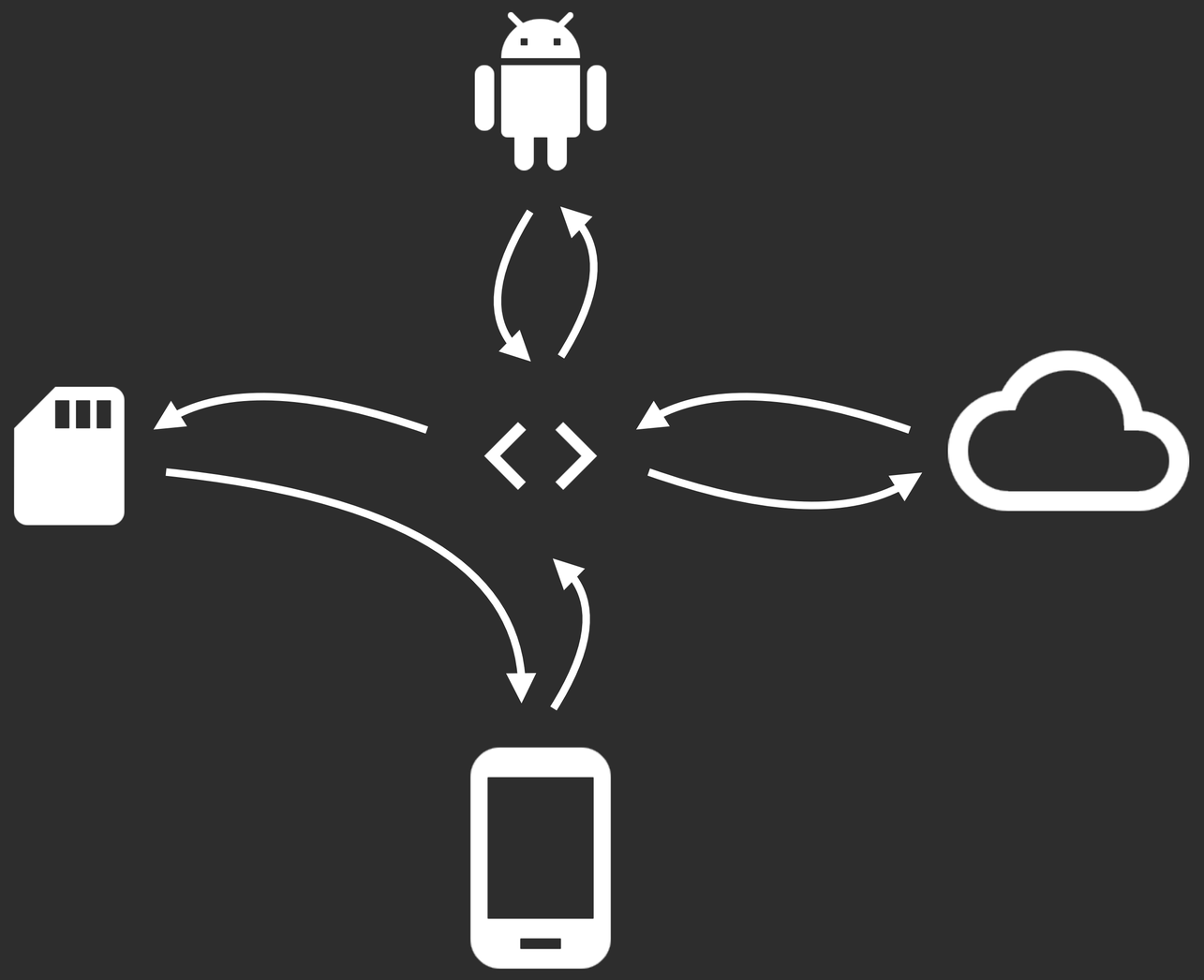

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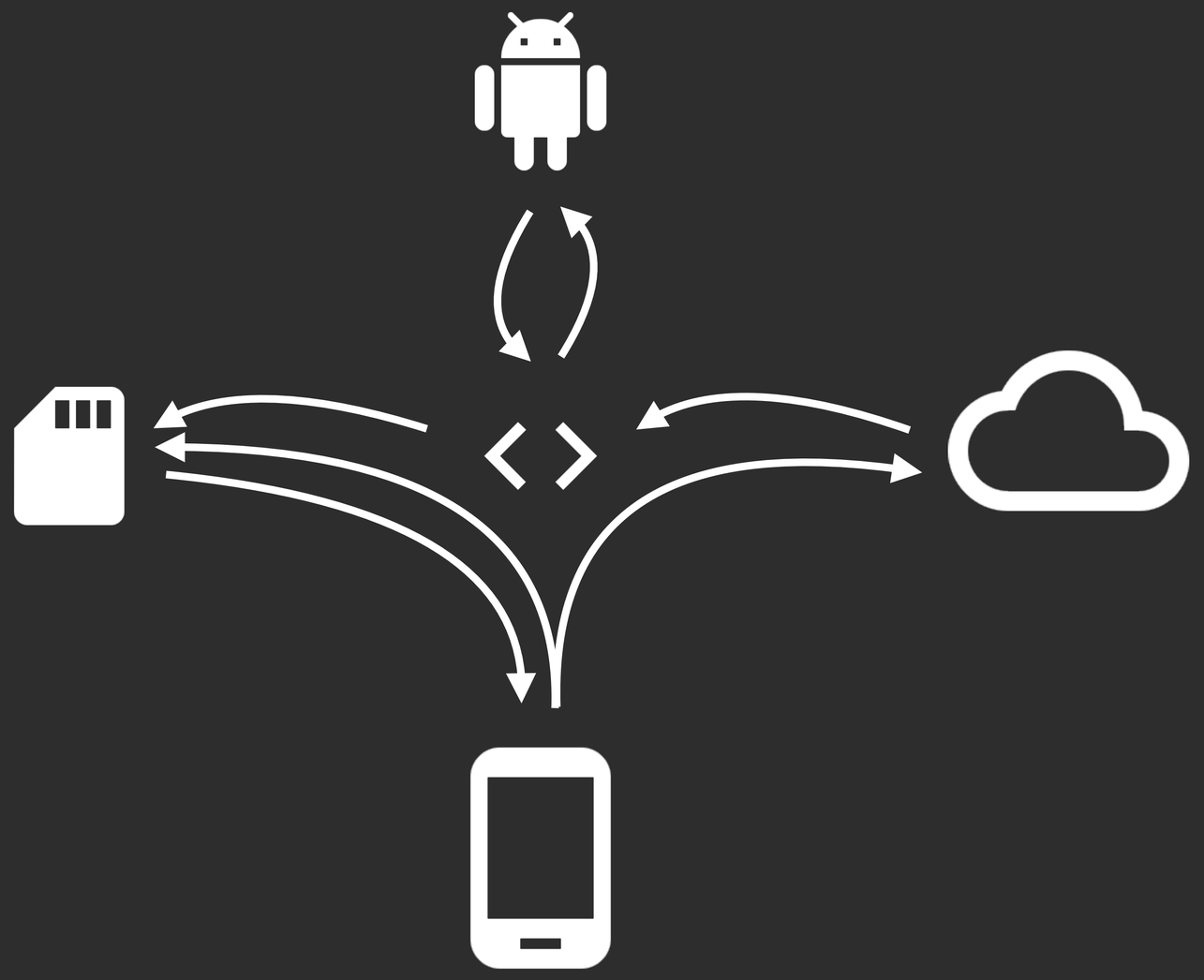

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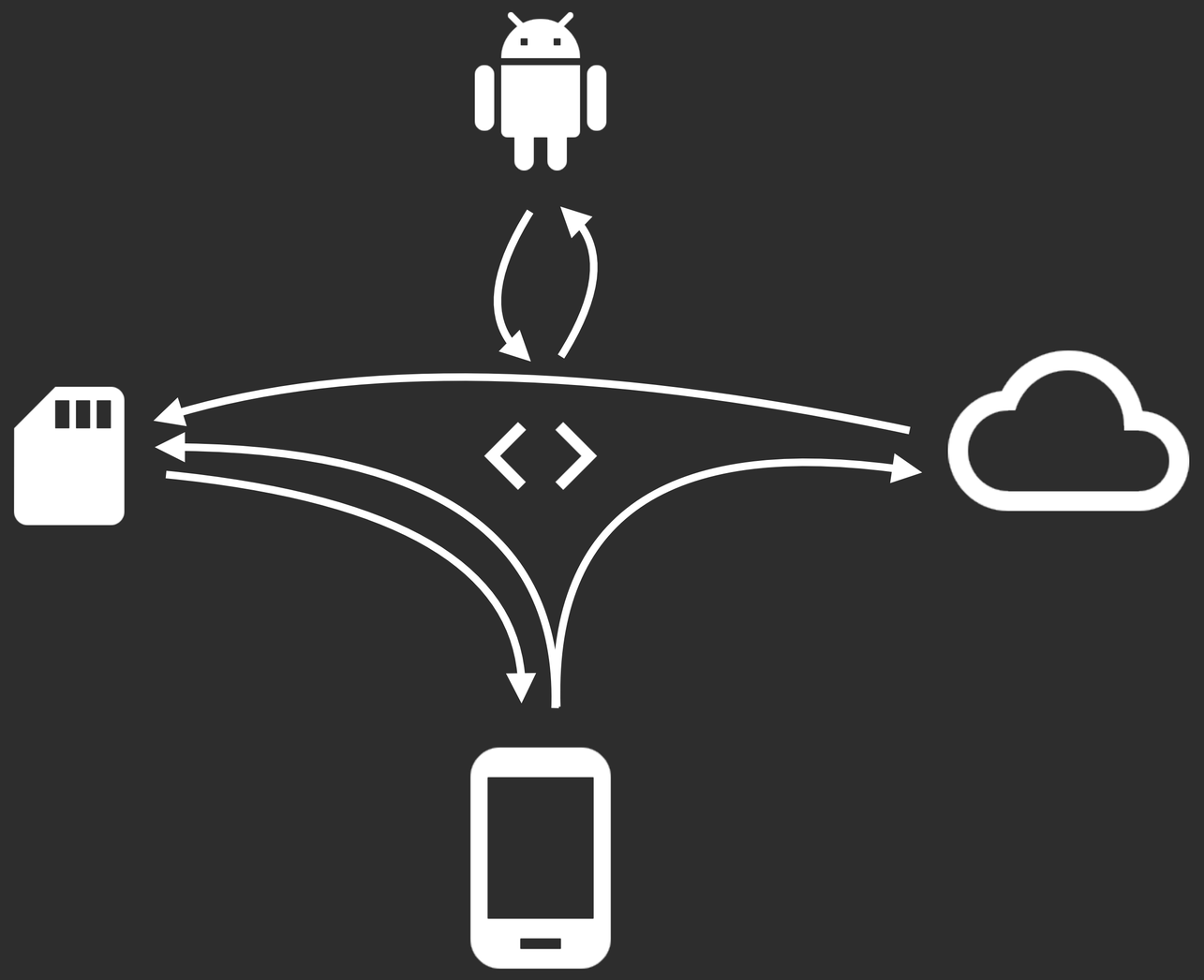

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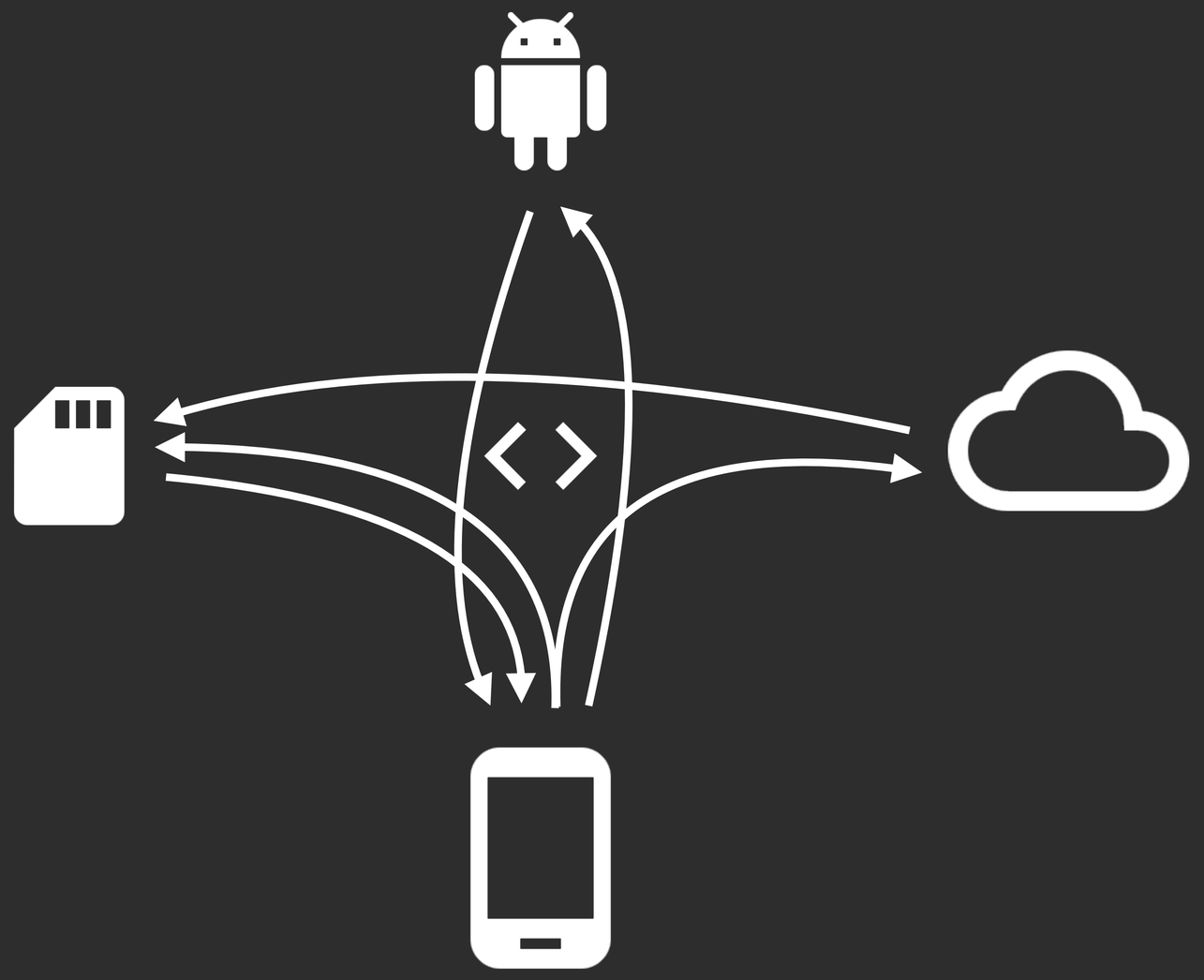

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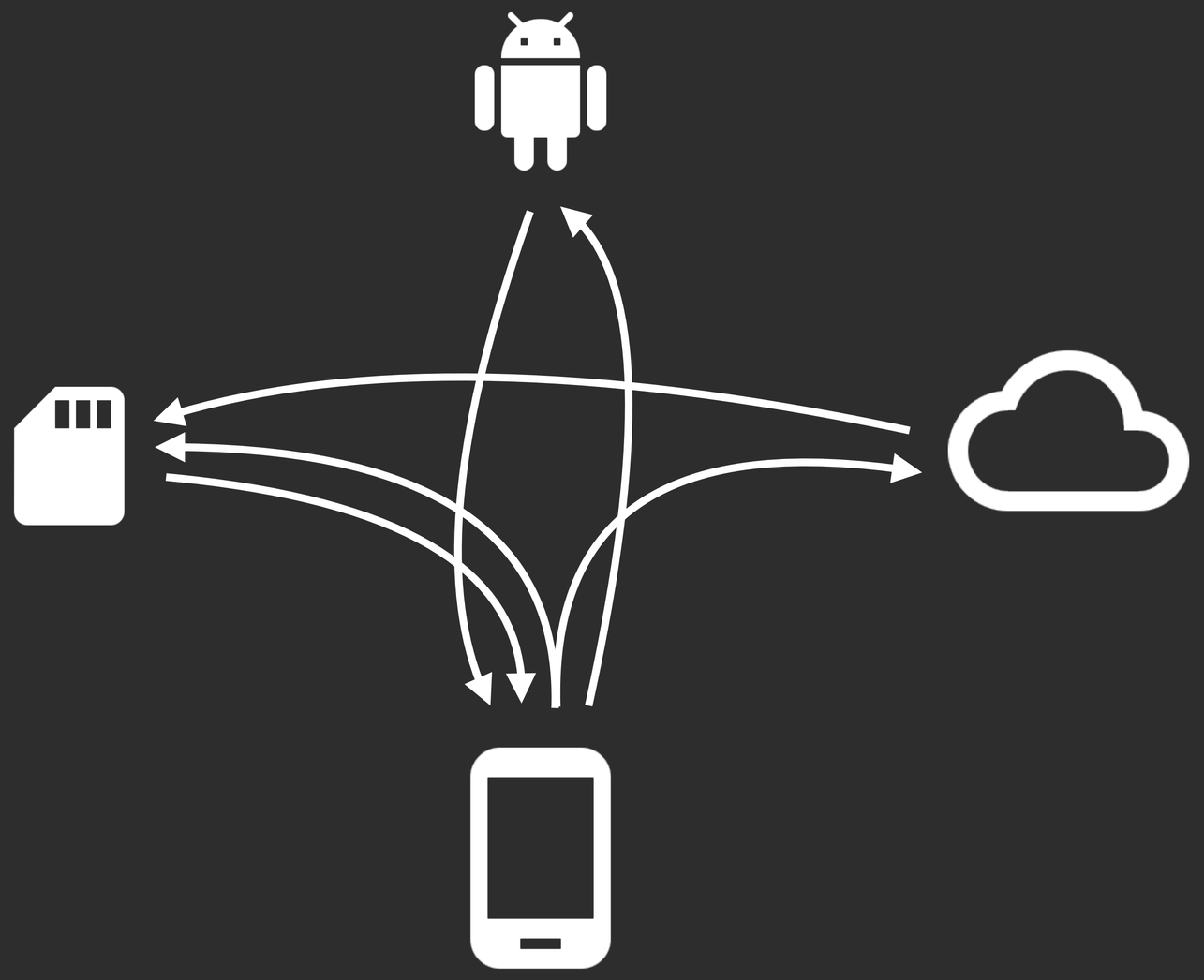

Being Reactive

```
interface UserManager {
  User getUser();
  void setName(String name);
  void setAge(int age);
}
```

Being Reactive

```
interface UserManager {
  Observable<User> getUser();
  void setName(String name);
  void setAge(int age);
}
```

Being Reactive

```
interface UserManager {
  Observable<User> getUser();
  Completable setName(String name);
  Completable setAge(int age);
}
```

Being Reactive

```
um.getUser()
```

Being Reactive

```
um.getUser()
  .observeOn(AndroidSchedulers.mainThread())
```

Being Reactive

```
um.getUser()
  .observeOn(AndroidSchedulers.mainThread())
  .subscribeWith(new DisposableObserver<User>() {
    @Override public void onNext(User user) {
    }
    @Override public void onComplete() { /* ignored */ }
    @Override public void onError(Throwable t) { /* crash or show */ }
  });
```

Being Reactive

```
um.getUser()
  .observeOn(AndroidSchedulers.mainThread())
  .subscribeWith(new DisposableObserver<User>() {
    @Override public void onNext(User user) {
      tv.setText(user.toString());
    }
    @Override public void onComplete() { /* ignored */ }
    @Override public void onError(Throwable t) { /* crash or show */ }
  });
```

Being Reactive

```
disposables.add(um.getUser()
  .observeOn(AndroidSchedulers.mainThread())
  .subscribeWith(new DisposableObserver<User>() {
    @Override public void onNext(User user) {
      tv.setText(user.toString());
    }
    @Override public void onComplete() { /* ignored */ }
    @Override public void onError(Throwable t) { /* crash or show */ }
  }));
```

Being Reactive

```
// onCreate
disposables.add(um.getUser()
  .observeOn(AndroidSchedulers.mainThread())
  .subscribeWith(new DisposableObserver<User>() {
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      tv.setText(user.toString());
    }
    @Override public void onComplete() { /* ignored */ }
    @Override public void onError(Throwable t) { /* crash or show */ }
  }));

// onDestroy
disposables.dispose();
```

Being Reactive

```
um.setName("Jane Doe")
```

Being Reactive

```
um.setName("Jane Doe")
  .subscribeOn(Schedulers.io())
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  .observeOn(AndroidSchedulers.mainThread())
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Being Reactive

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  .subscribeWith(new DisposableCompletableObserver() {
    @Override public void onComplete() {
    }
    @Override public void onError(Throwable t) {
      // retry or show
    }
  });
```

Being Reactive

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um.setName("Jane Doe")
  .subscribeOn(Schedulers.io())
  .observeOn(AndroidSchedulers.mainThread())
  .subscribeWith(new DisposableCompletableObserver() {
    @Override public void onComplete() {
      // success! re-enable editing
    }
    @Override public void onError(Throwable t) {
      // retry or show
    }
  });
```

Being Reactive

```
disposables.add(um.setName("Jane Doe")
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```

Being Reactive

```
// onCreate
disposables.add(um.getUser()
  .observeOn(AndroidSchedulers.mainThread())
  .subscribeWith(new DisposableObserver<User>() {
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      tv.setText(user.toString());
    }
    @Override public void onComplete() { /* ignored */ }
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  }));

// button click listener
disposables.add(um.setName("Jane Doe")
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// onDestroy
disposables.dispose();
```

Push-based updates

Being Reactive

```
// onCreate
disposables.add(um.getUser()
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Push-based updates

Declarative threading

Being Reactive

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Push-based updates

Declarative threading

Easy error-handling

Being Reactive

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Specialized callbacks

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Push-based updates

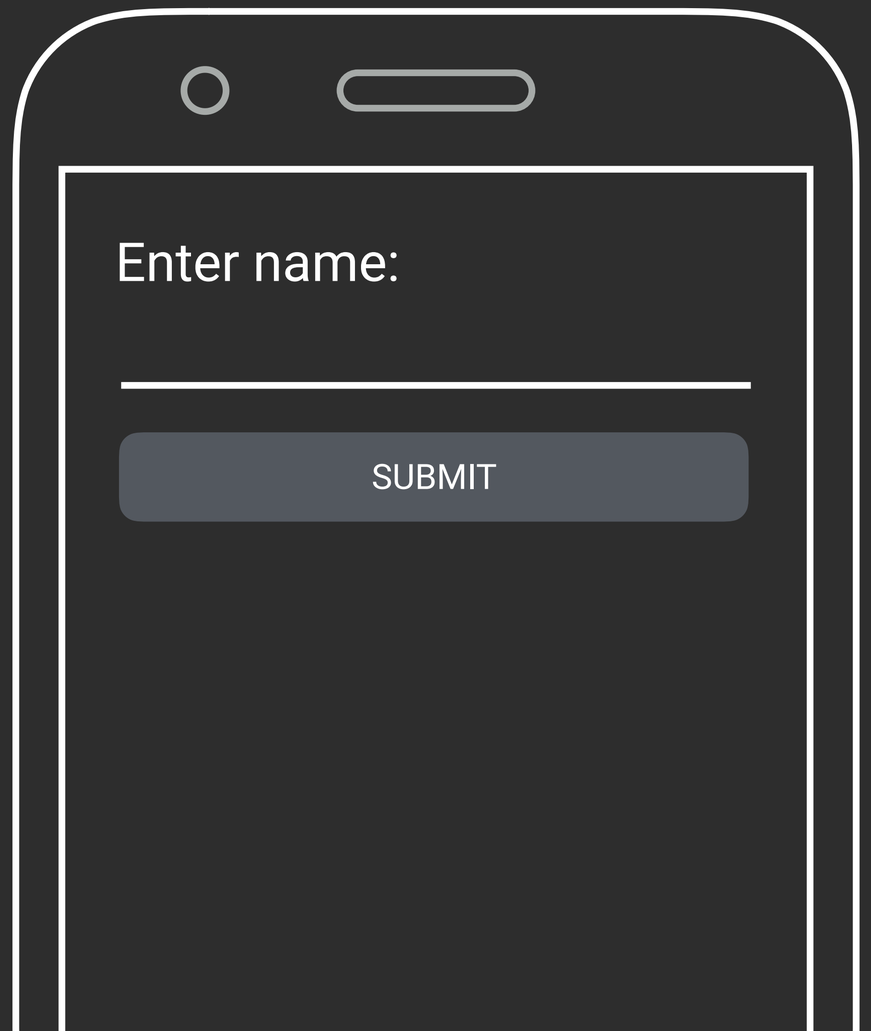
Declarative threading

Easy error-handling

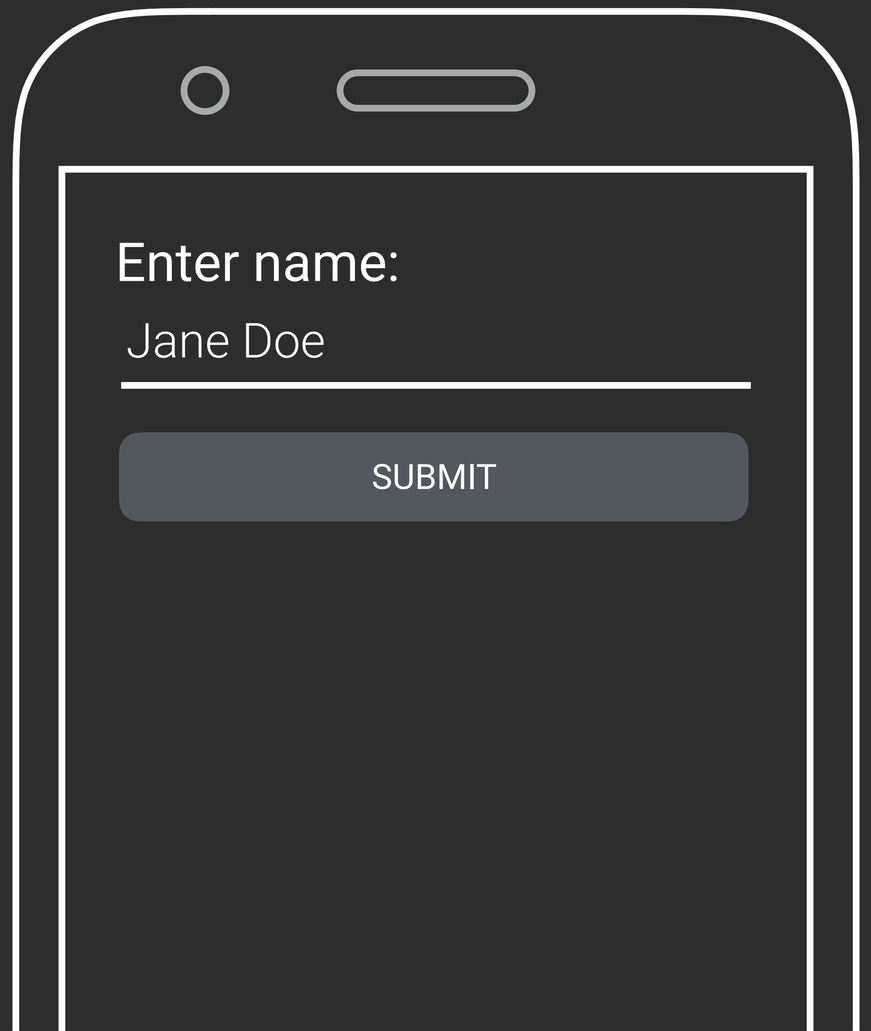
Specialized callbacks

Lifecycle cancelation

Managing State



Managing State



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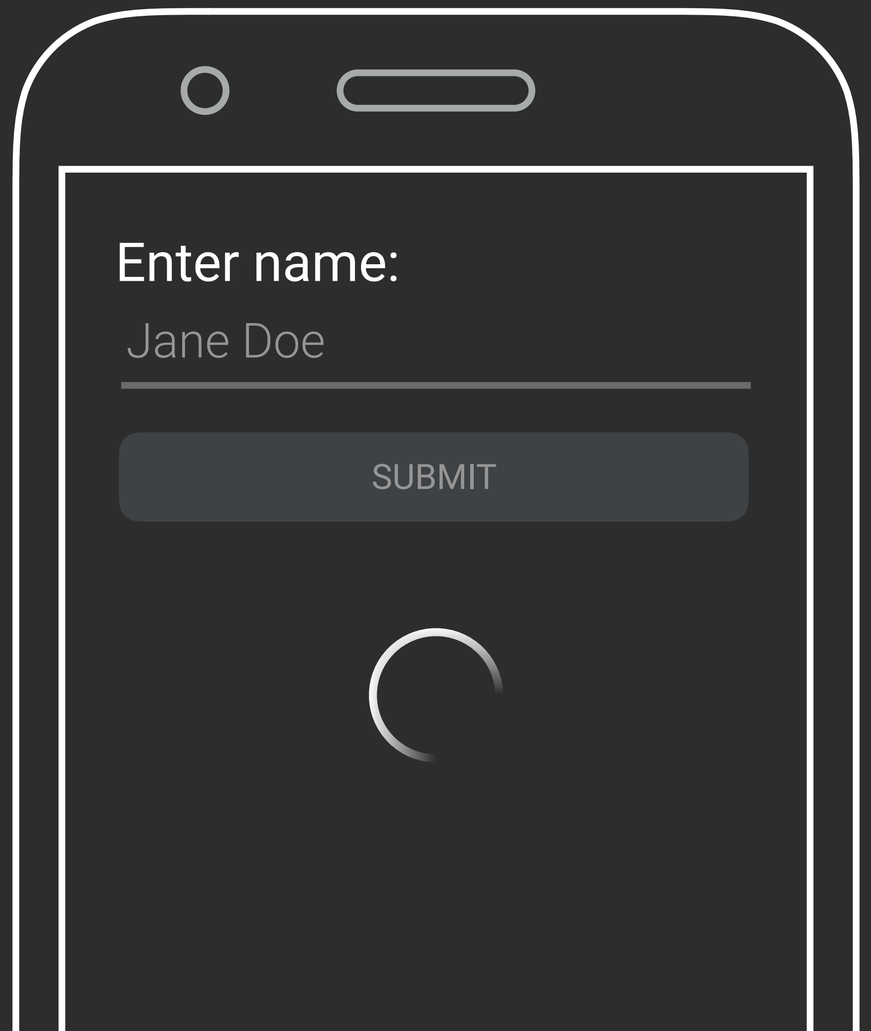

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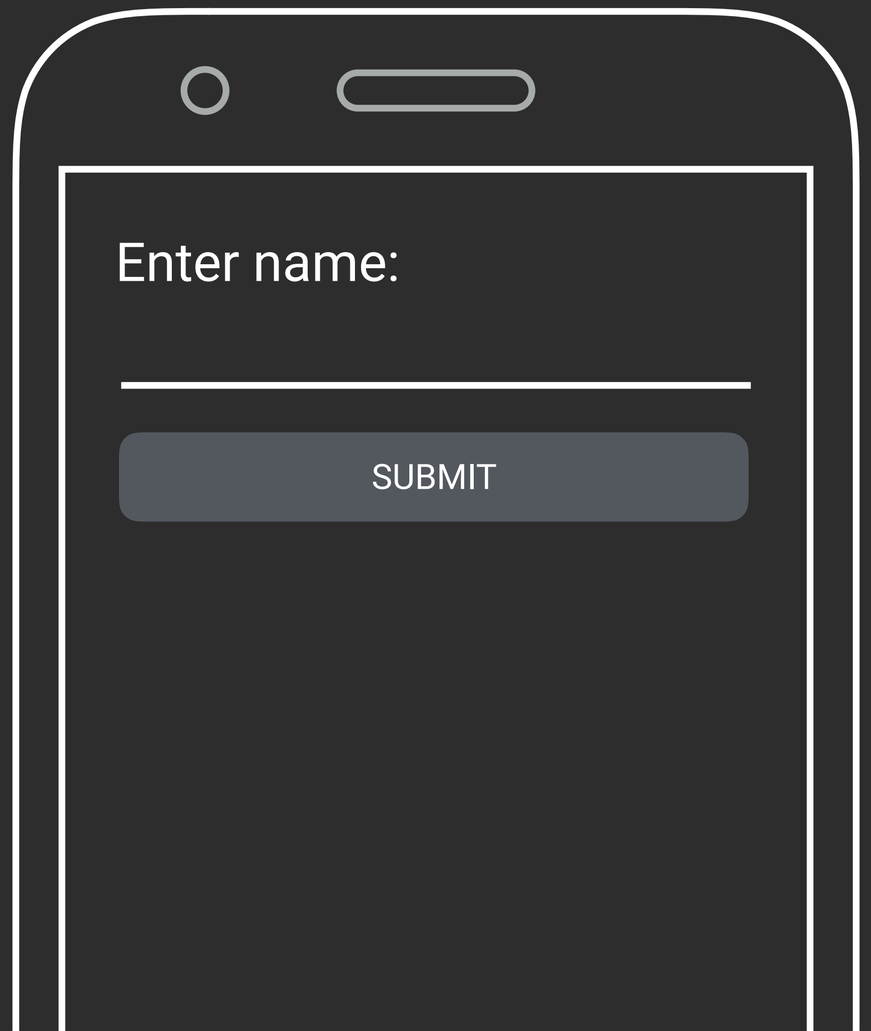

Managing State

```
disposables.add(RxView.clicks(submitView)
    .doOnNext(ignored -> {
      submitView.setEnabled(false);
      progressView.setVisibility(VISIBLE);
    })
    .flatMap(ignored -> service.setName(nameView.getText().toString()))
    .observeOn(AndroidSchedulers.mainThread())
    .doOnNext(ignored -> progressView.setVisibility(GONE))
    .subscribe(s -> finish(), t -> {
      submitView.setEnabled(true);
      Toast.makeText(this, "Failed to set name: " + t.getMessage(),
          LENGTH_SHORT).show();
    }));
```

Managing State

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    .observeOn(AndroidSchedulers.mainThread())
    .doOnNext(ignored -> progressView.setVisibility(GONE))
    .subscribe(s -> finish(), t -> {
      submitView.setEnabled(true);
      Toast.makeText(this, "Failed to set name: " + t.getMessage(),
          LENGTH_SHORT).show();
    }));
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Managing State

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disposables.add(RxView.clicks(submitView)
    .doOnNext(ignored -> {
      submitView.setEnabled(false);
      progressView.setVisibility(VISIBLE);
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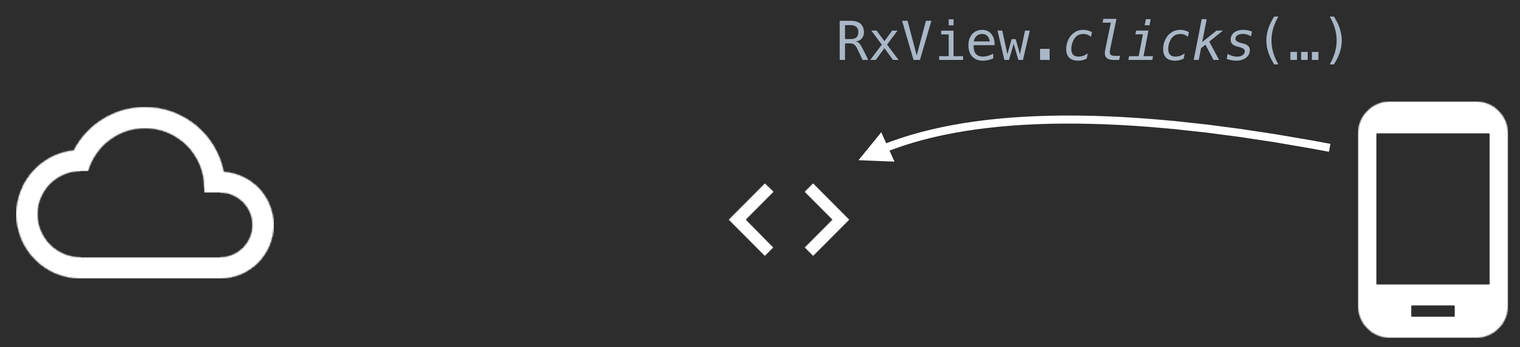
Managing State

Managing State



Managing State

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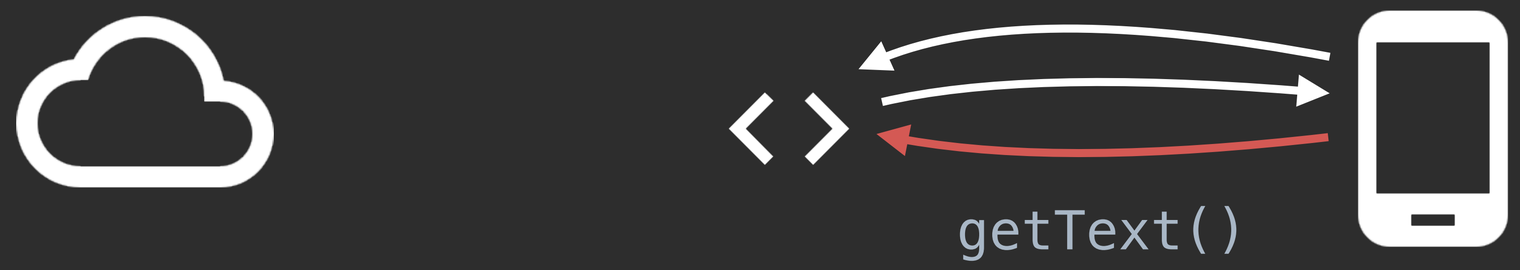

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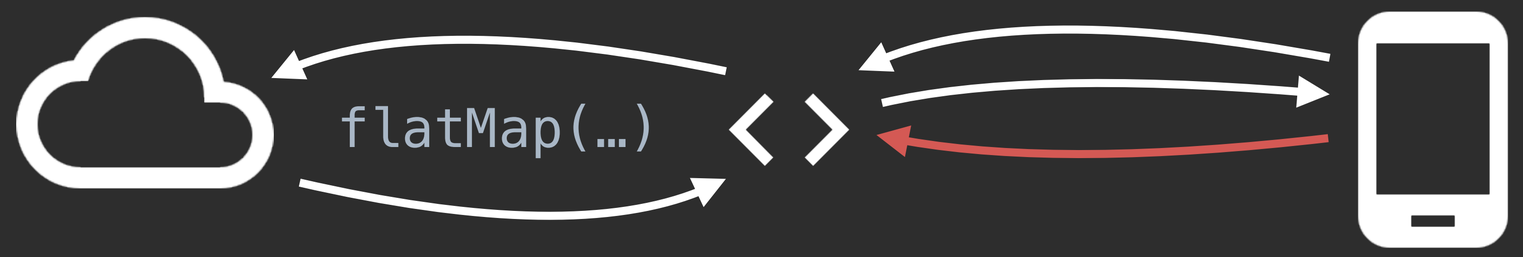

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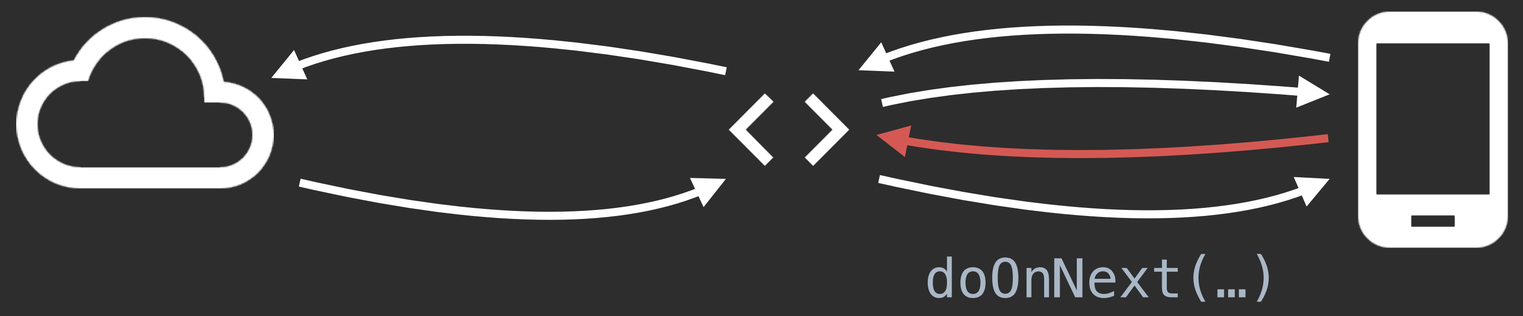

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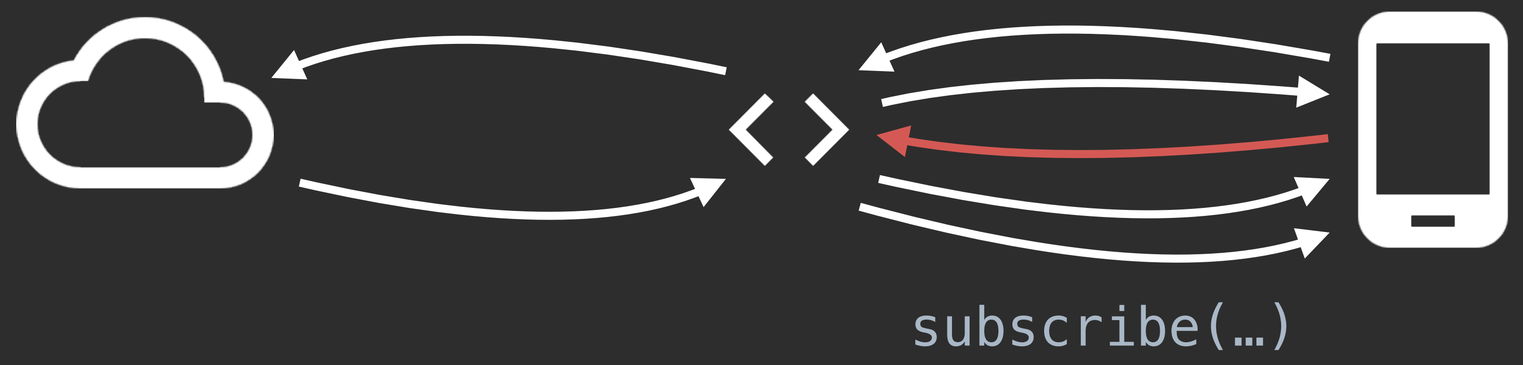

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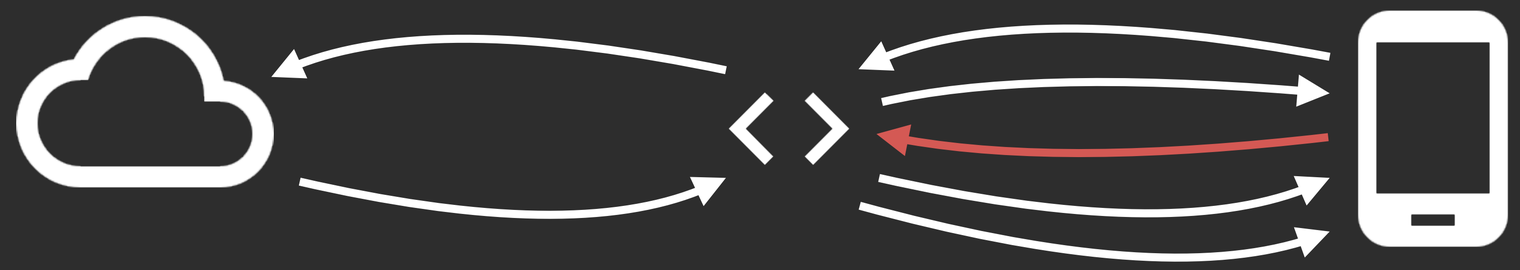

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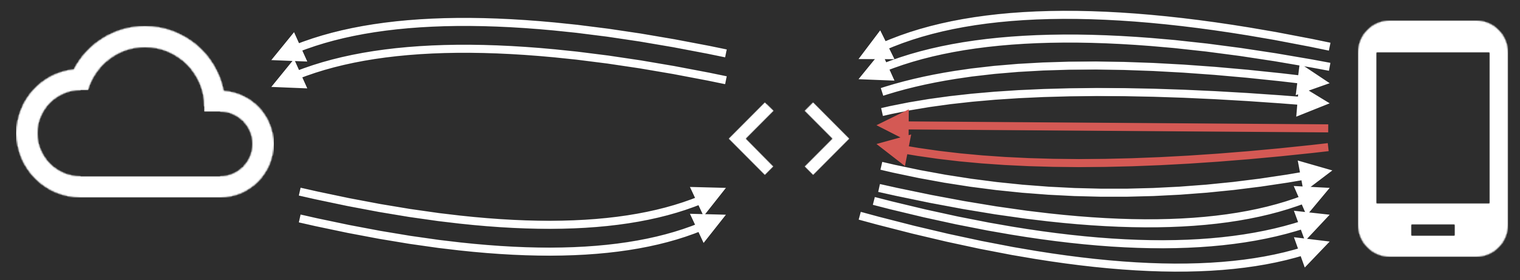

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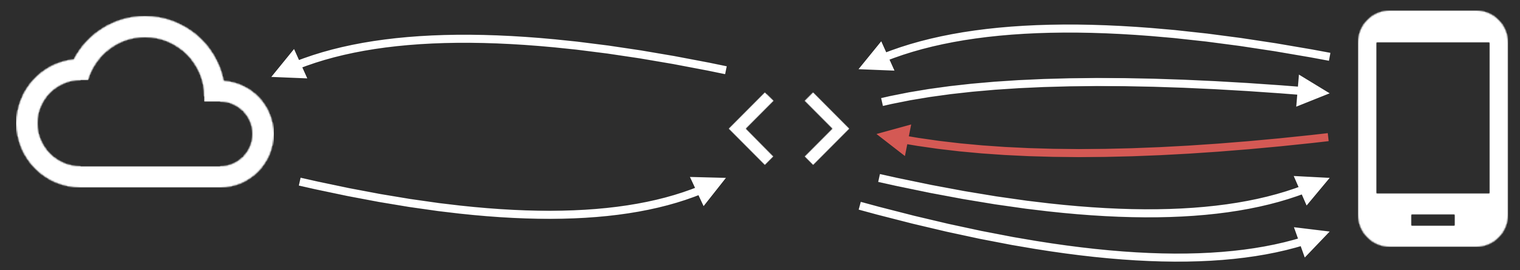

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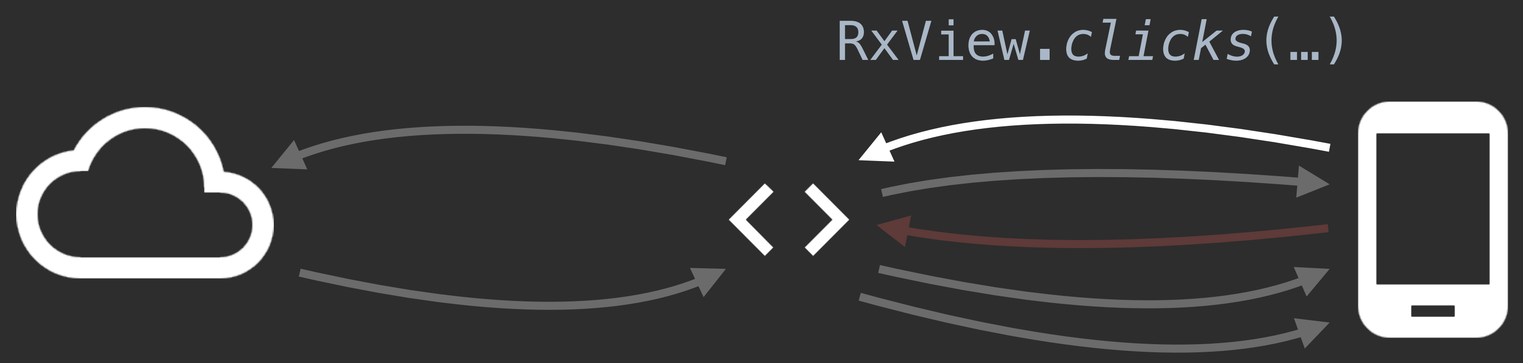

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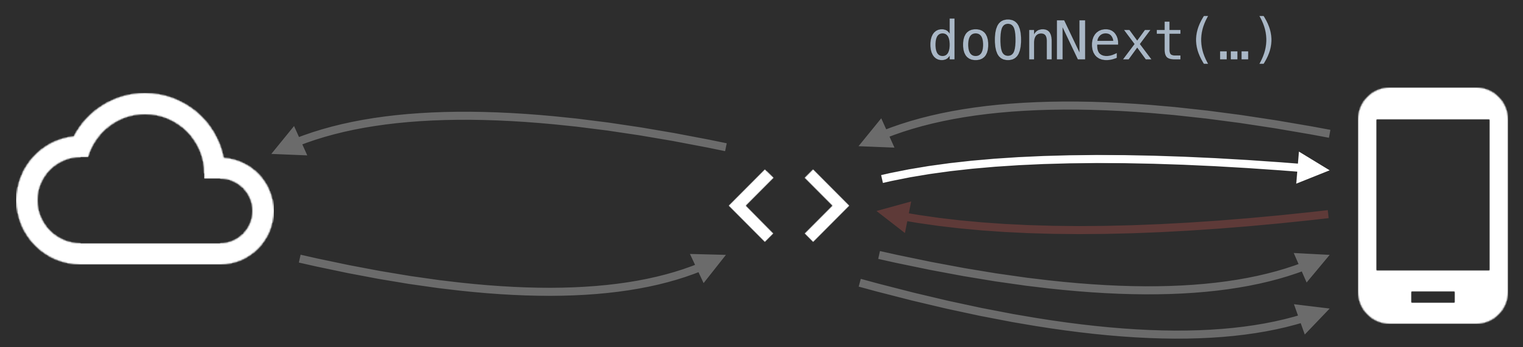

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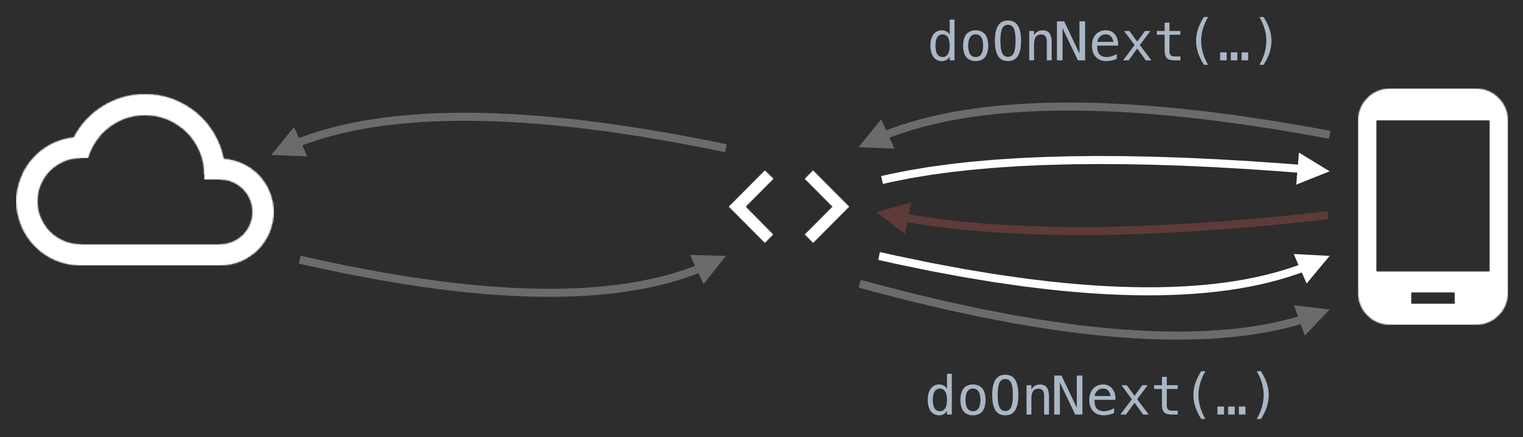

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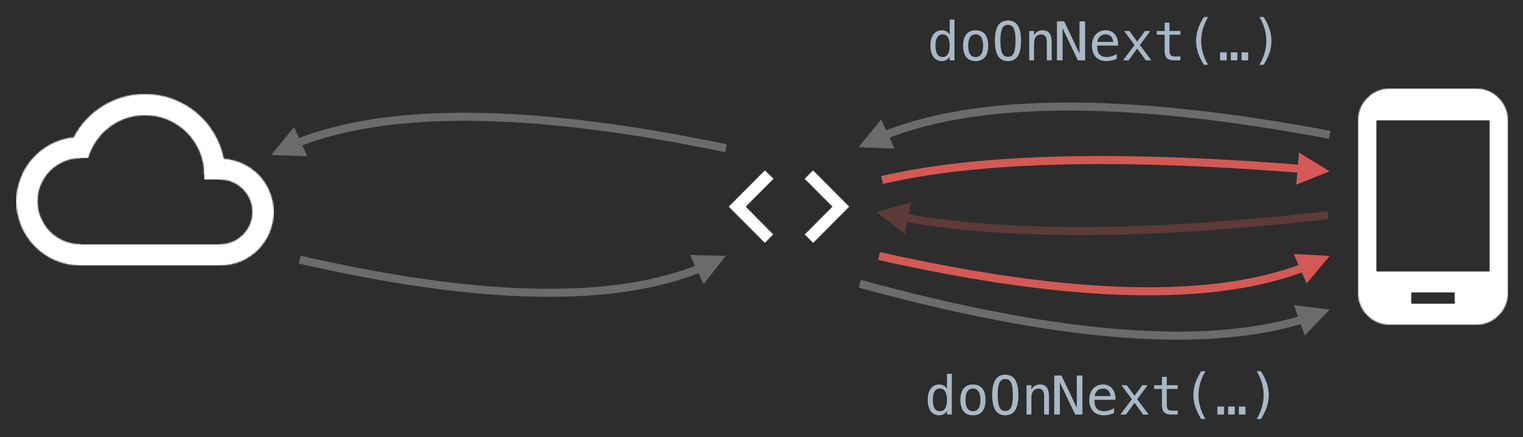

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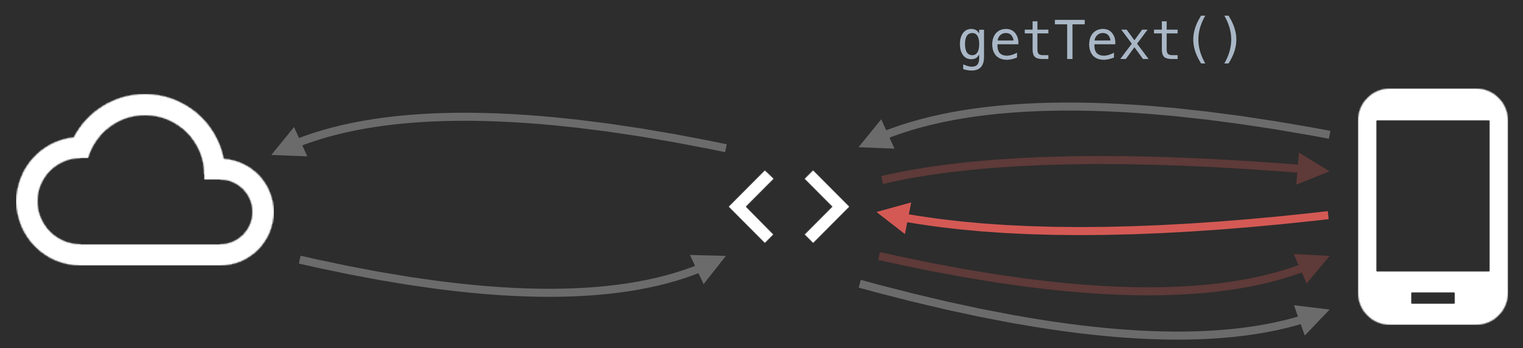

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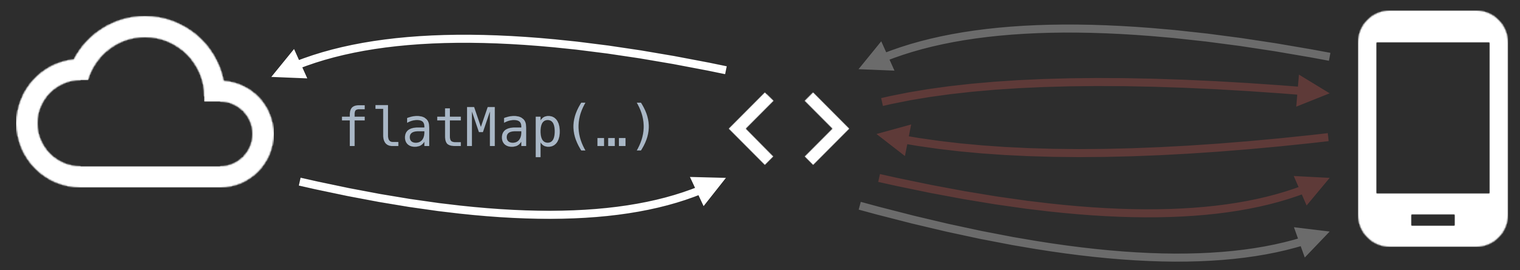

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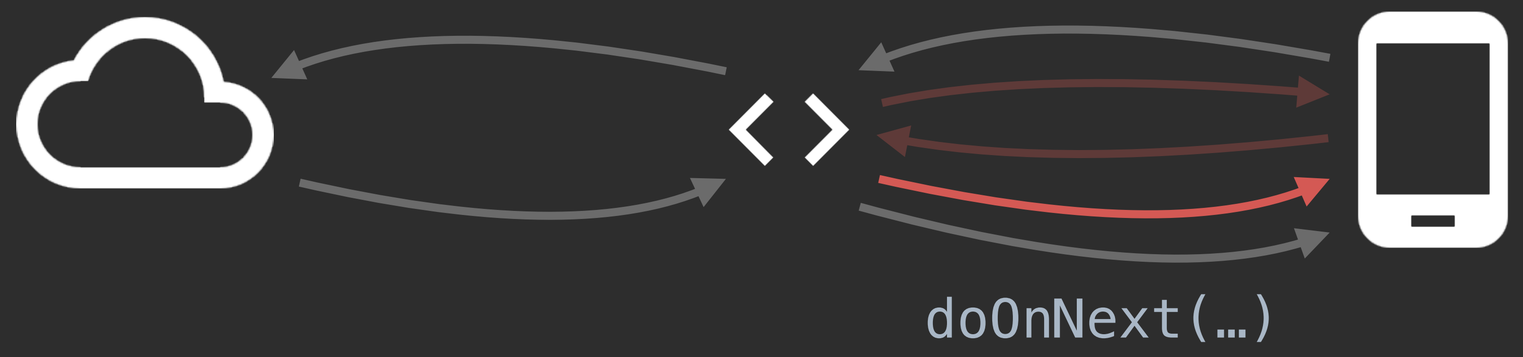

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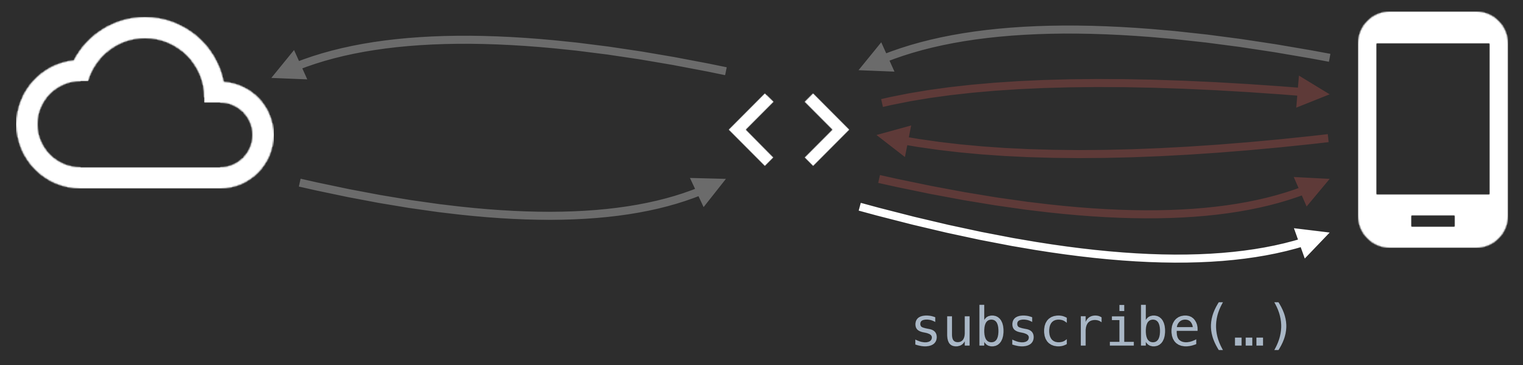

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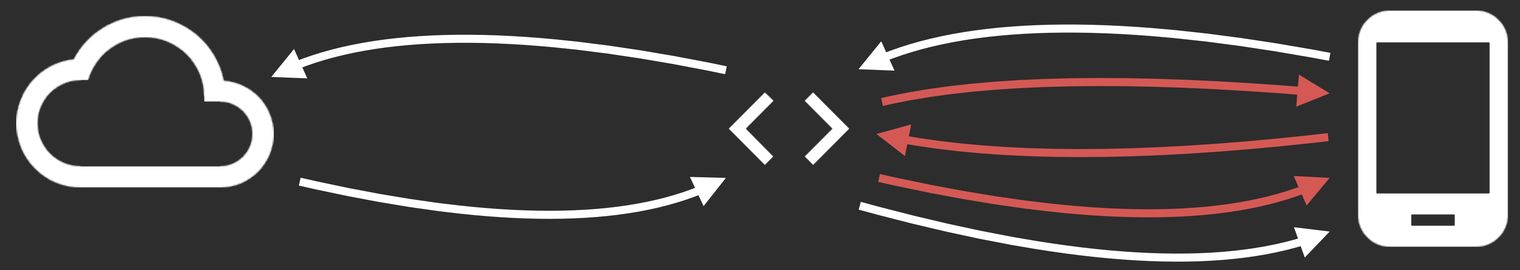

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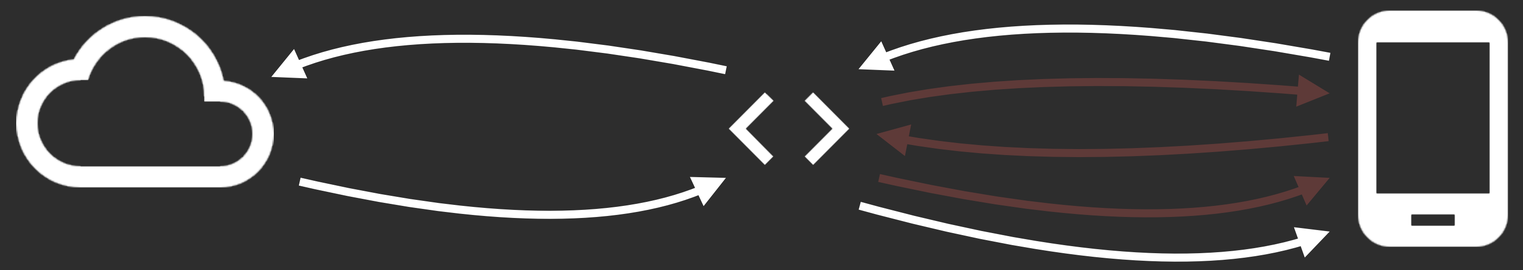

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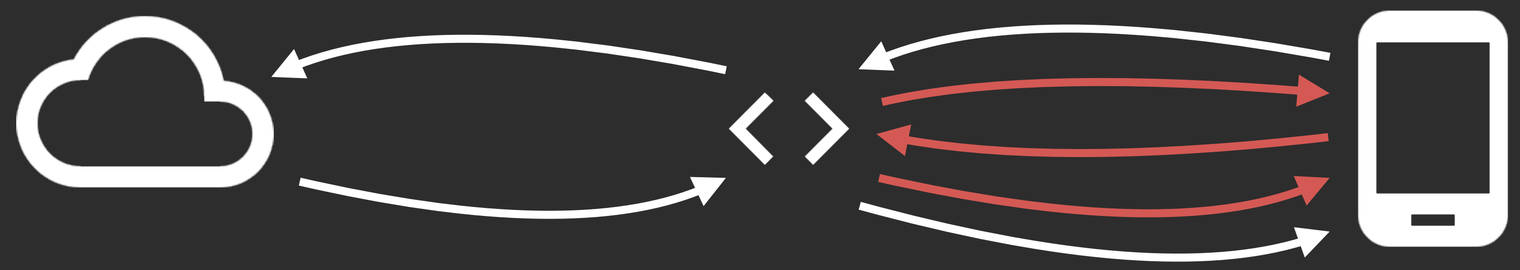

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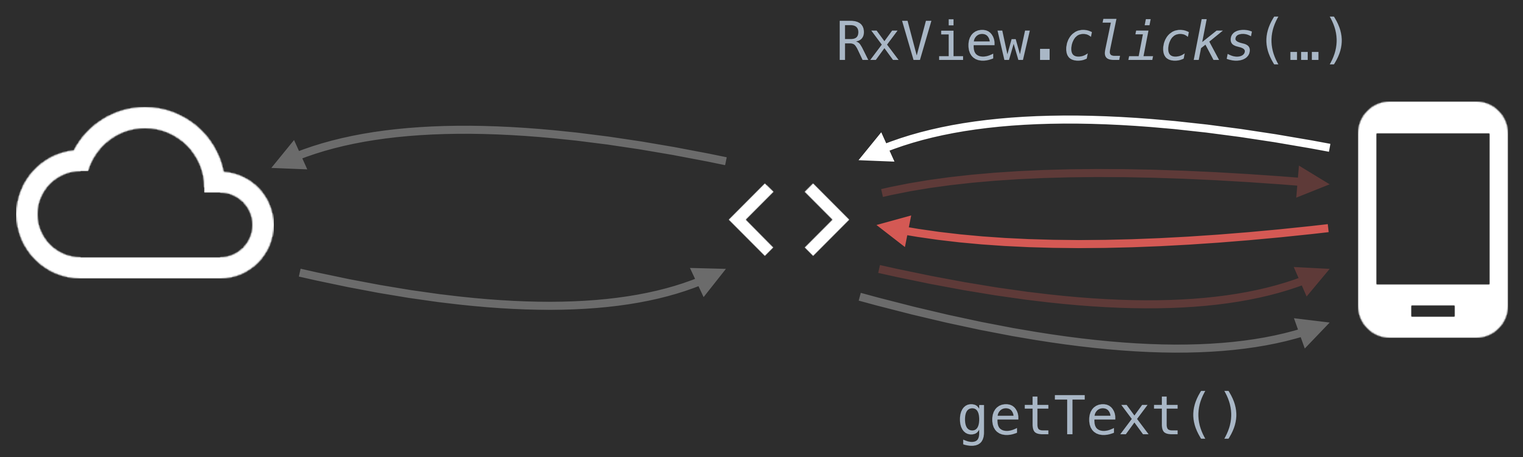

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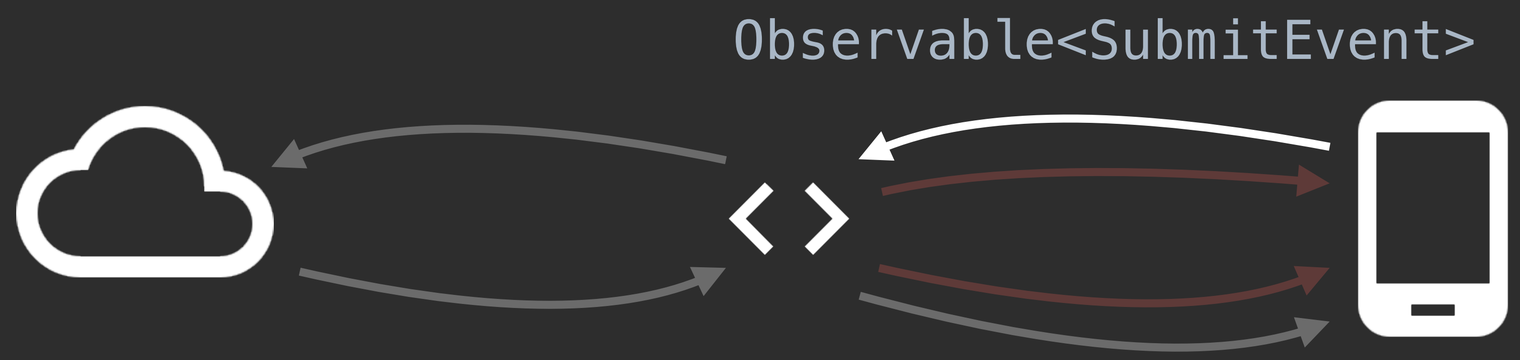

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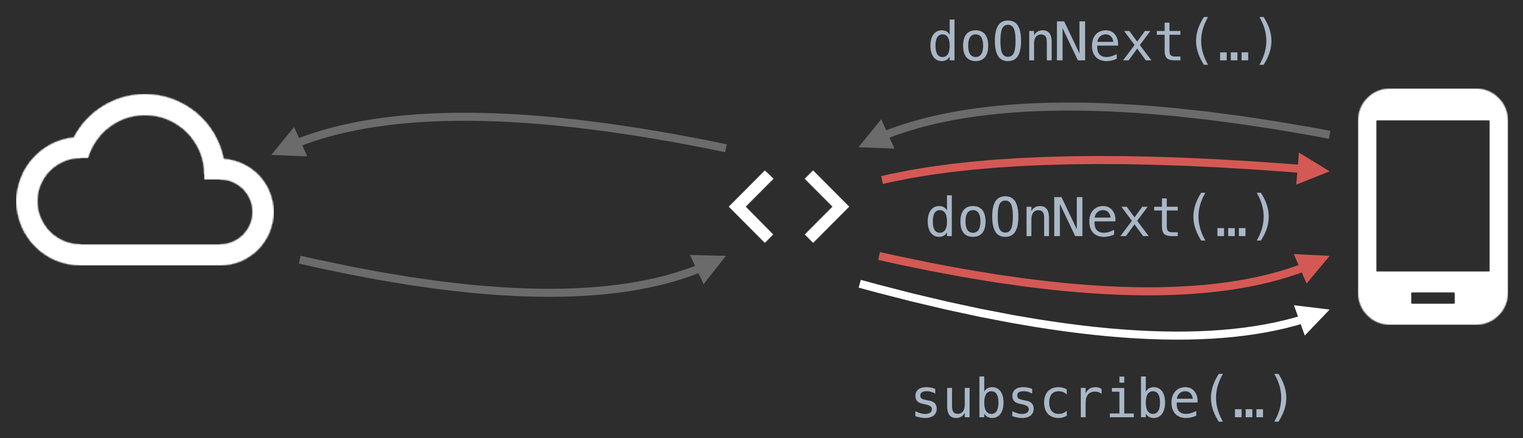

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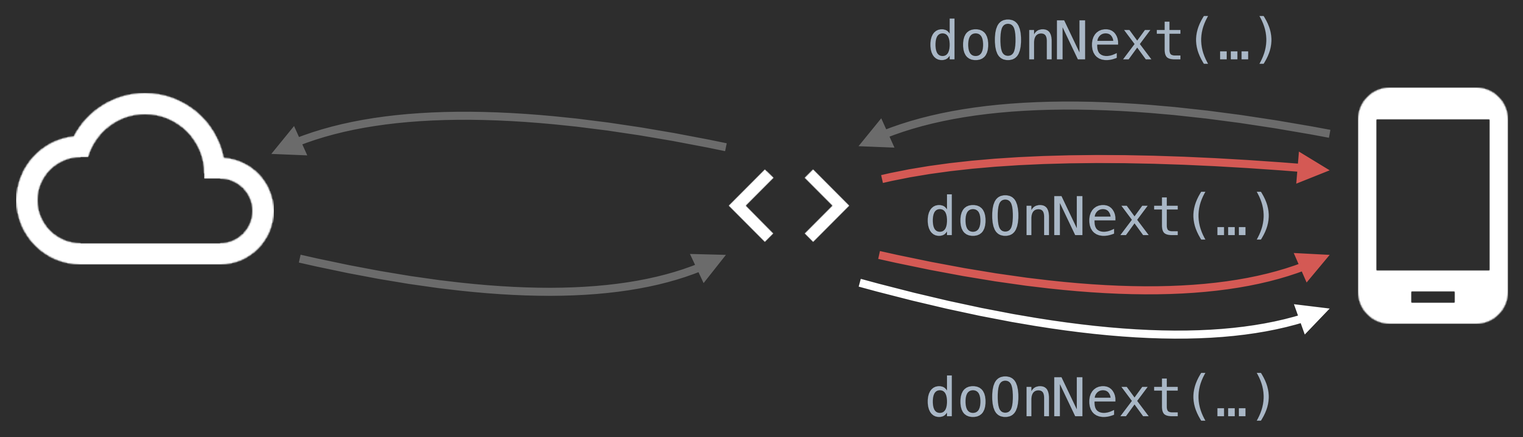

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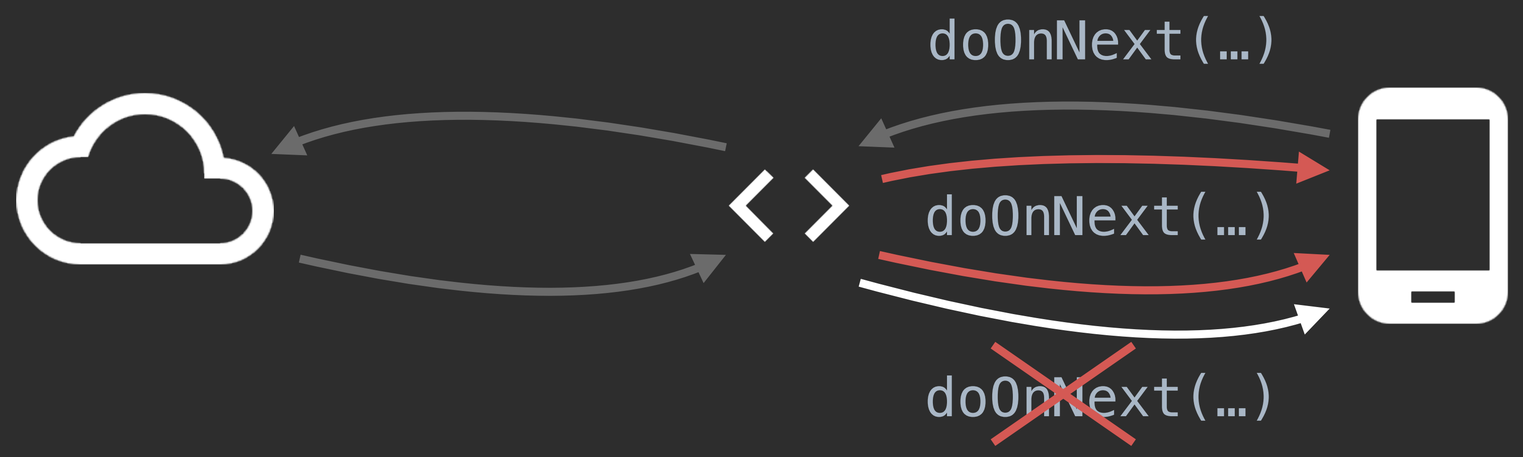

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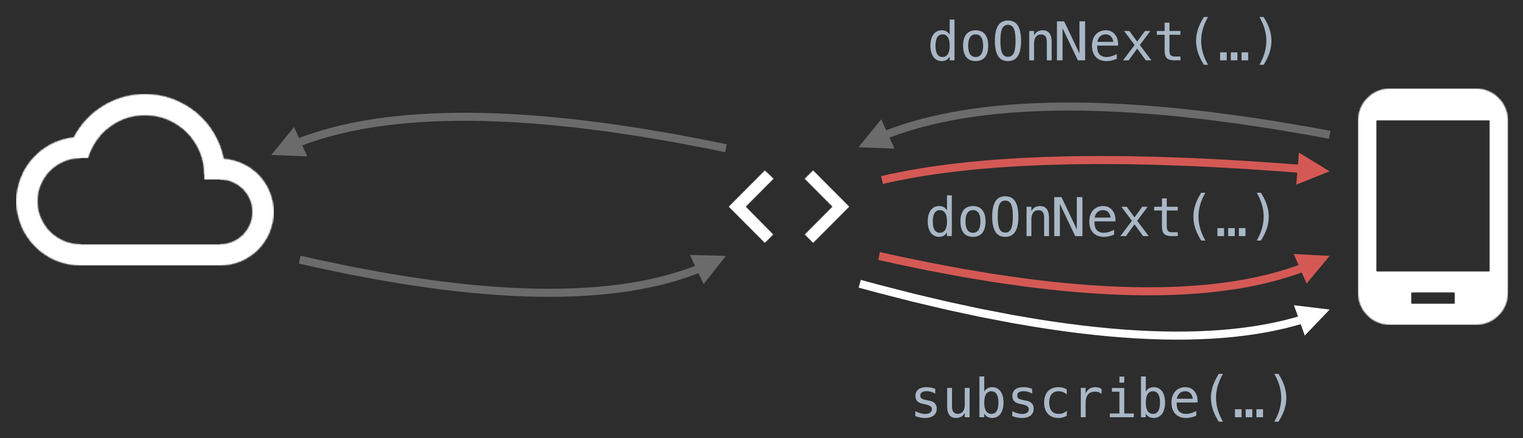

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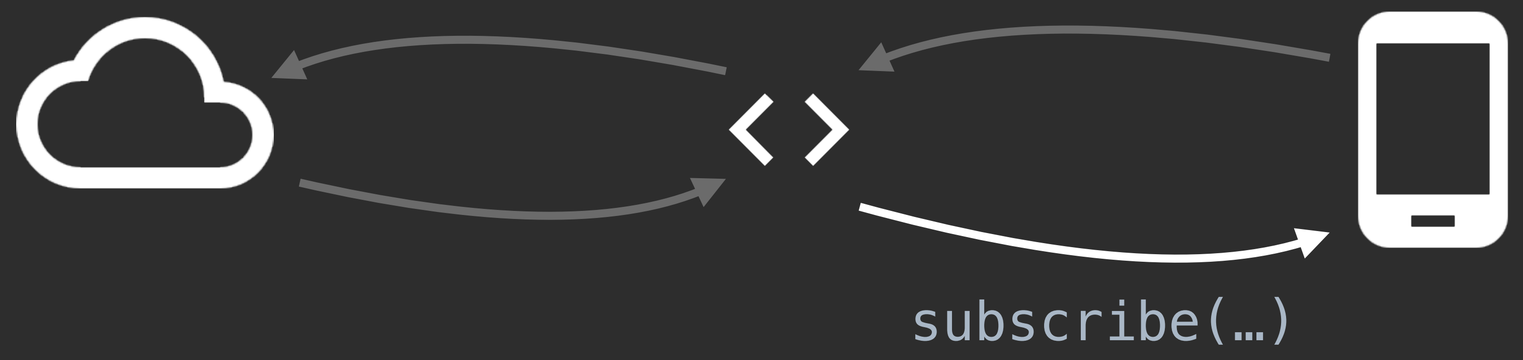

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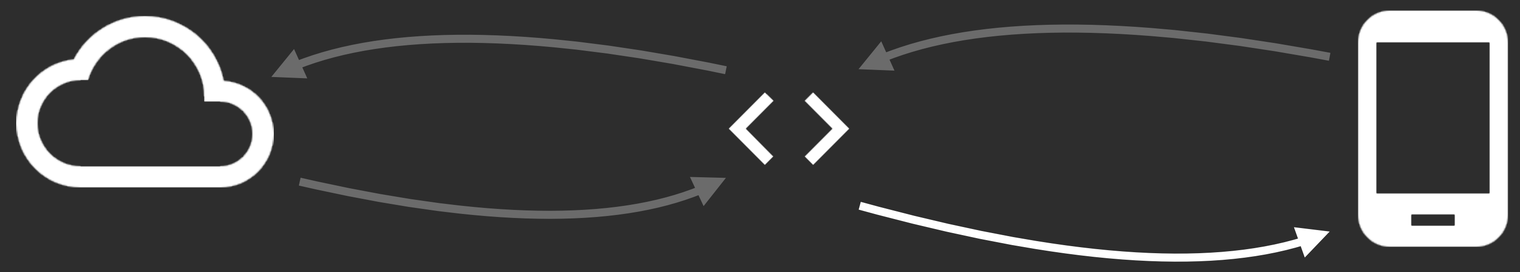
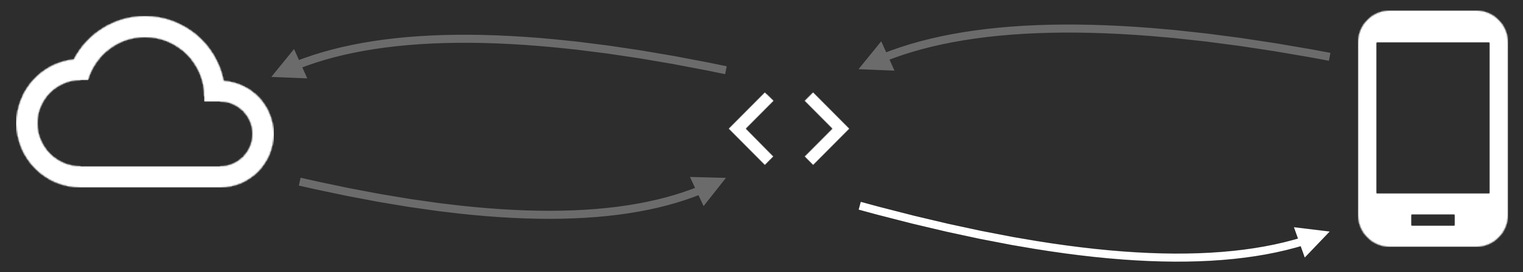


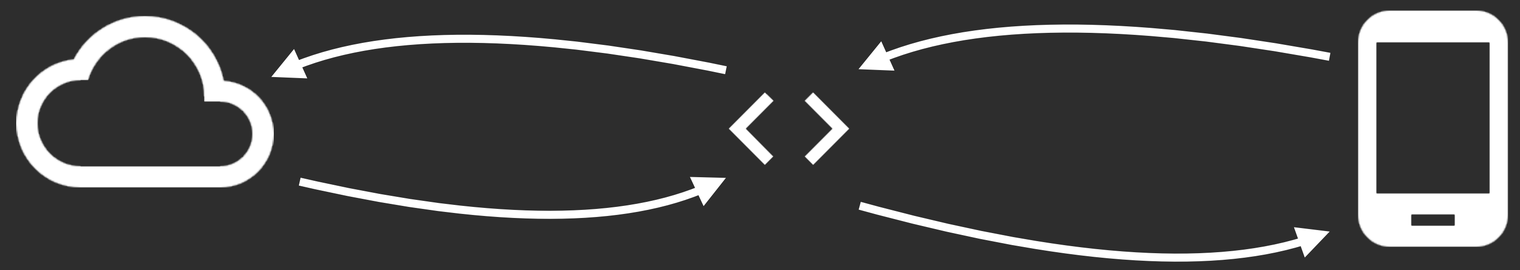
```
subscribe(ignored -> …)
```

Managing State

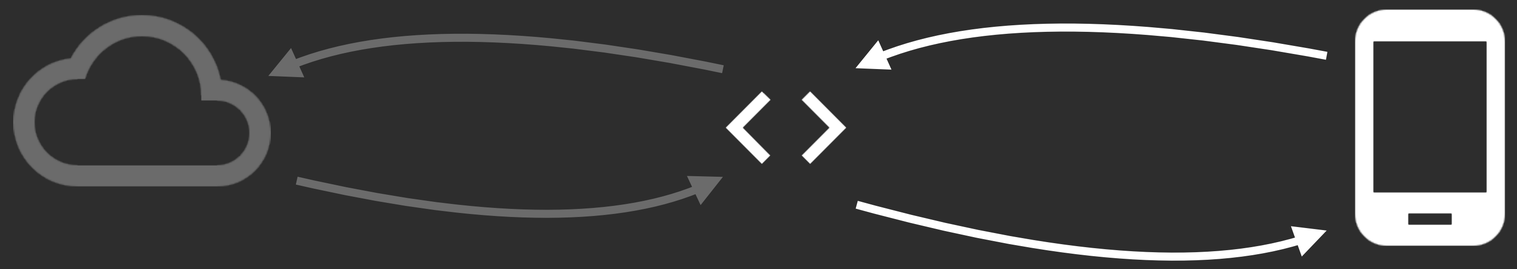


```
subscribe((SubmitUiModel model) -> …)
```

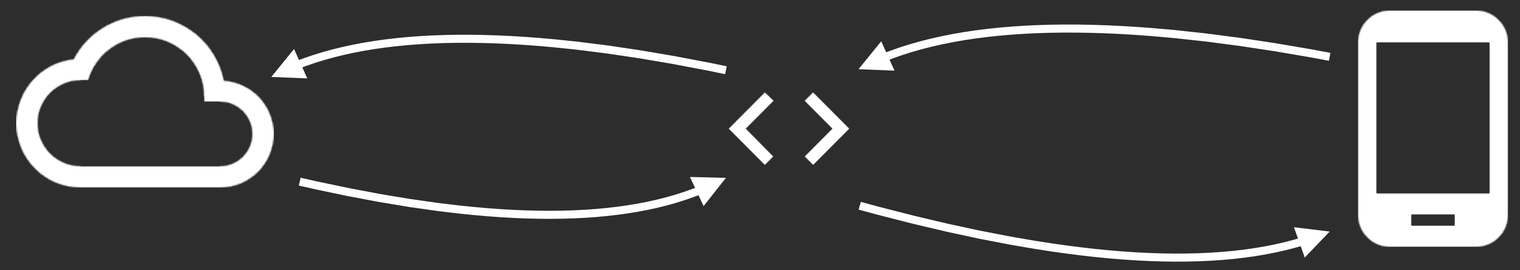
Managing State



Managing State



Reactive State



Reactive State

```
disposables.add(RxView.clicks(submitView)
    .doOnNext(ignored -> {
      submitView.setEnabled(false);
      progressView.setVisibility(VISIBLE);
    })
    .flatMap(ignored -> service.setName(nameView.getText().toString()))
    .observeOn(AndroidSchedulers.mainThread())
    .doOnNext(ignored -> progressView.setVisibility(GONE))
    .subscribe(s -> finish(), t -> {
      submitView.setEnabled(true);
      Toast.makeText(this, "Failed to set name: " + t.getMessage(),
          LENGTH_SHORT).show();
    }));
```

Reactive State

```
disposables.add(RxView.clicks(submitView)
    .doOnNext(ignored -> {
      submitView.setEnabled(false);
      progressView.setVisibility(VISIBLE);
    })
    .flatMap(ignored -> service.setName(nameView.getText().toString()))
    .observeOn(AndroidSchedulers.mainThread())
    .doOnNext(ignored -> progressView.setVisibility(GONE))
    .subscribe(s -> finish(), t -> {
      submitView.setEnabled(true);
      Toast.makeText(this, "Failed to set name: " + t.getMessage(),
          LENGTH_SHORT).show();
    }));
```

Reactive State

```
disposables.add(RxView.clicks(submitView)
    .map(ignored -> nameView.getText().toString())
    .doOnNext(ignored -> {
      submitView.setEnabled(false);
      progressView.setVisibility(VISIBLE);
    })
    .flatMap(name -> service.setName(name))
    .observeOn(AndroidSchedulers.mainThread())
    .doOnNext(ignored -> progressView.setVisibility(GONE))
    .subscribe(s -> finish(), t -> {
      submitView.setEnabled(true);
      Toast.makeText(this, "Failed to set name: " + t.getMessage(),
          LENGTH_SHORT).show();
    }));
```

Reactive State

```
disposables.add(RxView.clicks(submitView)
    .map(ignored -> new SubmitEvent(nameView.getText().toString()))
    .doOnNext(ignored -> {
      submitView.setEnabled(false);
      progressView.setVisibility(VISIBLE);
    })
    .flatMap(event -> service.setName(event.name))
    .observeOn(AndroidSchedulers.mainThread())
    .doOnNext(ignored -> progressView.setVisibility(GONE))
    .subscribe(s -> finish(), t -> {
      submitView.setEnabled(true);
      Toast.makeText(this, "Failed to set name: " + t.getMessage(),
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Reactive State

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      submitView.setEnabled(true);
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          LENGTH_SHORT).show();
    }));
```

Reactive State

```
final class SubmitUiModel {
  final boolean inProgress;
  final boolean success;
  final String errorMessage;

  private SubmitUiModel(
      boolean inProgress, boolean success, String errorMessage) {
    // ...
  }

  static SubmitUiModel inProgress() { /* ... */ }
  static SubmitUiModel success() { /* ... */ }
  static SubmitUiModel failure(String errorMessage) { /* ... */ }
}
```

Reactive State

```
final class SubmitUiModel {
  final boolean inProgress;
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  private SubmitUiModel(
      boolean inProgress, boolean success, String errorMessage) {
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  static SubmitUiModel inProgress() { /* ... */ }
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Reactive State

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          LENGTH_SHORT).show();
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Reactive State

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    .observeOn(AndroidSchedulers.mainThread())
    .doOnNext(ignored -> progressView.setVisibility(GONE))
    .subscribe(s -> finish(), t -> {
      submitView.setEnabled(true);
      Toast.makeText(this, "Failed to set name: " + t.getMessage(),
          LENGTH_SHORT).show();
    }));
```

Reactive State

```
disposables.add(RxView.clicks(submitView)
    .map(ignored -> new SubmitEvent(nameView.getText().toString()))
    .doOnNext(ignored -> {
      SubmitUiModel.inProgress()
    })
    .flatMap(event -> service.setName(event.name))
    .observeOn(AndroidSchedulers.mainThread())
    .doOnNext(ignored -> progressView.setVisibility(GONE))
    .subscribe(s -> finish(), t -> {
      submitView.setEnabled(true);
      Toast.makeText(this, "Failed to set name: " + t.getMessage(),
          LENGTH_SHORT).show();
    }));
```

Reactive State

```
disposables.add(RxView.clicks(submitView)
    .map(ignored -> new SubmitEvent(nameView.getText().toString()))
    .flatMap(event -> service.setName(event.name)
        .startWith(SubmitUiModel.inProgress()))
    .observeOn(AndroidSchedulers.mainThread())
    .doOnNext(ignored -> progressView.setVisibility(GONE))
    .subscribe(s -> finish(), t -> {
      submitView.setEnabled(true);
      Toast.makeText(this, "Failed to set name: " + t.getMessage(),
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    .flatMap(event -> service.setName(event.name)
        .startWith(SubmitUiModel.inProgress()))
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        .startWith(SubmitUiModel.inProgress()))
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      submitView.setEnabled(true);
      Toast.makeText(this, "Failed to set name: " + t.getMessage(),
          LENGTH_SHORT).show();
    }));
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Reactive State

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    .map(ignored -> new SubmitEvent(nameView.getText().toString()))
    .flatMap(event -> service.setName(event.name)
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()))
    .doOnNext(ignored -> progressView.setVisibility(GONE))
    .subscribe(s -> finish(), t -> {
      submitView.setEnabled(true);
      Toast.makeText(this, "Failed to set name: " + t.getMessage(),
          LENGTH_SHORT).show();
    }));
```

Reactive State

```
final class SubmitUiModel {
  final boolean inProgress;
  final boolean success;
  final String errorMessage;

  private SubmitUiModel(
      boolean inProgress, boolean success, String errorMessage) {
    // ...
  }

  static SubmitUiModel inProgress() { /* ... */ }
  static SubmitUiModel success() { /* ... */ }
  static SubmitUiModel failure(String errorMessage) { /* ... */ }
}
```

Reactive State

```
final class SubmitUiModel {
  final boolean inProgress;
  final boolean success;
  final String errorMessage;

  private SubmitUiModel(
      boolean inProgress, boolean success, String errorMessage) {
    // ...
  }

  static SubmitUiModel inProgress() { /* ... */ }
  static SubmitUiModel success() { /* ... */ }
  static SubmitUiModel failure(String errorMessage) { /* ... */ }
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Reactive State

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    .map(ignored -> new SubmitEvent(nameView.getText().toString()))
    .flatMap(event -> service.setName(event.name)
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()))
    .doOnNext(ignored -> progressView.setVisibility(GONE))
    .subscribe(s -> finish(), t -> {
      submitView.setEnabled(true);
      Toast.makeText(this, "Failed to set name: " + t.getMessage(),
          LENGTH_SHORT).show();
    }));
```

Reactive State

```
disposables.add(RxView.clicks(submitView)
    .map(ignored -> new SubmitEvent(nameView.getText().toString()))
    .flatMap(event -> service.setName(event.name)
        .map(response -> SubmitUiModel.success())
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()))
    .subscribe(s -> finish(), t -> {
      submitView.setEnabled(true);
      Toast.makeText(this, "Failed to set name: " + t.getMessage(),
          LENGTH_SHORT).show();
    }));
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Reactive State

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disposables.add(RxView.clicks(submitView)
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    .flatMap(event -> service.setName(event.name)
        .map(response -> SubmitUiModel.success())
        .onErrorReturn(t -> SubmitUiModel.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()))
    .subscribe(s -> finish(), t -> {}));
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disposables.add(RxView.clicks(submitView)
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    .flatMap(event -> service.setName(event.name)
        .map(response -> SubmitUiModel.success())
        .onErrorReturn(t -> SubmitUiModel.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()))
    .subscribe(s -> finish(), t -> {}));
```

Reactive State

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disposables.add(RxView.clicks(submitView)
    .map(ignored -> new SubmitEvent(nameView.getText().toString()))
    .flatMap(event -> service.setName(event.name)
        .map(response -> SubmitUiModel.success())
        .onErrorReturn(t -> SubmitUiModel.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
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    .subscribe(s -> finish(), t -> {}));
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Reactive State

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    .map(ignored -> new SubmitEvent(nameView.getText().toString()))
    .flatMap(event -> service.setName(event.name)
        .map(response -> SubmitUiModel.success())
        .onErrorReturn(t -> SubmitUiModel.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()))
    .subscribe(model -> {
      submitView.setEnabled(!model.inProgress);
      progressView.setVisibility(model.inProgress ? VISIBLE : GONE);
      if (!model.inProgress) {
        if (model.success) finish()
        else Toast.makeText(this, "Failed to set name: "
          + model.errorMessage, LENGTH_SHORT).show();
      }
    }, t -> {}));
```

Reactive State

```
disposables.add(RxView.clicks(submitView)
    .map(ignored -> new SubmitEvent(nameView.getText().toString()))
    .flatMap(event -> service.setName(event.name)
        .map(response -> SubmitUiModel.success())
        .onErrorReturn(t -> SubmitUiModel.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()))
    .subscribe(model -> {
      submitView.setEnabled(!model.inProgress);
      progressView.setVisibility(model.inProgress ? VISIBLE : GONE);
      if (!model.inProgress) {
        if (model.success) finish()
        else Toast.makeText(this, "Failed to set name: "
          + model.errorMessage, LENGTH_SHORT).show();
      }
    }, t -> {}));
```

Reactive State

```
disposables.add(RxView.clicks(submitView)
    .map(ignored -> new SubmitEvent(nameView.getText().toString()))
    .flatMap(event -> service.setName(event.name)
        .map(response -> SubmitUiModel.success())
        .onErrorReturn(t -> SubmitUiModel.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()))
    .subscribe(model -> {
      submitView.setEnabled(!model.inProgress);
      progressView.setVisibility(model.inProgress ? VISIBLE : GONE);
      if (!model.inProgress) {
        if (model.success) finish()
        else Toast.makeText(this, "Failed to set name: "
          + model.errorMessage, LENGTH_SHORT).show();
      }
    }, t -> { throw new OnErrorNotImplementedException(t); }));
```

Reactive State

```
disposables.add(RxView.clicks(submitView)
    .map(ignored -> new SubmitEvent(nameView.getText().toString()))
    .flatMap(event -> service.setName(event.name)
        .map(response -> SubmitUiModel.success())
        .onErrorReturn(t -> SubmitUiModel.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()))
    .subscribe(model -> {
      submitView.setEnabled(!model.inProgress);
      progressView.setVisibility(model.inProgress ? VISIBLE : GONE);
      if (!model.inProgress) {
        if (model.success) finish()
        else Toast.makeText(this, "Failed to set name: "
          + model.errorMessage, LENGTH_SHORT).show();
      }
    }, t -> { throw new OnErrorNotImplementedException(t); }));
```

Reactive State

```
Observable<SubmitEvent> events = RxView.clicks(submitView)
    .map(ignored -> new SubmitEvent(nameView.getText().toString()));

disposables.add(events.flatMap(event -> service.setName(event.name)
        .map(response -> SubmitUiModel.success())
        .onErrorReturn(t -> SubmitUiModel.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()))
    .subscribe(model -> {
      submitView.setEnabled(!model.inProgress);
      progressView.setVisibility(model.inProgress ? VISIBLE : GONE);
      if (!model.inProgress) {
        if (model.success) finish()
        else Toast.makeText(this, "Failed to set name: "
          + model.errorMessage, LENGTH_SHORT).show();
      }
    }, t -> { throw new OnErrorNotImplementedException(t); }));
```

Reactive State

```
Observable<SubmitEvent> events = RxView.clicks(submitView)
    .map(ignored -> new SubmitEvent(nameView.getText().toString()));

Observable<SubmitUiModel> models = events
    .flatMap(event -> service.setName(event.name)
        .map(response -> SubmitUiModel.success())
        .onErrorReturn(t -> SubmitUiModel.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()));

disposables.add(models.subscribe(model -> {
      submitView.setEnabled(!model.inProgress);
      progressView.setVisibility(model.inProgress ? VISIBLE : GONE);
      if (!model.inProgress) {
        if (model.success) finish()
        else Toast.makeText(this, "Failed to set name: "
          + model.errorMessage, LENGTH_SHORT).show();
      }
    }, t -> { throw new OnErrorNotImplementedException(t); }));
```

Reactive State

```
Observable<SubmitEvent> events = RxView.clicks(submitView)
    .map(ignored -> new SubmitEvent(nameView.getText().toString()));

ObservableTransformer<SubmitEvent, SubmitUiModel> submit = events -> events
    .flatMap(event -> service.setName(event.name)
        .map(response -> SubmitUiModel.success())
        .onErrorReturn(t -> SubmitUiModel.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()));

disposables.add(events.compose(submit).subscribe(model -> {
      submitView.setEnabled(!model.inProgress);
      progressView.setVisibility(model.inProgress ? VISIBLE : GONE);
      if (!model.inProgress) {
        if (model.success) finish()
        else Toast.makeText(this, "Failed to set name: "
          + model.errorMessage, LENGTH_SHORT).show();
      }
    }, t -> { throw new OnErrorNotImplementedException(t); }));
```

Reactive State

```
Observable<SubmitEvent> events = RxView.clicks(submitView)
    .map(ignored -> new SubmitEvent(nameView.getText().toString()));

ObservableTransformer<SubmitEvent, SubmitUiModel> submit = events -> events
    .flatMap(event -> service.setName(event.name)
        .map(response -> SubmitUiModel.success())
        .onErrorReturn(t -> SubmitUiModel.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()));

disposables.add(events.compose(submit).subscribe(model -> {
      submitView.setEnabled(!model.inProgress);
      progressView.setVisibility(model.inProgress ? VISIBLE : GONE);
      if (!model.inProgress) {
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        else Toast.makeText(this, "Failed to set name: "
          + model.errorMessage, LENGTH_SHORT).show();
      }
    }, t -> { throw new OnErrorNotImplementedException(t); }));
```
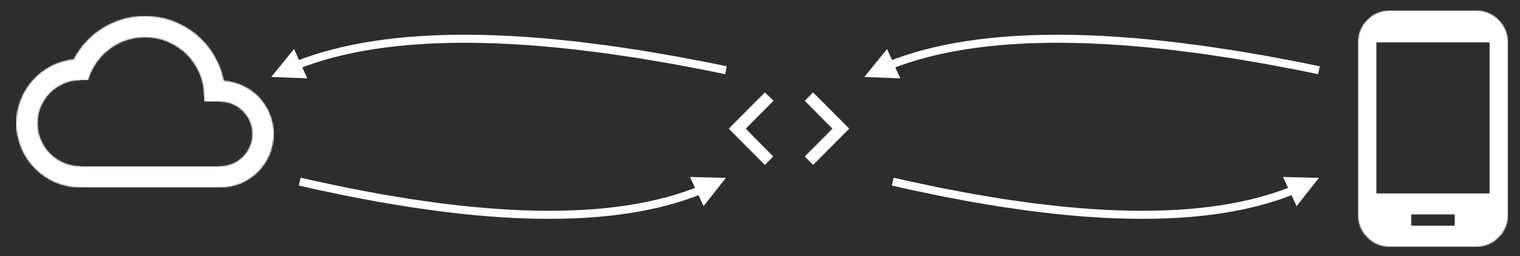
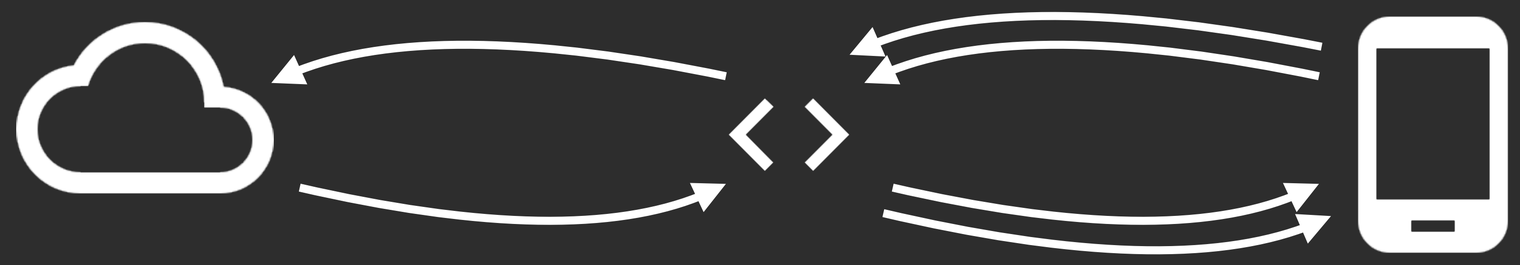

Reactive State

```
ObservableTransformer<SubmitEvent, SubmitUiModel> submit = events -> events
    .flatMap(event -> service.setName(event.name)
        .map(response -> SubmitUiModel.success())
        .onErrorReturn(t -> SubmitUiModel.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()));

disposables.add(RxView.clicks(submitView)
    .map(ignored -> new SubmitEvent(nameView.getText().toString()));
    .compose(submit)
    .subscribe(model -> {
      submitView.setEnabled(!model.inProgress);
      progressView.setVisibility(model.inProgress ? VISIBLE : GONE);
      if (!model.inProgress) {
        if (model.success) finish()
        else Toast.makeText(this, "Failed to set name: "
          + model.errorMessage, LENGTH_SHORT).show();
      }
    }, t -> { throw new OnErrorNotImplementedException(t); }));
```

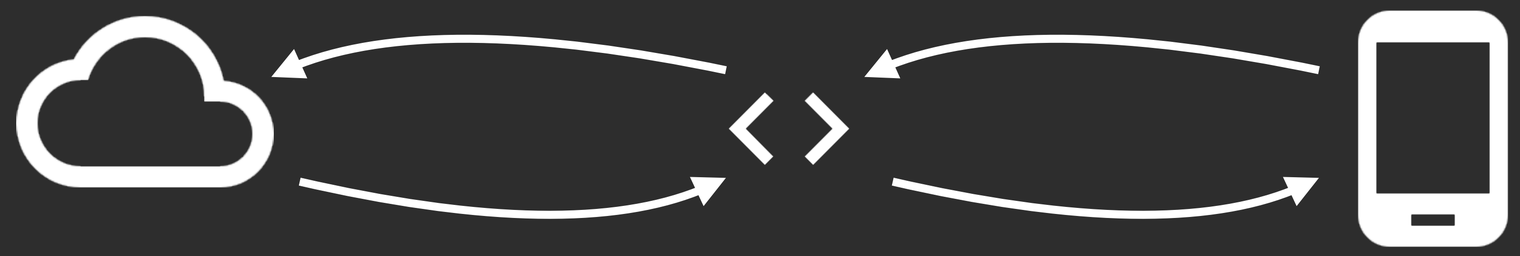
Reactive State



Reactive State



Reactive State



Reactive State

```
ObservableTransformer<SubmitEvent, SubmitUiModel> submit = events -> events
    .flatMap(event -> service.setName(event.name)
        .map(response -> SubmitUiModel.success())
        .onErrorReturn(t -> SubmitUiModel.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()));

disposables.add(RxView.clicks(submitView)
    .map(ignored -> new SubmitEvent(nameView.getText().toString()));
    .compose(submit)
    .subscribe(model -> {
      submitView.setEnabled(!model.inProgress);
      progressView.setVisibility(model.inProgress ? VISIBLE : GONE);
      if (!model.inProgress) {
        if (model.success) finish()
        else Toast.makeText(this, "Failed to set name: " + model.message,
          LENGTH_SHORT).show();
      }
    }, t -> { throw new OnErrorNotImplementedException(t); }));
```

Reactive State

```
Observable<SubmitEvent> events = RxView.clicks(submitView)
    .map(ignored -> new SubmitEvent(nameView.getText().toString()));

ObservableTransformer<SubmitEvent, SubmitUiModel> submit = events -> events
    .flatMap(event -> service.setName(event.name)
        .map(response -> SubmitUiModel.success())
        .onErrorReturn(t -> SubmitUiModel.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()));

disposables.add(events.compose(submit).subscribe(model -> {
      submitView.setEnabled(!model.inProgress);
      progressView.setVisibility(model.inProgress ? VISIBLE : GONE);
      if (!model.inProgress) {
        if (model.success) finish()
        else Toast.makeText(this, "Failed to set name: " + model.message,
          LENGTH_SHORT).show();
      }
    }, t -> { throw new OnErrorNotImplementedException(t); }));
```

Reactive State

```
Observable<SubmitEvent> events = RxView.clicks(submitView)
    .map(ignored -> new SubmitEvent(nameView.getText().toString()));

ObservableTransformer<SubmitEvent, SubmitUiModel> submit = events -> events
    .flatMap(event -> service.setName(event.name)
        .map(response -> SubmitUiModel.success())
        .onErrorReturn(t -> SubmitUiModel.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()));

disposables.add(events.compose(submit).subscribe(model -> {
      submitView.setEnabled(!model.inProgress);
      progressView.setVisibility(model.inProgress ? VISIBLE : GONE);
      if (!model.inProgress) {
        if (model.success) finish()
        else Toast.makeText(this, "Failed to set name: " + model.message,
          LENGTH_SHORT).show();
      }
    }, t -> { throw new OnErrorNotImplementedException(t); }));
```

Reactive State

```
class SubmitEvent { /* ... */ }

Observable<SubmitEvent> events = RxView.clicks(submitView)
    .map(ignored -> new SubmitEvent(nameView.getText().toString()));
```

Reactive State

```
abstract class SubmitUiEvent {}
class SubmitEvent extends SubmitUiEvent { /* ... */ }
class CheckNameEvent extends SubmitUiEvent { /* ... */ }

Observable<SubmitEvent> submitEvents = RxView.clicks(submitView)
    .map(ignored -> new SubmitEvent(nameView.getText().toString()));
```

Reactive State

```
abstract class SubmitUiEvent {}
class SubmitEvent extends SubmitUiEvent { /* ... */ }
class CheckNameEvent extends SubmitUiEvent { /* ... */ }

Observable<SubmitEvent> submitEvents = RxView.clicks(submitView)
    .map(ignored -> new SubmitEvent(nameView.getText().toString()));

Observable<CheckNameEvent> checkNameEvents =
    RxTextView.afterTextChanges(nameView)
        .map(text -> new CheckNameEvent(text));
```

Reactive State

```
abstract class SubmitUiEvent {}
class SubmitEvent extends SubmitUiEvent { /* ... */ }
class CheckNameEvent extends SubmitUiEvent { /* ... */ }

Observable<SubmitEvent> submitEvents = RxView.clicks(submitView)
    .map(ignored -> new SubmitEvent(nameView.getText().toString()));

Observable<CheckNameEvent> checkNameEvents =
    RxTextView.afterTextChanges(nameView)
        .map(text -> new CheckNameEvent(text));

Observable<SubmitUiEvent> events =
    Observable.merge(submitEvents, checkNameEvents);
```

Reactive State

```
Observable<SubmitUiEvent> events = /* ... */;

ObservableTransformer<SubmitEvent, SubmitUiModel> submit = events -> events
    .flatMap(event -> service.setName(event.name)
        .map(response -> SubmitUiModel.success())
        .onErrorReturn(t -> SubmitUiModel.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()));

disposables.add(events.compose(submit).subscribe(model -> {
      submitView.setEnabled(!model.inProgress);
      progressView.setVisibility(model.inProgress ? VISIBLE : GONE);
      if (!model.inProgress) {
        if (model.success) finish()
        else Toast.makeText(this, "Failed to set name: " + model.message,
          LENGTH_SHORT).show();
      }
    }, t -> { throw new OnErrorNotImplementedException(t); }));
```

Reactive State

```
Observable<SubmitUiEvent> events = /* ... */;

ObservableTransformer<SubmitEvent, SubmitUiModel> submit = events -> events
    .flatMap(event -> service.setName(event.name)
        .map(response -> SubmitUiModel.success())
        .onErrorReturn(t -> SubmitUiModel.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()));

disposables.add(events.compose(submit).subscribe(model -> {
      submitView.setEnabled(!model.inProgress);
      progressView.setVisibility(model.inProgress ? VISIBLE : GONE);
      if (!model.inProgress) {
        if (model.success) finish()
        else Toast.makeText(this, "Failed to set name: " + model.message,
          LENGTH_SHORT).show();
      }
    }, t -> { throw new OnErrorNotImplementedException(t); }));
```

Reactive State

```
ObservableTransformer<SubmitEvent, SubmitUiModel> submit = events -> events
    .flatMap(event -> service.setName(event.name)
        .map(response -> SubmitUiModel.success())
        .onErrorReturn(t -> SubmitUiModel.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()));
```

Reactive State

```
ObservableTransformer<SubmitEvent, SubmitUiModel> submit = events -> events
    .flatMap(event -> service.setName(event.name)
        .map(response -> SubmitUiModel.success())
        .onErrorReturn(t -> SubmitUiModel.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()));

ObservableTransformer<CheckNameEvent, SubmitUiModel> checkName = events -> events
    .switchMap(event -> event
        .delay(200, MILLISECONDS, AndroidSchedulers.mainThread())
        .flatMap(event -> service.checkName(event.name))
        .map(response -> ???)
        .onErrorReturn(t -> ???)
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(???));
```

Reactive State

```
ObservableTransformer<SubmitEvent, SubmitUiModel> submit = events -> events
    .flatMap(event -> service.setName(event.name)
        .map(response -> SubmitUiModel.success())
        .onErrorReturn(t -> SubmitUiModel.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()));

ObservableTransformer<CheckNameEvent, SubmitUiModel> checkName = events -> events
    .switchMap(event -> event
        .delay(200, MILLISECONDS, AndroidSchedulers.mainThread())
        .flatMap(event -> service.checkName(event.name))
        .map(response -> ???)
        .onErrorReturn(t -> ???)
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(???));
```

Reactive State

```
ObservableTransformer<SubmitEvent, SubmitUiModel> submit = events -> events
    .flatMap(event -> service.setName(event.name)
        .map(response -> SubmitUiModel.success())
        .onErrorReturn(t -> SubmitUiModel.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()));

ObservableTransformer<CheckNameEvent, SubmitUiModel> checkName = events -> events
    .switchMap(event -> event
        .delay(200, MILLISECONDS, AndroidSchedulers.mainThread())
        .flatMap(event -> service.checkName(event.name))
        .map(response -> ???)
        .onErrorReturn(t -> ???)
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(???));
```

Reactive State

```
ObservableTransformer<SubmitEvent, SubmitUiModel> submit = events -> events
    .flatMap(event -> service.setName(event.name)
        .map(response -> SubmitUiModel.success())
        .onErrorReturn(t -> SubmitUiModel.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()));

ObservableTransformer<CheckNameEvent, SubmitUiModel> checkName = events -> events
    .switchMap(event -> event
        .delay(200, MILLISECONDS, AndroidSchedulers.mainThread())
        .flatMap(event -> service.checkName(event.name))
        .map(response -> ???)
        .onErrorReturn(t -> ???)
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(???));
```

Reactive State

```
ObservableTransformer<SubmitEvent, SubmitUiModel> submit = /* ... */;

ObservableTransformer<CheckNameEvent, SubmitUiModel> checkName = /* ... */;
```

Reactive State

```
ObservableTransformer<SubmitEvent, SubmitUiModel> submit = /* ... */;

ObservableTransformer<CheckNameEvent, SubmitUiModel> checkName = /* ... */;

ObservableTransformer<SubmitUiEvent, SubmitUiModel> submitUi =
    events -> ???;
```

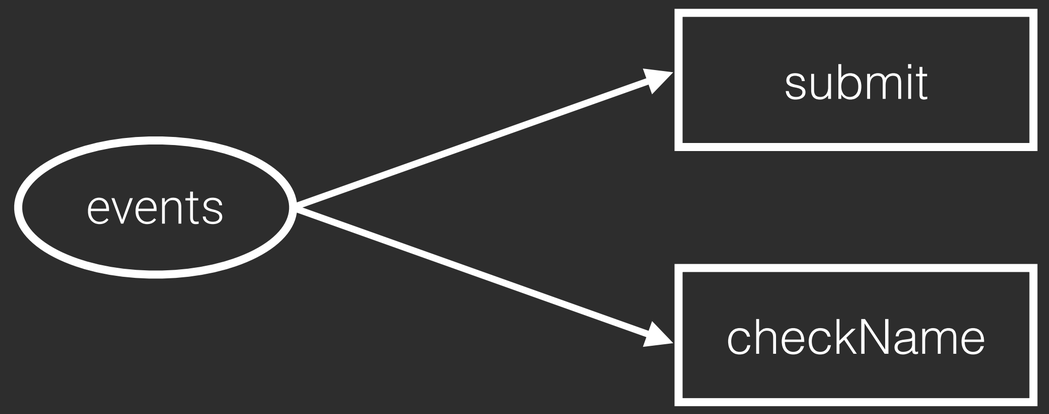
Reactive State

```
ObservableTransformer<SubmitEvent, SubmitUiModel> submit = /* ... */;

ObservableTransformer<CheckNameEvent, SubmitUiModel> checkName = /* ... */;

ObservableTransformer<SubmitUiEvent, SubmitUiModel> submitUi =
    events -> ???;
```

events

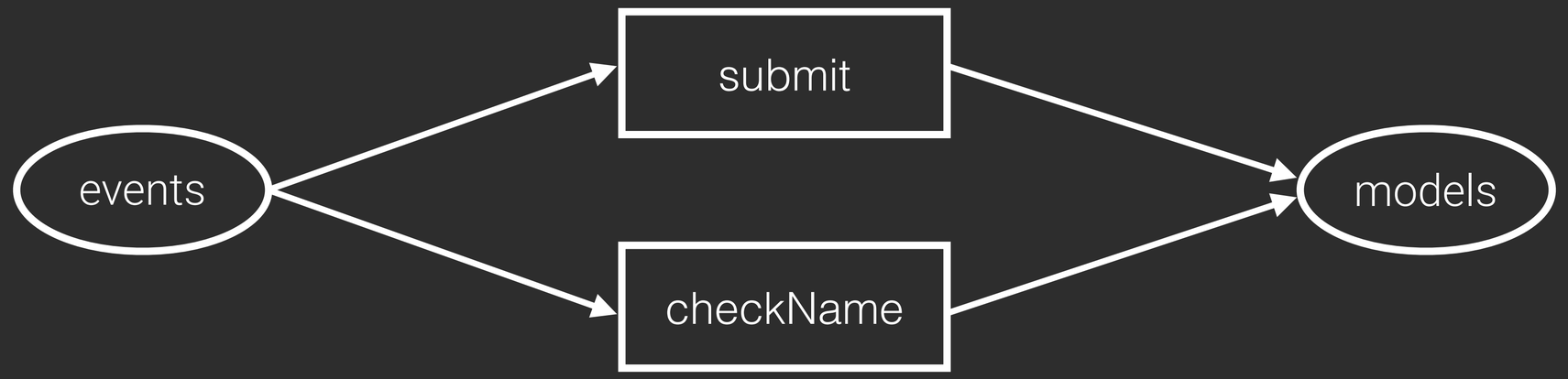
Reactive State

```
ObservableTransformer<SubmitEvent, SubmitUiModel> submit = /* ... */;

ObservableTransformer<CheckNameEvent, SubmitUiModel> checkName = /* ... */;

ObservableTransformer<SubmitUiEvent, SubmitUiModel> submitUi =
    events -> ???;
```



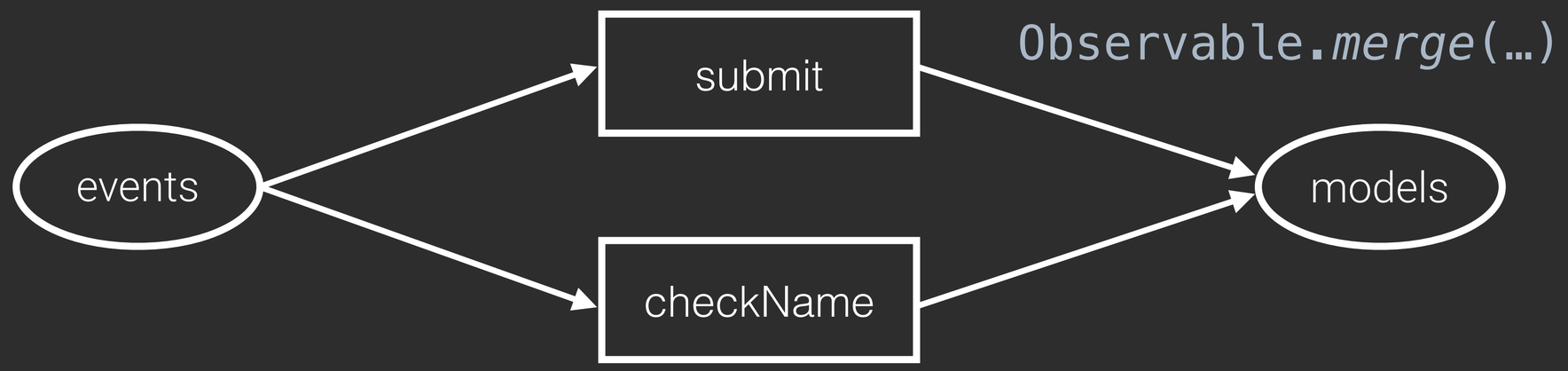
Reactive State

```
ObservableTransformer<SubmitEvent, SubmitUiModel> submit = /* ... */;

ObservableTransformer<CheckNameEvent, SubmitUiModel> checkName = /* ... */;

ObservableTransformer<SubmitUiEvent, SubmitUiModel> submitUi =
    events -> ???;
```



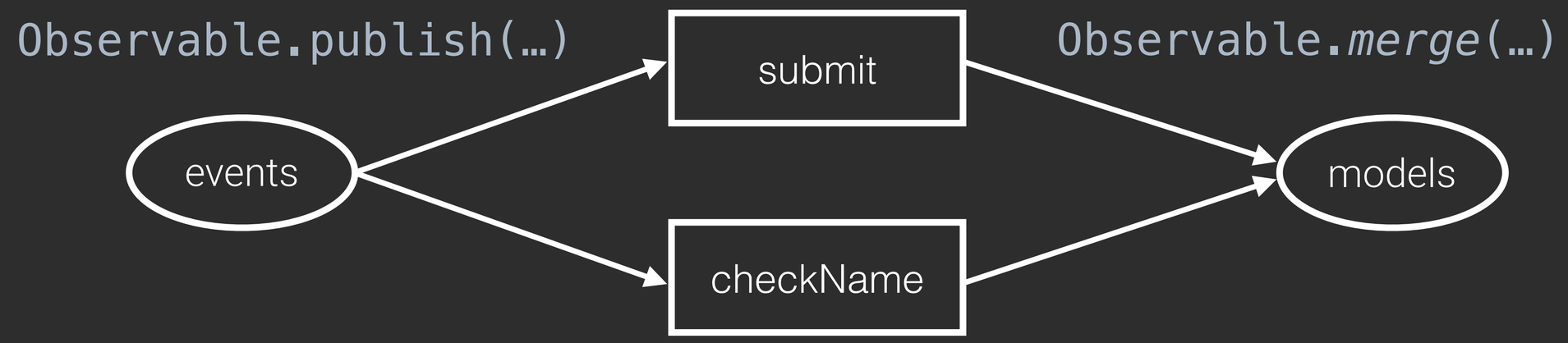
Reactive State

```
ObservableTransformer<SubmitEvent, SubmitUiModel> submit = /* ... */;

ObservableTransformer<CheckNameEvent, SubmitUiModel> checkName = /* ... */;

ObservableTransformer<SubmitUiEvent, SubmitUiModel> submitUi =
    events -> ???;
```



Reactive State

```
ObservableTransformer<SubmitEvent, SubmitUiModel> submit = /* ... */;

ObservableTransformer<CheckNameEvent, SubmitUiModel> checkName = /* ... */;

ObservableTransformer<SubmitUiEvent, SubmitUiModel> submitUi =
    events -> ???;
```



Reactive State

```
ObservableTransformer<SubmitEvent, SubmitUiModel> submit = /* ... */;

ObservableTransformer<CheckNameEvent, SubmitUiModel> checkName = /* ... */;

ObservableTransformer<SubmitUiEvent, SubmitUiModel> submitUi =
    events -> ???;
```

`Observable.publish(…)`

`Observable.merge(…)`

Reactive State

```
ObservableTransformer<SubmitEvent, SubmitUiModel> submit = /* ... */;

ObservableTransformer<CheckNameEvent, SubmitUiModel> checkName = /* ... */;

ObservableTransformer<SubmitUiEvent, SubmitUiModel> submitUi =
    events -> events.publish(shared -> Observable.merge());
```

Reactive State

```
ObservableTransformer<SubmitEvent, SubmitUiModel> submit = /* ... */;

ObservableTransformer<CheckNameEvent, SubmitUiModel> checkName = /* ... */;

ObservableTransformer<SubmitUiEvent, SubmitUiModel> submitUi =
    events -> events.publish(shared -> Observable.merge(
        shared.ofType(SubmitEvent.class).compose(submit),
        shared.ofType(CheckNameEvent.class).compose(checkName)));
```

Reactive State

```
Observable<SubmitUiEvent> events = /* ... */;

ObservableTransformer<SubmitUiEvent, SubmitUiModel> submitUi =
    events -> events.publish(shared -> Observable.merge(
        shared.ofType(SubmitEvent.class).compose(submit),
        shared.ofType(CheckNameEvent.class).compose(checkName)));

disposables.add(events.compose(submitUi).subscribe(model -> {
      submitView.setEnabled(!model.inProgress);
      progressView.setVisibility(model.inProgress ? VISIBLE : GONE);
      if (!model.inProgress) {
        if (model.success) finish()
        else Toast.makeText(this, "Failed to set name: " + model.message,
          LENGTH_SHORT).show();
      }
    }, t -> { throw new OnErrorNotImplementedException(t); }));
```

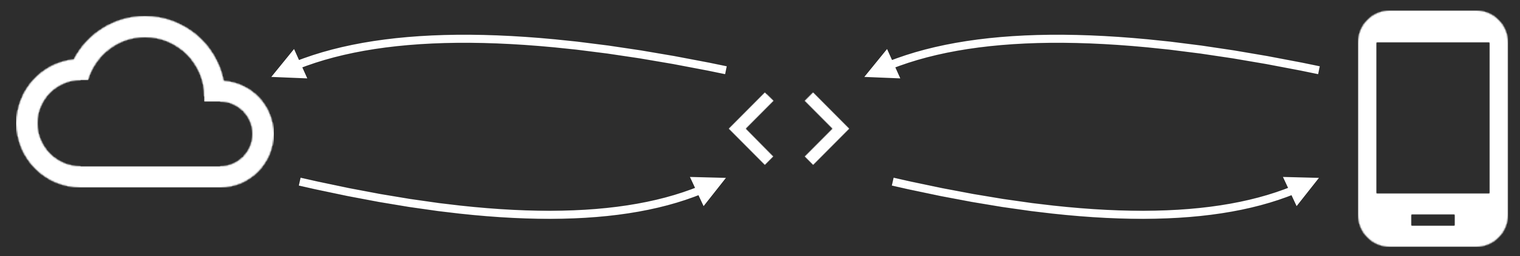
Reactive State

```
Observable<SubmitUiEvent> events = /* ... */;

ObservableTransformer<SubmitUiEvent, SubmitUiModel> submitUi =
    events -> events.publish(shared -> Observable.merge(
        shared.ofType(SubmitEvent.class).compose(submit),
        shared.ofType(CheckNameEvent.class).compose(checkName)));

disposables.add(events.compose(submitUi).subscribe(model -> {
      submitView.setEnabled(!model.inProgress);
      progressView.setVisibility(model.inProgress ? VISIBLE : GONE);
      if (!model.inProgress) {
        if (model.success) finish()
        else Toast.makeText(this, "Failed to set name: " + model.message,
          LENGTH_SHORT).show();
      }
    }, t -> { throw new OnErrorNotImplementedException(t); }));
```

Reactive State

```
Observable<SubmitUiEvent> events = /* ... */;

ObservableTransformer<SubmitUiEvent, SubmitUiModel> submitUi =
    events -> events.publish(shared -> Observable.merge(
        shared.ofType(SubmitEvent.class).compose(submit),
        shared.ofType(CheckNameEvent.class).compose(checkName)));

disposables.add(events.compose(submitUi).subscribe(model -> {
      submitView.setEnabled(!model.inProgress);
      progressView.setVisibility(model.inProgress ? VISIBLE : GONE);
      if (!model.inProgress) {
        if (model.success) finish()
        else Toast.makeText(this, "Failed to set name: " + model.message,
          LENGTH_SHORT).show();
      }
    }, t -> { throw new OnErrorNotImplementedException(t); }));
```

Reactive State



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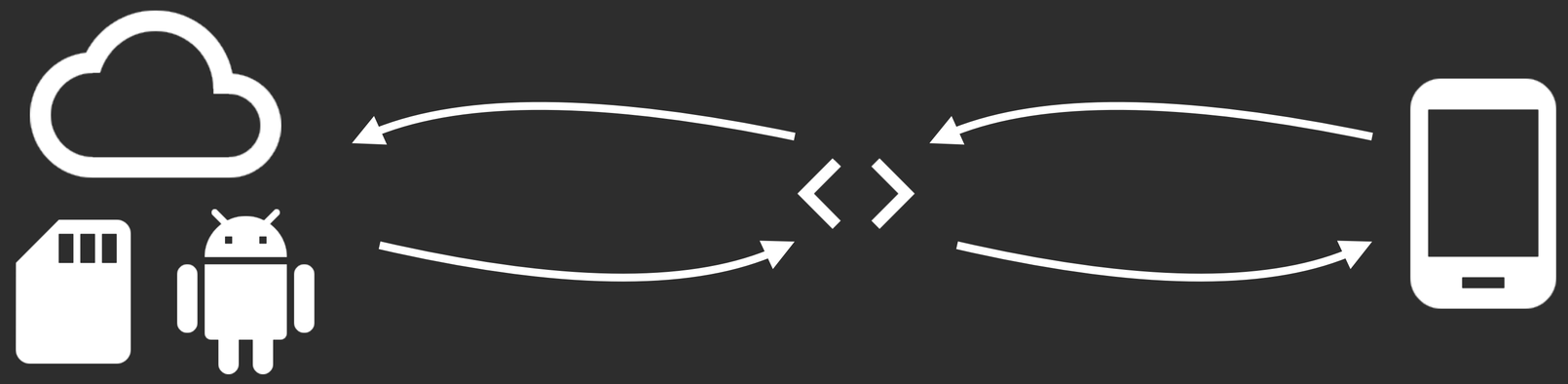

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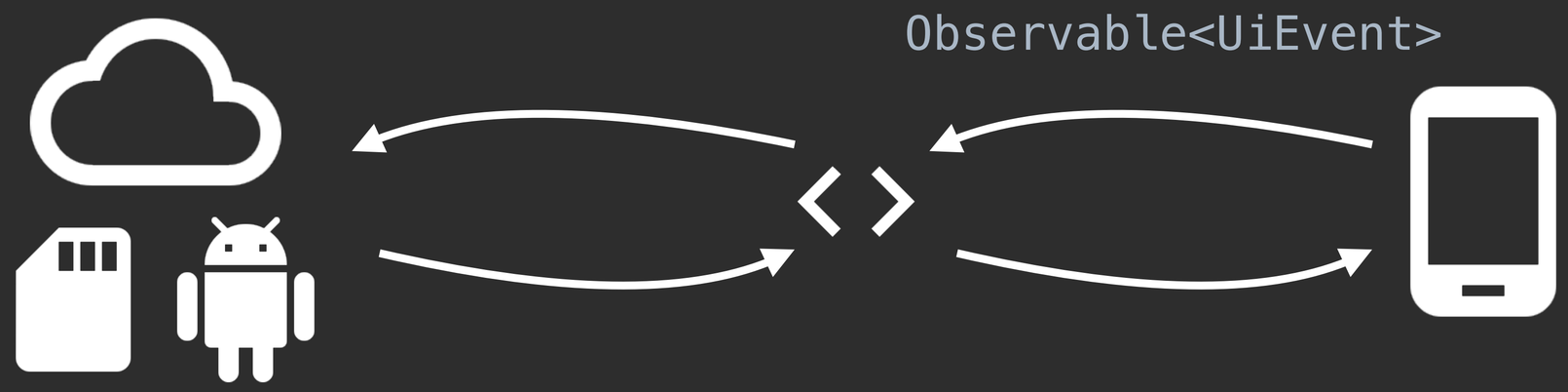

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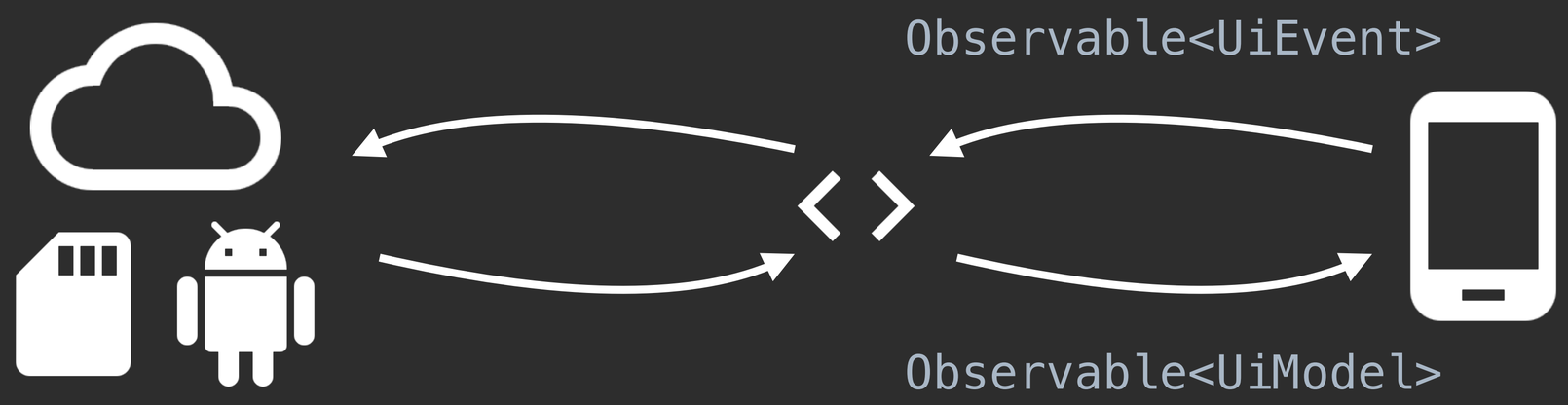
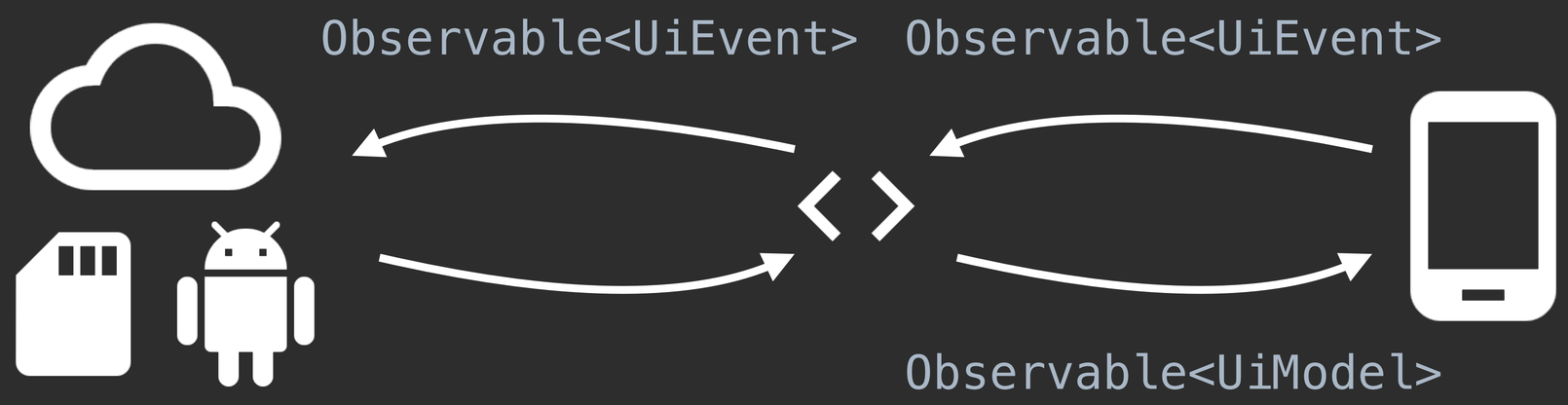
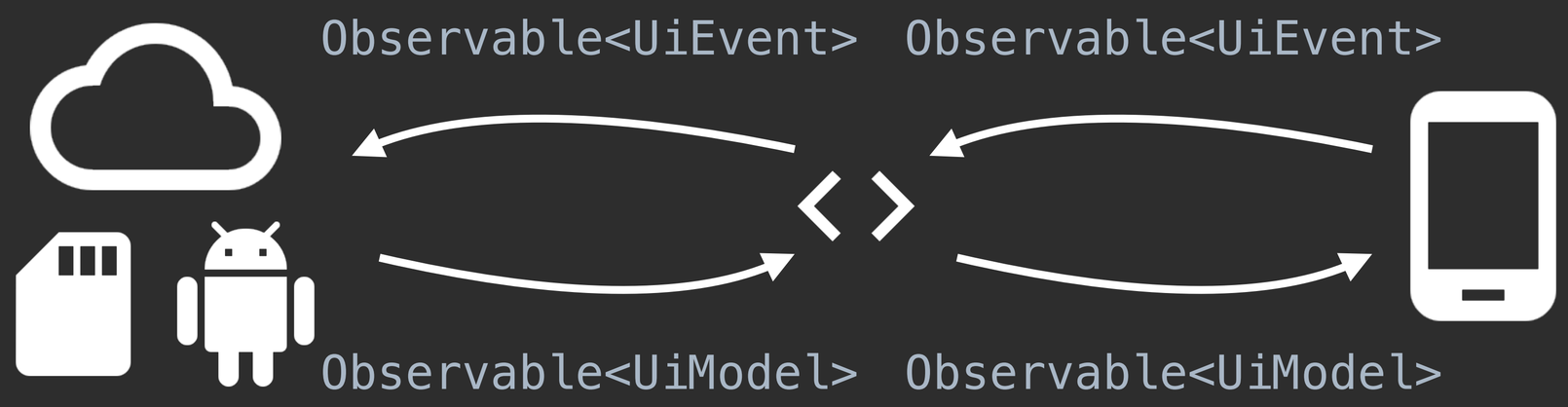


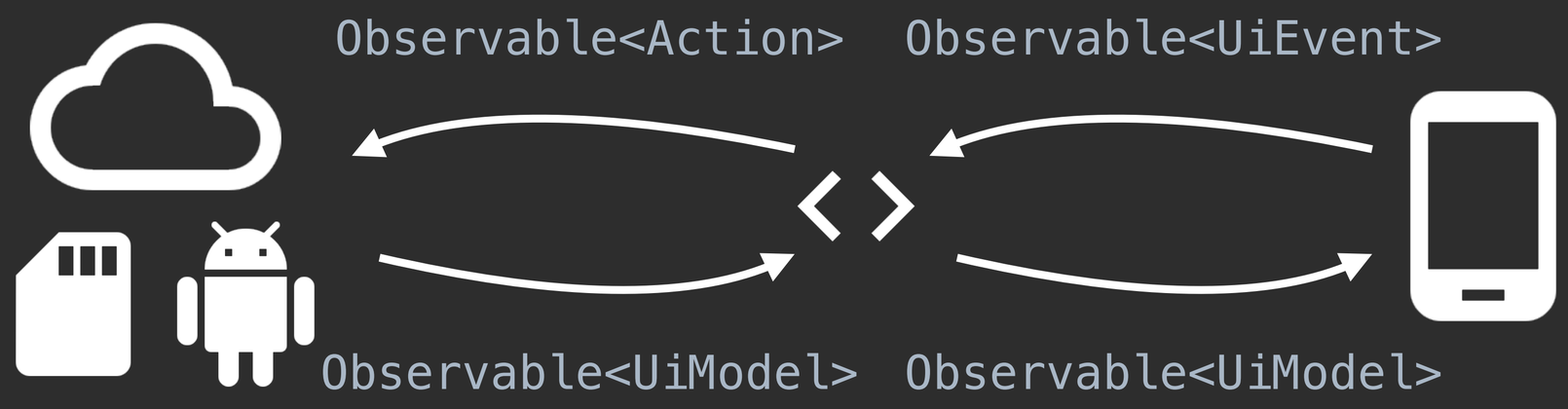
Reactive State



Reactive State



Reactive State



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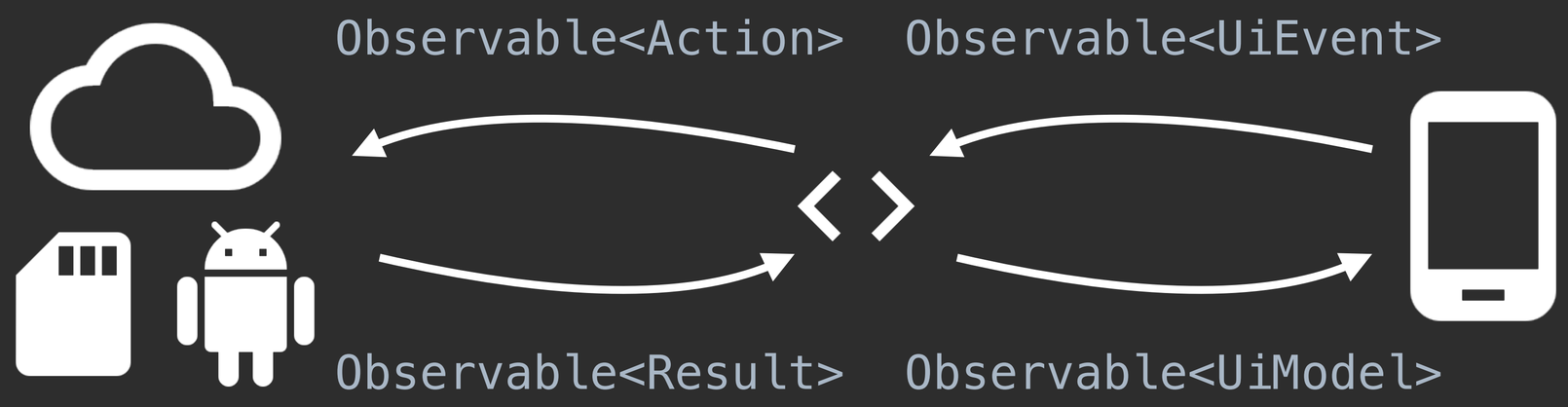
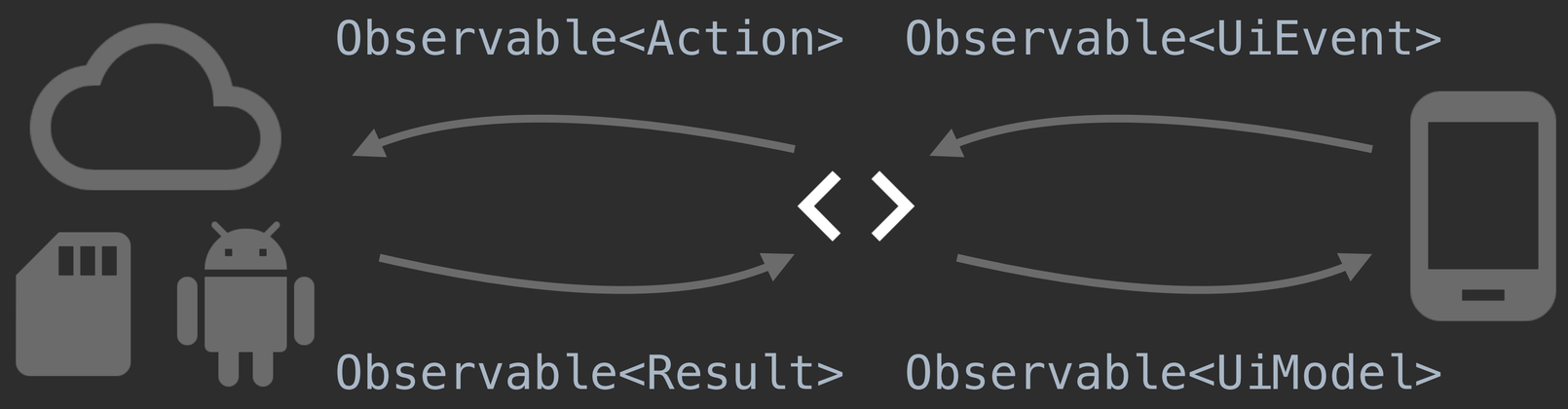


Reactive State



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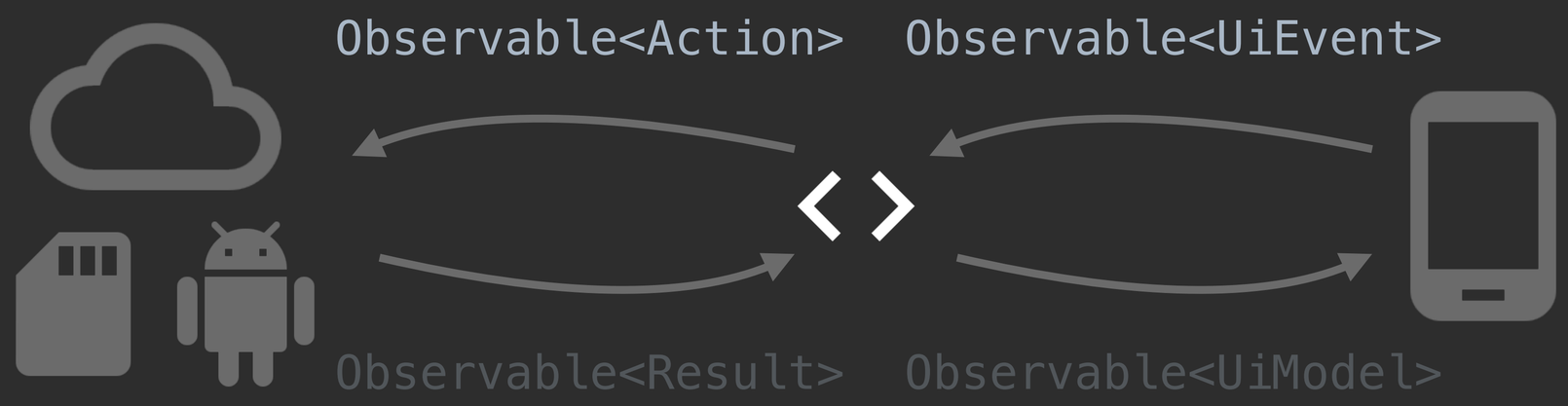

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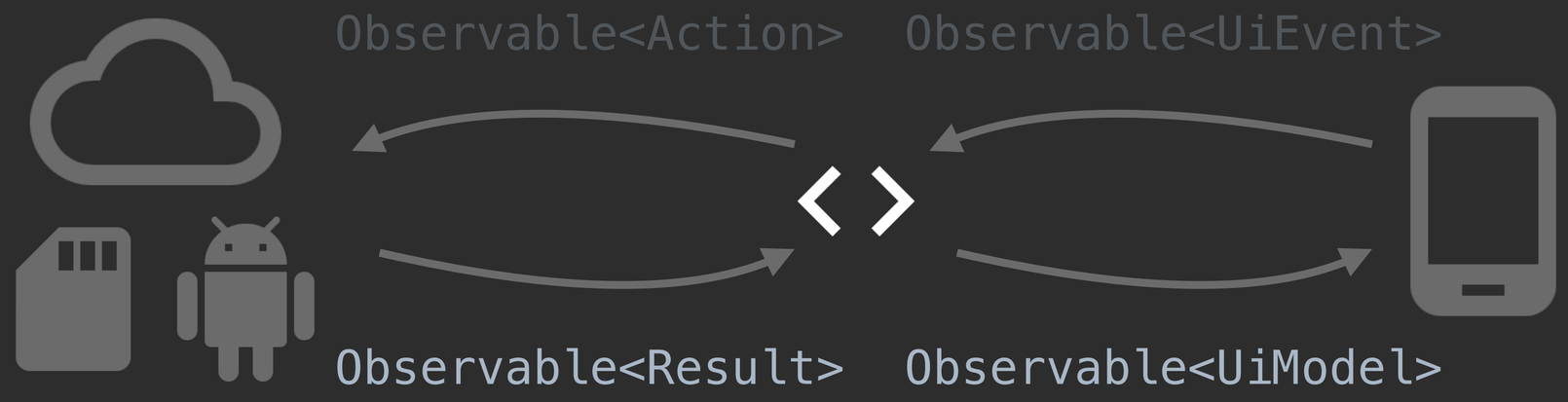

Reactive State

```
final class SubmitUiModel {
  final boolean inProgress;
  final boolean success;
  final String errorMessage;

  private SubmitUiModel(
      boolean inProgress, boolean success, String errorMessage) {
    // ...
  }

  static SubmitUiModel inProgress() { /* ... */ }
  static SubmitUiModel success() { /* ... */ }
  static SubmitUiModel failure(String errorMessage) { /* ... */ }
}
```

Reactive State

```
inProgress
false
success
false
errorMessage
null
```

Reactive State

inProgress
false

success
false

errorMessage
null

```
CheckNameResult.IN_FLIGHT
```

Reactive State

inProgress
false

success
false

errorMessage
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CheckNameResult.IN_FLIGHT

inProgress
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Reactive State

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CheckNameResult.IN_FLIGHT

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SubmitResult.IN_FLIGHT

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errorMessage
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SubmitResult.SUCCESS

Reactive State

```
SubmitResult.IN_FLIGHT
```

inProgress
true

success
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errorMessage
null

```
SubmitResult.SUCCESS
```

inProgress
false

success
true

errorMessage
null

Reactive State

```
SubmitUiModel initialState = SubmitUiModel.idle();
```

Reactive State

```
SubmitUiModel initialState = SubmitUiModel.idle();

Observable<Result> results = /* ... */;
```

Reactive State

```
SubmitUiModel initialState = SubmitUiModel.idle();

Observable<Result> results = /* ... */;

Observable<SubmitUiModel> uiModels = results
    .scan(initialState, (state, result) -> /* ... */);
```

Reactive State

```
SubmitUiModel initialState = SubmitUiModel.idle();

Observable<Result> results = /* ... */;

Observable<SubmitUiModel> uiModels = results
    .scan(initialState, (state, result) -> {
      if (result == CheckNameResult.IN_FLIGHT
          || result == SubmitResult.IN_FLIGHT)
        return SubmitUiModel.inProgress();
      if (result == CheckNameResult.SUCCESS)
        return SubmitUiModel.idle();
      if (result == SubmitResult.SUCCESS)
        return SubmitUiModel.success();
      // TODO handle check name and submit failures...
      throw new IllegalArgumentException("Unknown result: " + result);
    });
```

Reactive State

```
ObservableTransformer<SubmitEvent, SubmitUiModel> submit =
    events -> events.flatMap(event -> service.setName(event.name)
        .map(response -> SubmitUiModel.success())
        .onErrorReturn(t -> SubmitUiModel.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()));

ObservableTransformer<CheckNameEvent, SubmitUiModel> checkName =
    events -> events.switchMap(event -> event
        .delay(200, MILLISECONDS, AndroidSchedulers.mainThread())
        .flatMap(event -> service.checkName(event.name))
        .map(response -> ???)
        .onErrorReturn(t -> ???)
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(???));
```

Reactive State

```
ObservableTransformer<SubmitAction, SubmitUiModel> submit =
    actions -> actions.flatMap(action -> service.setName(action.name)
        .map(response -> SubmitUiModel.success())
        .onErrorReturn(t -> SubmitUiModel.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()));

ObservableTransformer<CheckNameAction, SubmitUiModel> checkName =
    actions -> actions.switchMap(action -> action
        .delay(200, MILLISECONDS, AndroidSchedulers.mainThread())
        .flatMap(action -> service.checkName(action.name))
        .map(response -> ???)
        .onErrorReturn(t -> ???)
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(???));
```

Reactive State

```
ObservableTransformer<SubmitAction, SubmitUiModel> submit =
    actions -> actions.flatMap(action -> service.setName(action.name)
        .map(response -> SubmitUiModel.success())
        .onErrorReturn(t -> SubmitUiModel.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitUiModel.inProgress()));

ObservableTransformer<CheckNameAction, SubmitUiModel> checkName =
    actions -> actions.switchMap(action -> action
        .delay(200, MILLISECONDS, AndroidSchedulers.mainThread())
        .flatMap(action -> service.checkName(action.name))
        .map(response -> ???)
        .onErrorReturn(t -> ???)
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(???));
```

Reactive State

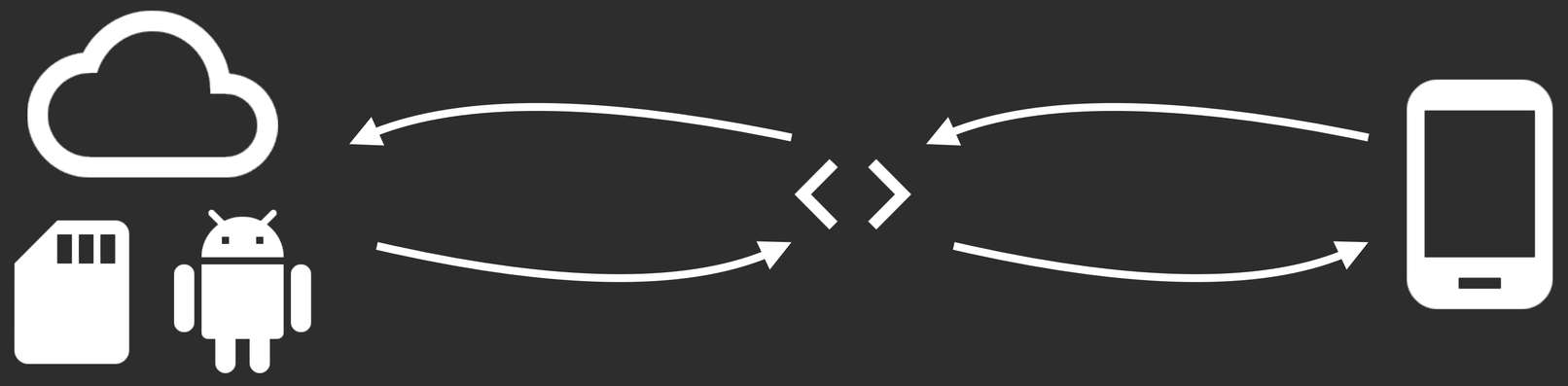
```
ObservableTransformer<SubmitAction, SubmitResult> submit =
    actions -> actions.flatMap(action -> service.setName(action.name)
        .map(response -> SubmitResult.SUCCESS)
        .onErrorReturn(t -> SubmitResult.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitResult.IN_FLIGHT));

ObservableTransformer<CheckNameAction, CheckNameResult> checkName =
    actions -> actions.switchMap(action -> action
        .delay(200, MILLISECONDS, AndroidSchedulers.mainThread())
        .flatMap(action -> service.checkName(action.name))
        .map(response -> CheckNameResult.SUCCESS)
        .onErrorReturn(t -> CheckNameResult.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(CheckNameResult.IN_FLIGHT));
```

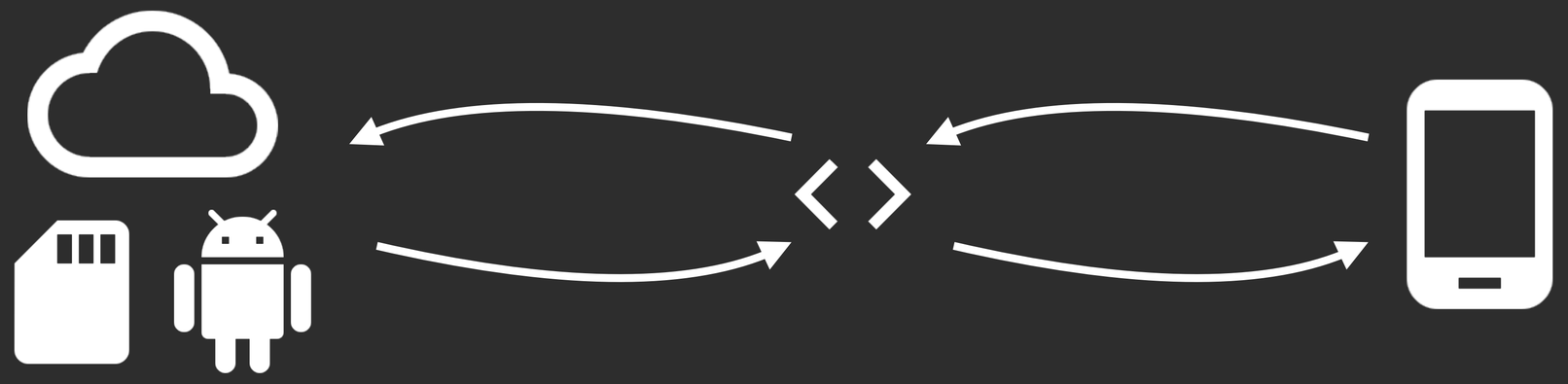
Reactive State

```
ObservableTransformer<SubmitAction, SubmitResult> submit =
    actions -> actions.flatMap(action -> service.setName(action.name)
        .map(response -> SubmitResult.SUCCESS)
        .onErrorReturn(t -> SubmitResult.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(SubmitResult.IN_FLIGHT));

ObservableTransformer<CheckNameAction, CheckNameResult> checkName =
    actions -> actions.switchMap(action -> action
        .delay(200, MILLISECONDS, AndroidSchedulers.mainThread())
        .flatMap(action -> service.checkName(action.name))
        .map(response -> CheckNameResult.SUCCESS)
        .onErrorReturn(t -> CheckNameResult.failure(t.getMessage()))
        .observeOn(AndroidSchedulers.mainThread())
        .startWith(CheckNameResult.IN_FLIGHT));
```

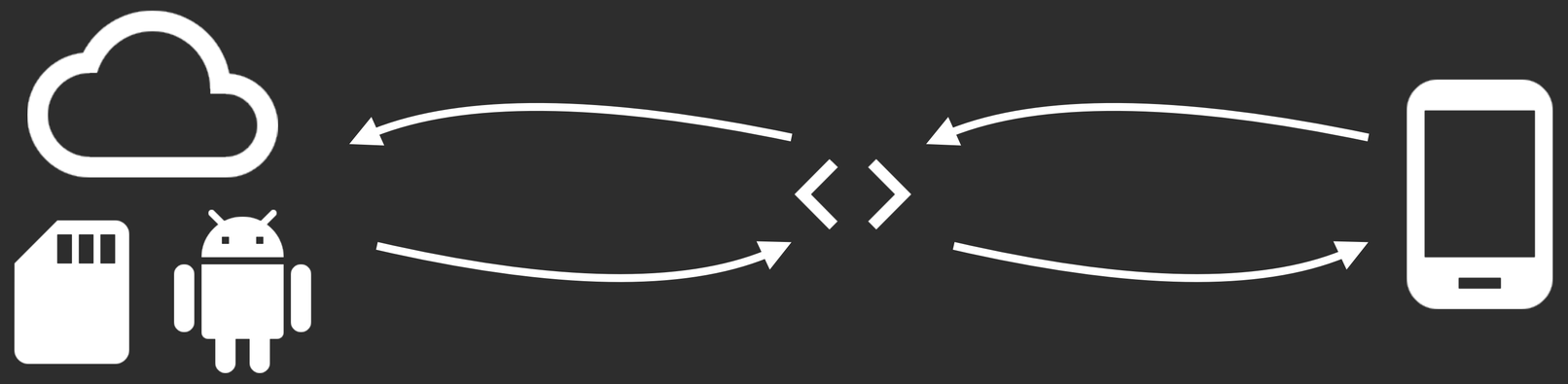


Observable<UiEvent>



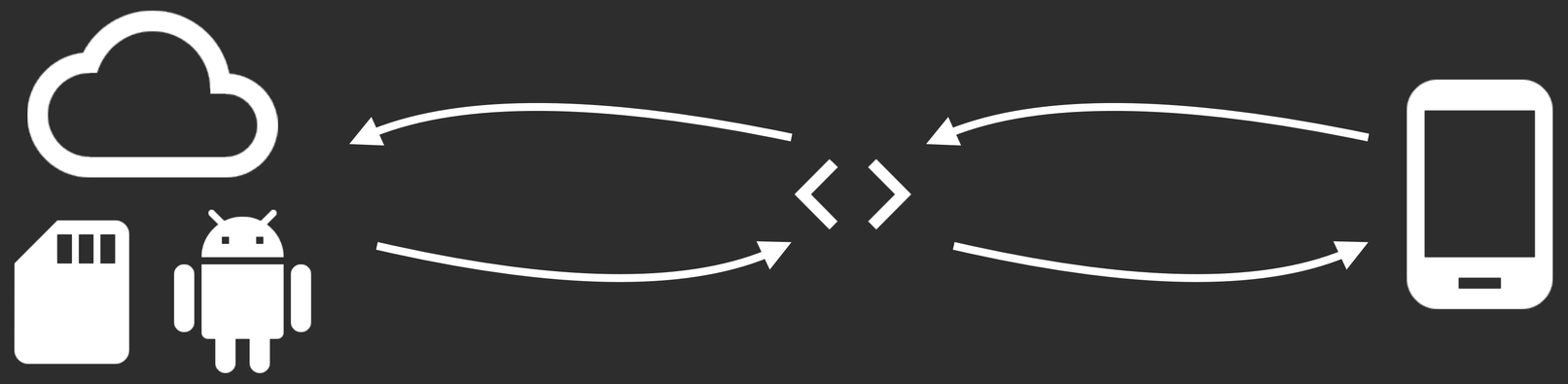
Observable<Action>

Observable<UiEvent>



Observable<Action>

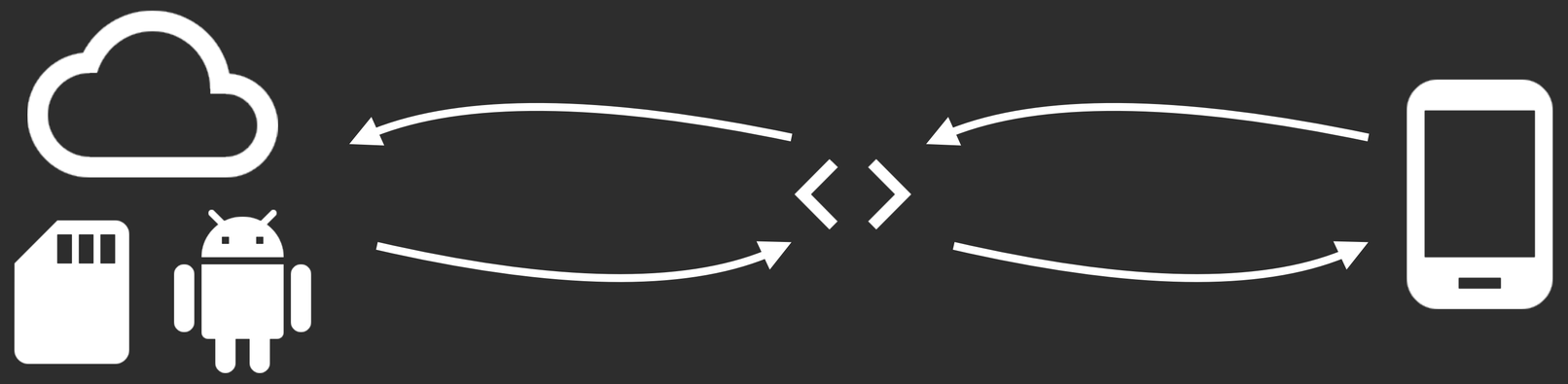
Observable<UiEvent>



Observable<Result>

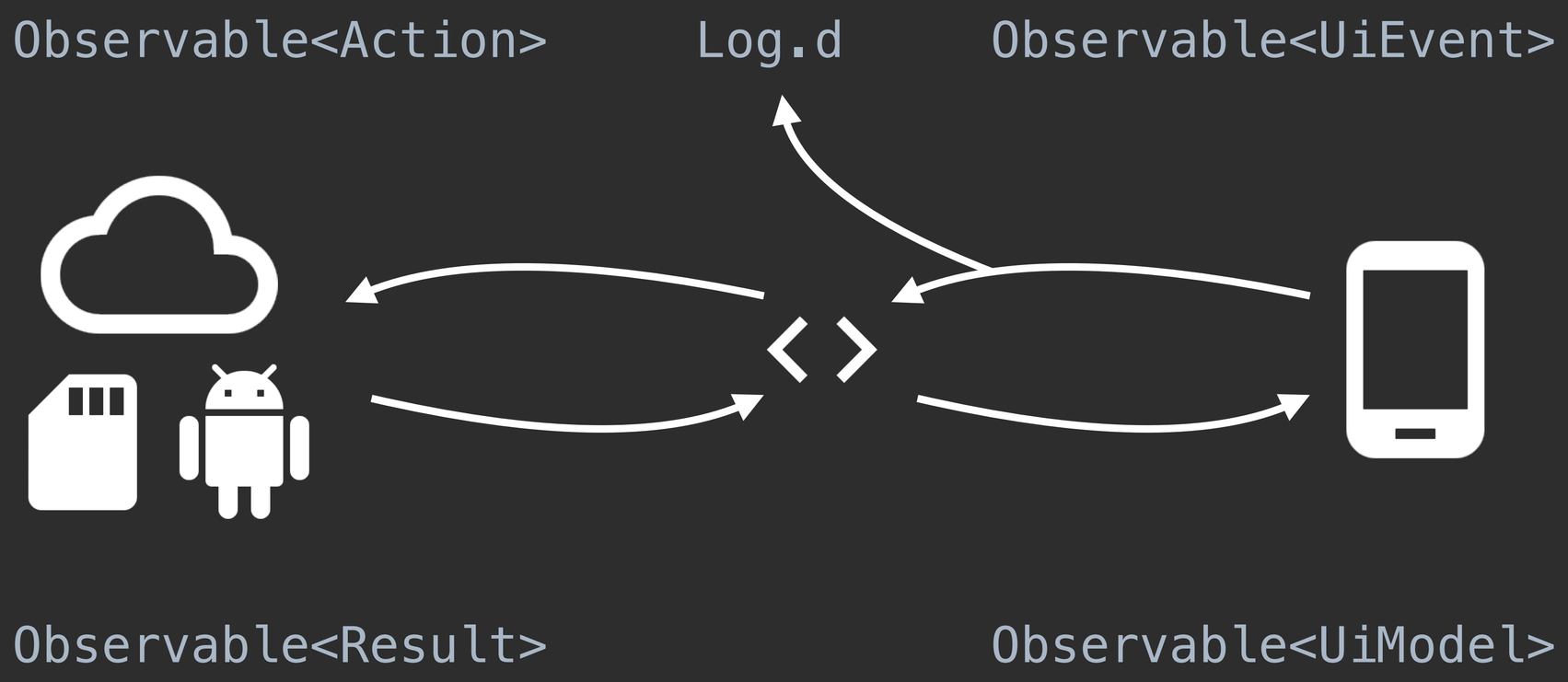
Observable<Action>

Observable<UiEvent>



Observable<Result>

Observable<UiModel>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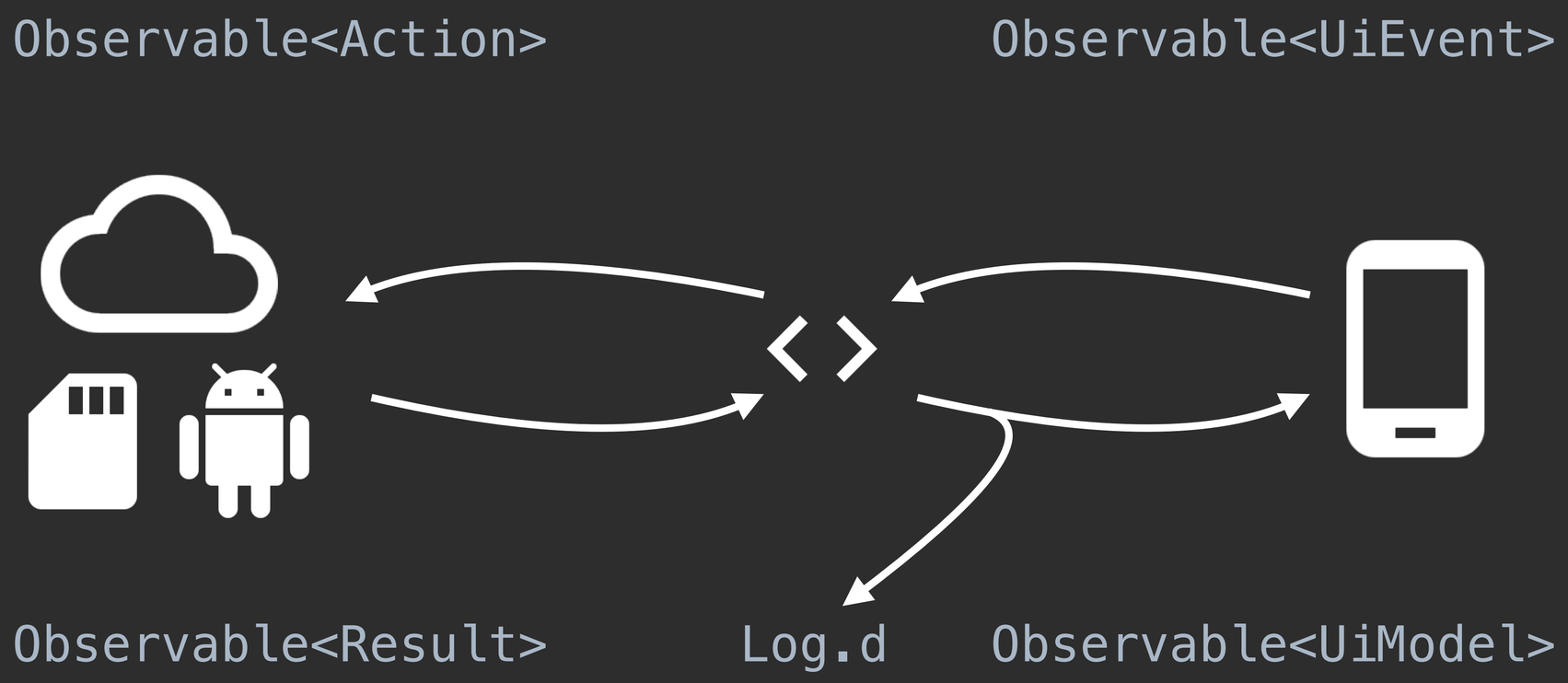
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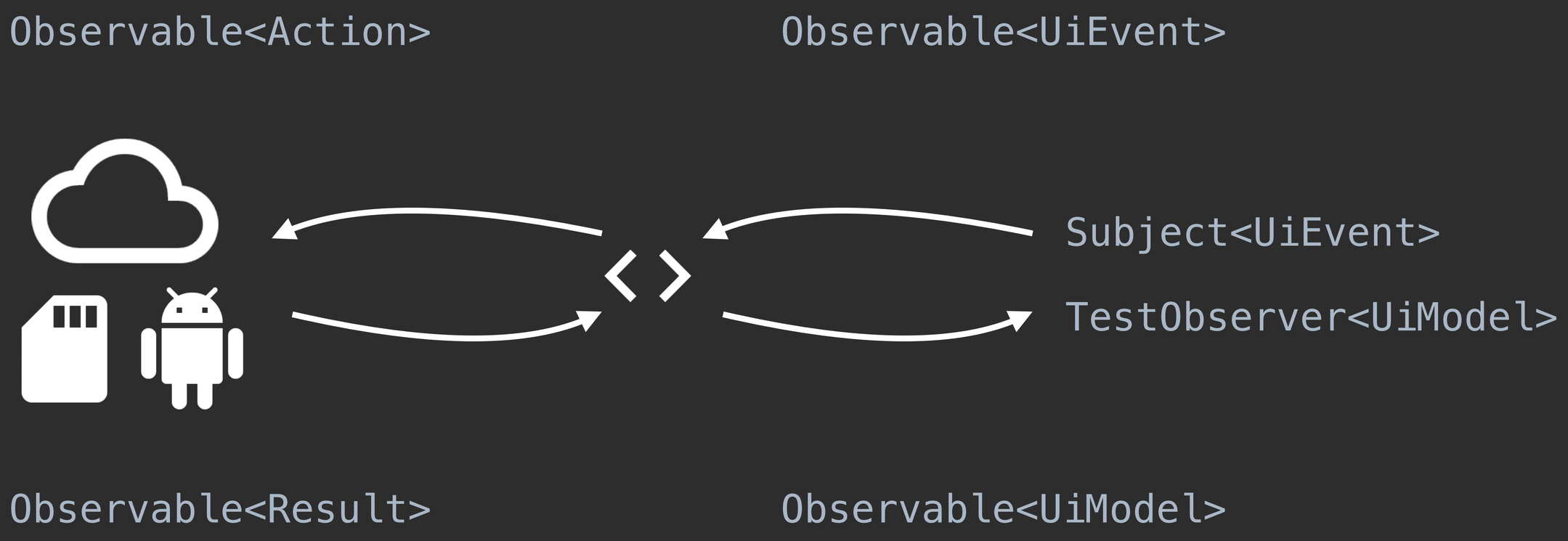
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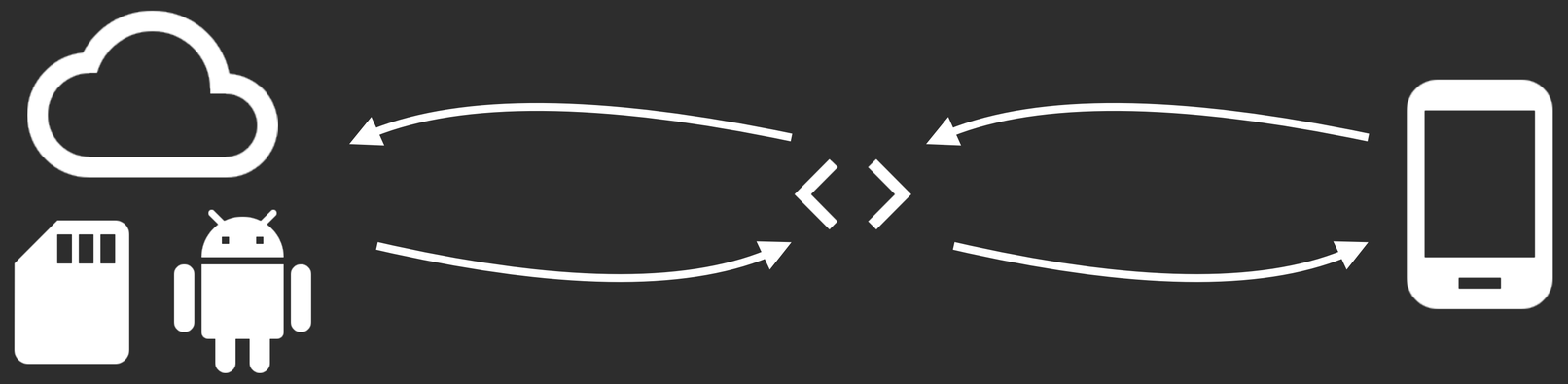

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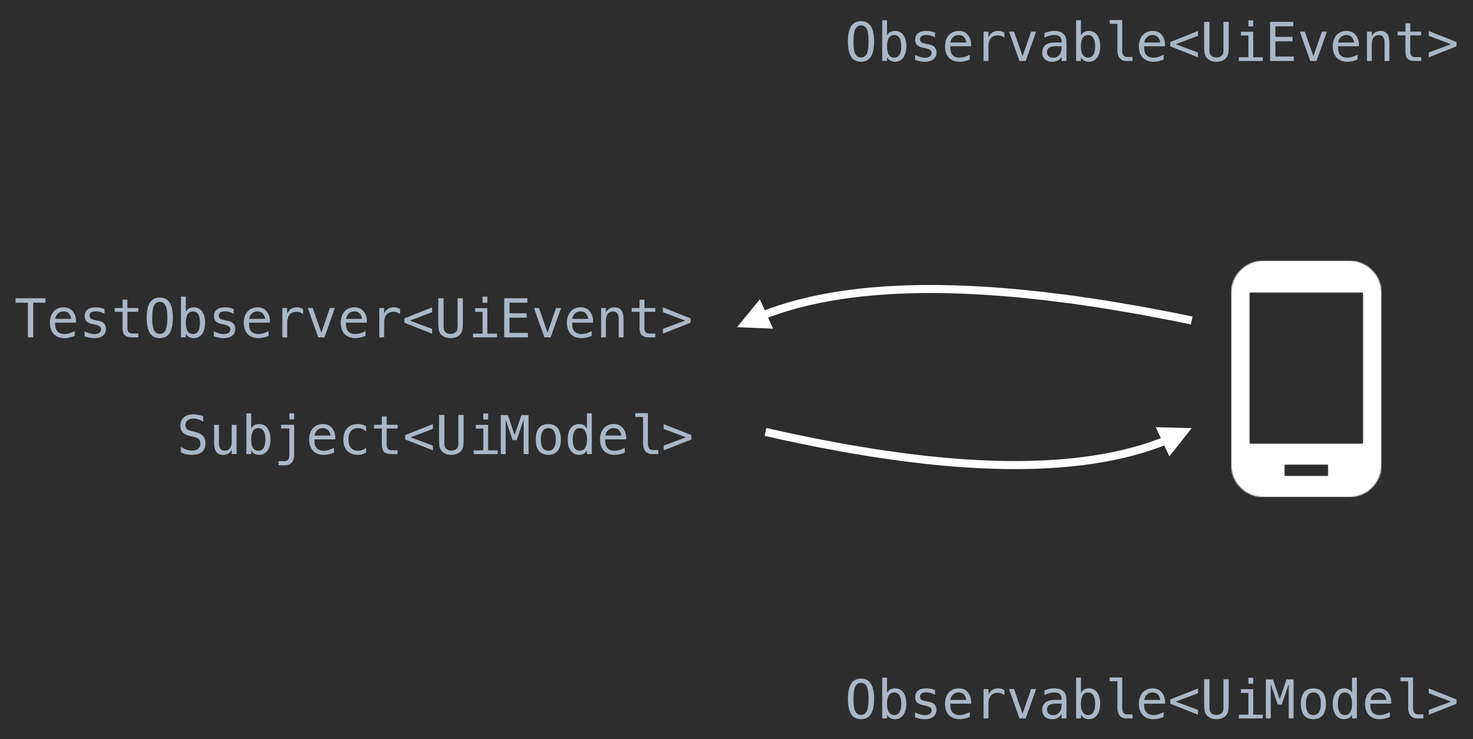
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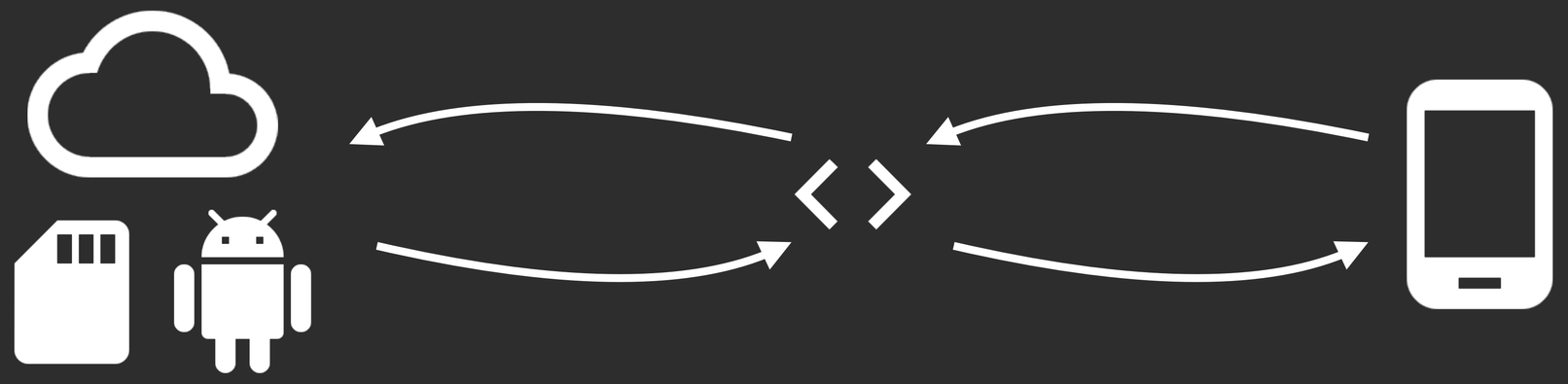

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Observable<UiModel>

Redux / Cycle

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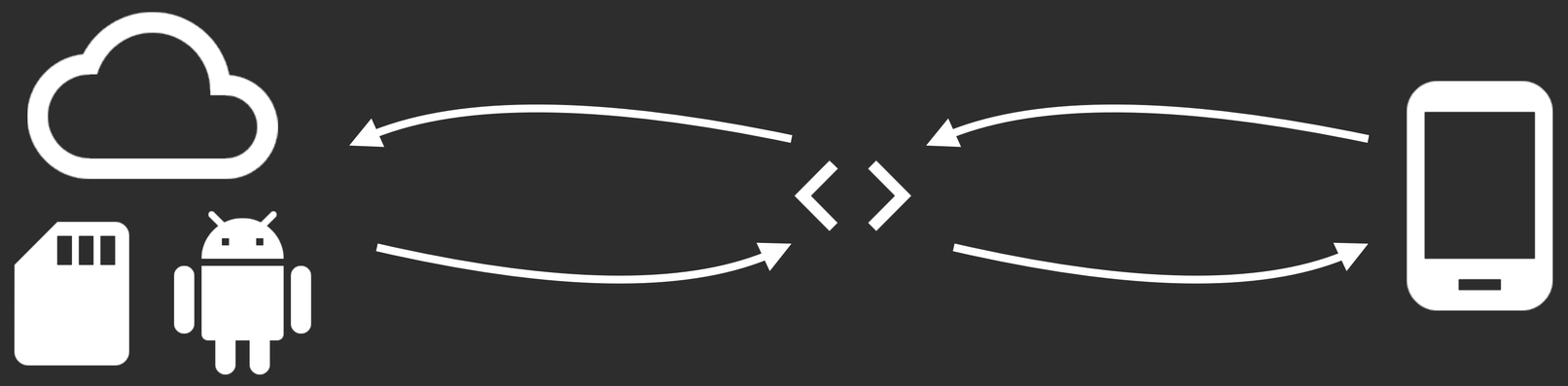

Observable<Result>

Observable<UiModel>

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